

ICEC - KIISS Spring Conference Proceedings



ICEC 2022

23rd International Conference on Electronic Commerce

icec2022.net



June 22-24, 2022

Hotel Inter-Burgo Daegu, South Korea

On-off line, Hybrid Conference



Day 1: ICEC 2022 & KIISS –Wed 22nd June				
KIISS Committee meeting				
08:00-09:00	A Track	B Track	C Track	D Track
Track	Room 9	Room 5&6	Room 3&4	Room 2
Room	Tutorial A1	Special Session B1	ICEC-Paper Session C1	KIISS-Paper Session D1
9:00-10:50	Chair: Kyoung Jun Lee (Kyung Hee University)	Chair: Sung Bum Park (Hoseo University)	Chair: Ning Yi Yang (National Taiwan University)	Chair: Tae Ho Hong (Pusan National University)
10:50-11:10	Tutorial (AI,DX,F&D)	Intelligence Award I	Social Media	Cryptocurrency & Fintech 1
Coffee Break				
Opening Ceremony and Keynote Speech				
Happy Hall Banquet (Main building 1F)				
11:10-12:30	Keynote Speech : Prof. Jae Kyu Lee, Xian Jiaotong University and KAIST (Can the Bright Origin-based eCommerce be Possible?) Opening Remark : Woong Kyu Lee, Conference Chair WelcomeAddress 1 : Gyoo Gun Lim, ConferenceChair, President, KIISS, ICEC WelcomeAddress 2 : Qi Li, ConferenceChair, Xian Jiaotong University, China Congratulatory Remark 1 : Dong Min Moon, Deputy Minster for Trade & Investment, Ministry of Trade, Industry and Engery Congratulatory Remark 2 : Yo Sik Kang, President of Seoul Digital Foundation Congratulatory Remark 3 : Jung Sook Park, WeGo Secretary General Award Session : Best Paper Award, Intelligence Award Announcement ICEC 2023 : Shan Liu, Vice-Dean, School of Management, Xian Jiaotong University			
12:30-13:30	Welcome Lunch			
13:30-15:50	Tutorial A2 Chair: Kyung Jin Cha (Hanyang University)	Special Session B2 Chair: Young Hyun Kim (Seoul Digital Foundation)	ICEC-Paper Session C2 Chair: Jong Ki Kim (Pusan National University)	Special Session D2-1 Chair: Jung Sook Park (WeGo)
	Tutorial (Amazon, Gartner)	Seoul Digital Foundation	E-Commerce Strategy	Welcome to World Smart Sustainable Cities Organization (WeGo)
				KIISS-Paper Session D2-2 Chair: Soon Young Oh (KB Bank)
				Cryptocurrency & Fintech 2
15:50-16:00	Coffee Break			
16:00-17:50	Academic Forum A3 Chair: Dae Gon Cho (KAIST)	Special Session B3 Chair: Sung Bum Park (Hoseo University)	ICEC-Paper Session C3 Chair: Liqueo Lou (Ningbo University of Technology)	KIISS-Paper Session D3 Chair: Seung Ik Beak (Hanyang University)
	Bright Internet and Emerging Technologies	Intelligence Award II	Recommender System	Natural Language Processing: NLP
18:00-20:00	Banquet Dinner			
				Recommender System & AI

Day2: ICEC 2022 & KI/ISS – Thu 23rd June				
ICEC Committee meeting				
08:00-09:00	A Track	B Track	C Track	E Track
Track	Room 9	Room 5&6	Room 3&4	Room 1
9:20-10:50	Tutorial A1 Chair: Sung Byung Yang (Kyung Hee University)	Special Session B1 Chair: Shin Ae Shin (NIA)	KI/ISS-Paper Session C1 Chair: In Ho Choi (Sundo Software)	ICEC-Paper Session E1 Chair: Shan Liu (Xian Jiaotong University)
	Tutorial (Africa Startup)	NIA Open Data	Intelligence Service	Economic Analysis of IT
10:50-11:00	Coffee Break			
11:00-12:50	Startup Session A2 Chair: Han Su Lee (LITALCO)	Special Session B2 Chair: Jee Won Choi (Soon Chun Hyang University)	KI/ISS-Paper Session C2	ICEC-Paper Session E2
	Korean Startups, Leading AI and E-Commerce	Graduate Student Research Colloquium for Publication in High-ranking Journals	Chair: Sung Byung Yang (Kyung Hee University)	Chair: Hye Jung Lee (Tokyo University of Science)
12:50-14:00	Lunch			
14:00-15:50	Junior Faculty/Researcher A3 Chair: Joon Koh (Chonnam National University)	Special Session B3 Chair: Oh Byung Kwon (Kyung Hee University)	KI/ISS-Paper Session C3	ICEC-Paper Session E3
	Junior Faculty/Researcher Seminar	Virtual Humans	Chair: Choong Kwon Lee (Keimyung University)	Chair: Jan Mou (Pusan National University)
15:50-16:00	Coffee Break			
16:00-17:50	MFDS Session A4 Chair: Yong Uk Song (Yonsei University MIRAE Campus)	Special Session B4 Chair: Hyun Sil Moon (Kookmin University)	ICEC-Paper Session C4	ICEC-Paper Session E4
	Imported Food Safety Prediction	KMU-KI/ISS AI Professional Certificate Program	Chair: Young Chan Lee (Dongguk University)	Chair: Sang Kon Lee (KOREATECH)
		Live Commerce	AI Applications	IT/IS General

Day3: ICEC 2022 – Fri 24th June	
09:30-15:30	Industry-Academic Networking in Daegu

[전체 프로그램]

첫째날 (6월 22일 수요일)					
시 간	순 서				
08:00~09:00	한국지능정보시스템학회 이사회 및 총회				
09:00~10:50	SESSION A	SESSION B	SESSION C	SESSION D	SESSION E
	A1 [Tutorial]	B1 [Special Session]	C1 [ICEC-Paper Session]	D1 [KIISS-Paper Session]	E1 [KIISS-Paper Session]
	Tutorial (AI, DX, R&D)	인텔리전스 대상 기업 세션 I	Social Media	암호화폐와 핀테크 1	인공지능과 딥러닝 1
	좌장: Kyoung Jun Lee (Kyung Hee Univ.)	좌장: 박 승 범 (호서대)	좌장: Ning-Yi Yang (National Taiwan Univ.)	좌장: 홍 태 호 (부산대)	좌장: 안 현 철 (국민대)
10:50~11:10	Coffee Break				
11:10~12:30	개막식 및 기조연설 (사회: 이서영 아나운서(동양대학교))				
	<기조연설> Can the Bright Origin-based eCommerce be Possible? (이재규 시안교통대 석좌교수, KAIST 명예교수)				
	개회사: 이용규 대구대 교수, ICEC 2022 대회장 환영사1: 임규건 한양대 교수, ICEC 2022 대회장, 한국지능정보시스템학회 회장, ICEC 원장 환영사2: Qi Li 중국 시안교통대 교수, ICEC 2022 대회장 축사1: 문동민 산업통상자원부 무역투자실장 축사2: 강요식 서울디지털재단 이사장 축사3: 박정숙 WeGo 사무총장 시상식: 우수논문상, 인텔리전스 대상, 공로상 시상				
12:30~13:30	Welcome Lunch				
13:30~15:50	A2 [Tutorial]	B2 [Special Session]	C2 [ICEC-Paper Session]	D2-1 [Special Session]	E2 [KIISS-Paper Session]
	Tutorial (Amazon, Gartner)	서울디지털재단	E-Commerce Strategy	Welcome to World Smart Sustainable Cities	인공지능과 딥러닝 2
	좌장: Kyung Jin Cha (Hanyang Univ.)	좌장: 김 영 현 (서울디지털재단)	좌장: Jongki Kim (Pusan Nat'l Univ.)	좌장: 박 정 속 (WeGo)	사회: 권 혁 진 (서울과기대)
				D2-2 [KIISS-Paper Session] 암호화폐와 핀테크 2 좌장: 오 순 영 (KB국민은행)	
15:50~16:00	Coffee Break				
16:00~17:50	A3 [Academic Forum]	B3 [Special Session]	C3 [ICEC-Paper Session]	D3 [KIISS-Paper Session]	E3 [KIISS-Paper Session]
	Bright Internet and Emerging Technologies	인텔리전스 대상 기업 세션 II	Recommender System	자연어 처리	추천시스템과 인공지능
	좌장: Daegon Cho (KAIST)	좌장: 박 승 범 (호서대)	좌장: Liquo Lou (Nigbo Univ. of Technology)	좌장: 백 승 익 (한양대)	사회: 김 남 규 (국민대)
18:00~20:00	Banquet Dinner				

둘째날 (6월 23일 목요일)

시 간	순 서				
08:00~09:00	ICEC 이사회 및 총회				
09:20~10:50	SESSION A	SESSION B	SESSION C	SESSION D	SESSION E
	A1 [Tutorial]	B1 [Special Session]	C1 [KIISS-Paper Session]	D1 [ICEC-Paper Session]	E1 [ICEC-Paper Session]
	Tutorial (Africa Startup)	NIA 공공데이터	Intelligence Service	Machine Learning & Text Mining I	Economic Analysis of IT
	좌장: Sung Byung Yang (Kyung Hee Univ.)	좌장: 신 신 애 (NIA)	좌장: 최 인 호 (선도소프트)	좌장: Jongbae Kim (Sejong Cyber Univ.)	좌장: Shan Liu (Xi'an Jiaotong Univ.)
10:50~11:00	Coffee Break				
11:00~12:50	A2 [Startup Session]	B2 [Special Session]	C2 [KIISS-Paper Session]	D2 [ICEC-Paper Session]	E2 [ICEC-Paper Session]
	AI와 이커머스를 이끄는 한국의 스타트업들	Graduate Student Research Colloquium for Publication in High-ranking Journals	지능형 디바이스와 서비스	Machine Learning & Text Mining II	COVID-19 &IT Applications
	좌장: 이 한 수 (리탈코)	좌장: Jaewon Choi (Soon Chun Hyang Univ.)	좌장: 최 인 호 (선도소프트)	좌장: Jongbae Kim (Sejong Cyber Univ.)	좌장: Hyejung Lee (Tokyo University of Science)
12:50~14:00	Lunch				
16:00~17:50	A3 [Academic Forum]	B3 [Special Session]	C3 [ICEC-Paper Session]	D3 [KIISS-Paper Session]	E3 [KIISS-Paper Session]
	Bright Internet and Emerging Technologies	인텔리전스 대상 기업 세션 II	Recommender System	자연어 처리	추천시스템과 인공지능
	좌장: Daegon Cho (KAIST)	좌장: 박 승 범 (호서대)	좌장: Liquo Lou (Nigbo Univ. of Technology)	좌장: 백 승 익 (한양대)	사회: 김 남 규 (국민대)
14:00~15:50	A3 [Junior Faculty /Researcher]	B3 [Special Session]	C3 [KIISS-Paper Session]	D3 [ICEC-Paper Session]	E3 [ICEC-Paper Session]
	Junior Faculty /Researcher Seminar	Virtual Humans	빅데이터 플랫폼	AI Applications	Service Design & Business Model
	좌장: Joon Koh (Chonnam Univ.)	좌장: 권 오 병 (경희대)	좌장: 이 충 권 (계명대)	좌장: Kyoung Jun Lee (Kyung Hee Univ.)	좌장: Jian Mou (Pusan National Univ.)

15:50~16:00	Coffee Break				
16:00~17:50	A4 [MFDS Session]	B4 [Special Session]	C4 [ICEC-Paper Session]	D4 [ICEC-Paper Session]	E4 [ICEC-Paper Session]
	Imported Food Safety Prediction	KMU-KIIS AI 실무능력 인증과정	Live Commerce	Fintech & Blockchain & Cryptocurrency	IT/IS General
	좌장: Yong Uk Song	좌장: 문 현 실	좌장: Young-Chan Lee	좌장: Sang Mi Chai	좌장: Sang Kon Lee
	(Yonsei Univ.)	(국민대)	(Dongguk Univ.)	(Ewha Womans Univ.)	(KOREATECH)

(6월 24일 금요일)	
시 간	순 서
09:30~15:30	대구 산학프로그램 (Industry-Academic Networking in Daegu)

[세부 프로그램]

Day 1 (Wed. 22nd June)

A1 [Tutorial] Tutorial(AI, DX, R&D)

- A1.1 AI Sharing without Sharing Data: Research Findings & Business Models 2
 인공지능 공유 플랫폼을 통한 디지털 양극화 해소 및 생태계 경쟁력 강화 전략
 Kyoung Jun Lee (Kyung Hee University)
 이경전 (경희대)
- A1.2 1Focus on Customer : Data-Driven Customer Experience Redesign 4
 데이터 기반 고객 경험 디자인
 Kyung Jin Cha (Hanyang University)
 차경진 (한양대)
- A1.3 An innovative approach to evaluating and selecting system for performance
 enhancement of SMEs' R&D projects supported by government 9
 중소기업 R&D 성과 향상을 위한 정부지원과제 선정평가체계 혁신 방안
 Hyung Sung Chang (TIP)
 장현성 (중소기업기술정보진흥원)

B1 [Special Session] Intelligence Award I 인텔리전스 대상 기업 세션 I

- B1.1 My DATA Driven by AI 13
 AI 기반 마이데이터 (하나합)
 JongKwon Ham (KEB HANA BANK)
 함종권 (하나은행)
- B1.2 Super Simple AI Logistics Competitiveness 14
 초간단 AI 물류경쟁력, 콜로세움
 Jin Soo Park (Colosseum)
 박진수 (콜로세움)
- B1.3 AI CuC, AI-Based Contactless business support solution 15
 LGCNS의 계속사용인증(CuC) 보안서비스
 Beekei, PARK (LGCNS)
 박병권 (LGCNS)
- B1.4 Caremind Dreams of the Futeure 17
 케어마인드가 꿈꾸는 미래
 Yoonje, Shin (CAREMIND)
 신윤제 (케어마인드)
- B1.5 Demonstration of AI-based Energy Efficiency Platform for Resorts 19
 AI 기반 에너지 효율화 솔루션 리조트 실증
 John Lee (GreenData)
 이호준 (그린데이터)

C1 [ICEC-Paper Session] Social Media

C1.1	How Social Media Capability Influence the Firm Performance of SMEs: The Moderating Role of Social CRM System Adoption	23
	Ning-Yi Yang (National Taiwan Univ.), Choon Ling Sia (National Taiwan Univ.)	
C1.2	How destination marketing on social media affects behavioral intention	29
	Ivelina Ilieva (Kyoto Univ.), Spring Han (Kyoto Univ.)	
C1.3	How to Choose the Right Person? Social Media	37
	Kitae Kim (KAIST), Sung-Hyuk Park (KAIST)	
C1.4	Understanding the Usage of In-app Community in Photo and Video Editing Apps	38
	Ning-Yi Yang (National Taiwan Univ.), Choon Ling Sia (National Taiwan Univ.)	
C1.5	Understand Users' Sharing and Continuance Intention toward Commodity-Oriented AR Filters on Social Media: an Integrated Perspective of Stimulus-Organism-Response Theory	43
	Ning-Yi Yang (National Taiwan Univ.), Choon Ling Sia (National Taiwan Univ.)	
C1.6	Exploring changes in sharing experiences to social media: Focusing on the case of domestic tourists in Jeju Island before and after Covid-19	49
	Unchan Park (Hanyang Univ.), Minha Choi (Hanyang Univ.), KyungJin Cha (Hanyang Univ.)	

D1 [KIISS-Paper Session] Cryptocurrency & Fintech 1

암호화폐와 핀테크 1

D1.1	CNN based Robot Advisor for the investment of Cryptocurrency	58
	암호화폐 투자를 위한 CNN 기반 로보 어드바이저 원종관, 홍태호 (부산대)	
D1.2	An Analysis of the Information Flow of Thematic Cryptocurrencies and Tokens Using Transfer Entropy and Network Topology	59
	전이 엔트로피 및 네트워크 위상을 활용한 테마별 암호화폐 및 토큰의 시스템적 위험의 정보 흐름 분석 최인수 (KAIST), 이준협 (한양대), 조영환(KAIST), 최현수 (동국대), 김우창 (KAIST)	
D1.3	부도예측모형에서 도메인 지식을 통합한 반사고적 예시 기반 설명력 증진 방법	61
	조수현, 신경식 (이화여대)	

E1 [KIISS-Paper Session] AI & Deep-Learning 1

인공지능과 딥러닝 1

E1.1	Automated Machine Learning Using Transaction Data	63
	트랜잭션 데이터 기반 머신러닝 자동화 방법론 Kyeongbin Park, Yoonho Cho 박경빈, 조운호 (국민대)	
E1.2	Improving particulate matter prediction performance using reconstruction error	65
	복원오류를 활용한 시공간 트랜스포머 모델의 미세먼지 예측 성능 향상	

	Youngkwang Kim 김영광 (웨슬리퀘스트)	
E1.3	Data Proliferation Techniques through Shape Deformation 67 이미지 데이터 증식 Crumple 알고리즘 연구 Kyounglim Cho, Minyoung Lee, Inchoel Shin 신인철, 조경림, 이민영 (선도소프트)	
E1.4	AI-Connect Protocol: A New Federated Deep Learning Method for User-Centric AI Service 69 Seung-Ho Choi, Baek Jeong, YuJeong Hwangbo, Kyung Yang Park, Kyoung Jun Lee 최승호(경희대), 정백(경희대), 황보유정(경희대), 박경양(하렉스인포텍), 이경전(경희대)	
E1.5	Multivariate time series traffic anomaly detection with Prediction & AutoEncoder ConvLSTM과 ATTENTION AutoEncoder를 통한 다변량 시계열 트래픽 이상탐지 71 Junghyeon Lee, Koosup Jeong, Wooju Kim 이정현, 정구섭, 김우주 (연세대)	

A2 [Tutorial] Tutorial (Amazon, Gartner)
--

A2.1	Accelerate Digital Experience Transformation 73 Choi, Youn (Gartner) 최윤 (가트너)	
A2.2	Amazon A9 & A10 Algorithms that Make Amazon Sellers Laugh and Cry 74 Ju-young Seo (FAEM GLOBAL Inc) 서주영 (FAEM GLOBAL)	
A2.3	ICAN: icon-based coding education software for all ages 75 Byungseok Kang (S1) 강병석 (에스원)	

B2 [Special Session] Seoul Digital Foundation 서울디지털재단
--

	Analyzing Environmental effects the Park and Green Space on Urban area :	
B2.1	A Case of Using Dense IoT Infrastructure in Seoul 78 스마트시티에서 IoT인프라의 정책 활용 Jihye Park 박지혜 (디지털재단)	
B2.2	The Impact of Enforcement of The Serious Accident Punishment Act in the Digital Technology 79 중대재해처벌법 시행에 따른 건설분야 디지털 기술 활용에 대한 고찰 Ko Seoltae 고설태 (디지털재단)	
B2.3	A Study on the Location of the Public Wi-Fi Hot Place Based on the Analysis of the Floating Population in Time and Space : Seoul Metropolitan Government 80 시공간 이동인구 분석 기반 공공와이파이 핫플레이스 입지 분석 Tae-Houn Ji 지태훈 (디지털재단)	

B2.4	A Study on the Introduction and use of GeoAI-based urban change detection service 81 GeoAI 기반 도시 변화탐지 서비스 도입과 활용방안 Sujin Back 백수진 (디지털재단)
B2.6	A Study on the Elderly-friendly Digital Accessibility Guideline 82 고령층 친화 디지털 접근성 표준개발 Minjung Kang 강민정 (디지털재단)

C2 [ICEC-Paper Session] E-Commerce Strategy

C2.1	The Effects of Social Influence on Consumer Behaviors in Social Commerce from Innovation Attributives 84 Li Zhao (Southwestern Univ. of Finance and Economics), Yun Xu (Southwestern Univ. of Finance and Economics), Xu Xu (Southwestern Univ. of Finance and Economics)
C2.2	Feeling Close: The Role of Psychological Distance in Augmented Reality-Enabled E-commerce Experiences 98 Jun Liu (Beijing Sport Univ.), Zhao Du (Beijing Sport Univ.), Tianjiao Wang (Beijing Sport Univ.), Guode Sun (Beijing Sport Univ.)
C2.3	The Impact of E-Commerce Capability on 99 Ilham Ait Bouazza (KAIST)
C2.4	The impact of artificial intelligence on customer 100 Lei Li (Northwest Agriculture and Forestry Univ.), Jiabao Lin (South China Agricultural Univ.), Wenyi Luo (South China Agricultural Univ.)
C2.5	Can Social Commerce Platforms Retain Users? The Perspectives of Technological Environments and Perceived Values of Generation Z 104 Ziqing Xu (Beijing Normal Univ.-Hong Kong Baptist Univ. United International College), Zhenhua Ye (Beijing Normal Univ.-Hong Kong Baptist Univ. United International College), Angela K-F Ma (Beijing Normal Univ.-Hong Kong Baptist Univ. United International College)
C2.6	Consumer Engagement and Reuse Intention Through Content Type in Mobile Commerce 108 Ming Wang (Soonchunhyang Univ.), Jaewon Choi (Soonchunhyang Univ.)

D2 [Special Session] Welcome to World Smart Sustainable Cities

D2.1	In-depth research on the application of blockchain in the virtual world 126 ShengJuan Zhao, Dengsheng Yu, GyooGun Lim 조승연 (한양대), Dengsheng Yu (Wenzhou Univ. of Technology), 임규건 (한양대)
------	--

D2.2	Analysis of NFT diversity trends	128
	Hee-young Joe, Na-yeon Kim, Ho-yeon Park 조희영 (이화여대), 김나연 (이화여대), 박호연 (이화여대)	
D2.3	A Study on the service quality factors perceived by users mobile banking service : Analysis of user review using Combined Topic Model and Sentiment analysis	130
	모바일 뱅킹 서비스에 대한 서비스품질과 중요도 파악 : BERTopic 및 감성분석을 통한 사용자 리뷰 분석 Min Ji Kim, Kyung jin Cha 김민지, 차경진 (한양대 경영대학)	
D2.4	KB-BERT: Training and Application of Korean Pre-trained Language Model in Financial Domain	132
	KB-BERT: 금융 특화 한국어 사전학습 언어모델과 그 응용 Donggyu Kim, Dongwook Lee, Jangwon Park(KB Bank TechGroup Finance AI Center) 김동규, 이동욱, 박장원, 오성우, 권성준, 이인용 (국민은행)	
D2.5	Analysis of Local Currency Issues using Text Mining	133
	텍스트마이닝을 활용한 지역화폐 이슈 분석 Soonhyoung Park, Soongoo Hong 박순형, 홍순구 (동아대)	

E2 [KIISS-Paper Session] AI & Deep-Learning 2 인공지능과 딥러닝 2

E2.1	Skin cancer detection using a hybrid model of deep learning and machine learning	135
	CNN과 분류기의 결합을 이용한 피부질환 분류모델 구축 Sunkyoung Jeong, Jiyoung Woo 정선경, 우지영(순천향대)	
E2.2	A Study on the Visual Art Image Retrieval Using Vision Transformer and K-NN Triplet Mining	137
	비전 트랜스포머와 K-최근접 트리플 마이닝을 활용한 시각예술 이미지의 검색에 관한 연구 Junghyun Gan, Wooju kim 간정현, 김우주(연세대)	
E2.3	A Study for Data Center integration failure analysis using CEP	139
	CEP를 활용한 데이터센터 통합 장애 분석 Hyunjong Shin, Sungkeun Kim, Byoungwhan Chun, Seungjeong Yang 신현종, 양승정, 김성근, 천병환 (한화시스템)	
E2.4	Deepfake Detection using masked autoencoder -transformer with Squeeze and Excitation Block	140
	Masked Autoencoder와 SE-block 기반의 Vision Transformer 을 활용한 딥페이크 탐지에 관한 연구 Dongjae Park , Wooju Kim 박동재, 김우주 (연세대)	

A3 [Academic Forum] Bright Internet and Emerging Technologies
--

A3.1	Cryptocurrency Price Fluctuations and Prices of Non-Fungible Tokens: Empirical Evidence from OpenSea	143
	Jaehyeong Park (College of Business, KAIST), Daegon Cho (College of Business, KAIST) 박재형, 조대근 (KAIST)	
A3.2	Will Cryptocurrency-Based Loyalty Programs Thrive as the Coin Price Rises?	144
	Euro Bae (KAIST), Hyeokkoo Eric Kwon (Nanyang Technological University) Jaywon Lee (Sejong University), Daegon Cho (KAIST) 배유로 (KAIST), 권혁규(난징기술대), 이재원 (세종대), 조대근(KAIST)	
A3.3	Quantifying Knowledge Synchronization in the 21st century	145
	Jisung Yoon (POSTECH), Jinseo Park (Indiana University), Jinhyuk Yun (KISTI), Woo-Sung Jung (POSTECH) 윤지성(POSTECH), 박진서(Indiana대), 윤진혁(KISTI), 정우성(POSTECH)	

B3 [Special Session] Intelligence Award II 인텔리전스 대상 기업 세션 II
--

B3.1	Generative AI-based Virtual Identity Service and Solution	147
	생성적 AI 기술 기반 가상 아이덴티티 서비스 및 솔루션 Jintae Han (Xinapse) 한진태 (자이냅스)	
B3.2	A System for Detecting Changes in Agricultural Land and Calculating the Area Using GeoAI	148
	GeoAI를 활용한 농경지 변화탐지 및 면적 산출 시스템 Min-young Lee (Sundosoft) 이민영 (선도소프트)	
B3.3	E-commerce, which is popular these days, uses these technologies.	150
	잘나가는 이커머스는 이런 기술들을 사용합니다 Shin Hyun Kyu (Seoul Ventures) 신현규 (서울벤처스)	
B3.4	SaaS-based industrial AIoT service	151
	SaaS 기반의 산업용 AIoT 서비스 LIM Dae Geun (SimPlatform) 임대근 (심플랫폼)	
B3.5	Artificial intelligence-based sewage pipeline defect detection system	153
	인공지능 기반 하수관로 결함탐지 시스템 Ko Seoltae (Seoul Digital Foundation) 고설태 (디지털재단)	

C3 [ICEC-Paper Session] Recommender System

C3.1	Incorporating Price Preferences for Product Recommendations in Electronic Commerce	155
	Han Chen (South China Normal Univ.), Weiwei Deng (South China Normal Univ.)	

C3.2	A multimodal deep learning approach for online course recommendation	163
	Weiwei Deng (South China Normal Univ.), Lingjun Fu (South China Normal Univ.), Han Chen (South China Normal Univ.)	
C3.3	TransformRec: User-Centric Recommender System for e-Commerce Using Transformer	171
	Kyoung Jun Lee (Kyung Hee Univ.), Yujeong Hwangbo (Kyung Hee Univ.), Hokyung Jung (Kyung Hee Univ.), Baek Jeong (Kyung Hee Univ.), Jong Il Park (HAREX INFOTECH)	
C3.4	Multi-dimension Recommender System based on Hotel Selection Attribute Provided by TripAdvisor Online Reviews	179
	Kyungmo Kang (KyungHee Univ.), Yugyeong Son (KyungHee Univ.), Seungwoo Lee (KyungHee Univ.), Jaekyeong Kim (KyungHee Univ.)	
C3.5	AMPER(Aim-Measure-Predict-Evaluate-Recommend): The Paradigm of Digital Me	182
	Kyoung Jun Lee (Kyung Hee Univ.), Baek Jeong (Kyung Hee Univ.), Yujeong Hwangbo (Kyung Hee Univ.), Youngchan Kim (POSTECH), Sungwon Bae (Kyung Hee Univ.), Taehoon Baek (HAREX INFOTECH)	
C3.6	Analyzing the Impact of Components of Yelp.com on Recommender System Performance	185
	Seungwoo Lee (Kyunghee Univ.), Hyunjoo Shin (Kyunghee Univ.), Kyungmo Kang (Kyunghee Univ.), Jaekyeong Kim (Kyunghee Univ.)	

<p>D3 [KIISS-Paper Session] Natural Language Processing: NLP 자연어 처리</p>

D3.1	AI meaning detection BIO tagging	189
	복수 텍스트(text)로 단수 컨텍스트(context)의 의미를 분해하는 인공지능 자연어처리 기술 개발 Kim, Won Hoi 김원희 (브레인벤처스)	
D3.2	Exploring the Effects of Corporate Organizational Culture on Financial Performance : Using Word2Vec model and Panel Data	19
	기업의 조직문화가 재무성과에 미치는 영향에 대한 연구: Word2Vec 모델과 패널 데이터를 이용하여 Han Sol Kim, Hye min Kim, Seung Ik Baek 김한솔, 김혜민, 백승익 (한양대)	
D3.3	An Exploration of MIS Quarterly Research Trends: Applying Topic Modeling and Keyword Network Analysis	199
	MIS Quarterly 연구동향 분석: 토픽모델링 및 키워드 네트워크분석 활용 Eunkyung Kang, Yeonsik Jung, Seonuk Yang, Jiyoon Kwon, Sung-Byung Yang 강은경, 정연식, 양선욱, 권지윤, 양성병 (경희대)	
D3.4	Proposal of Youth Policy Agenda Using Internet Community Comments	200
	인터넷 커뮤니티 게시글을 활용한 청소년 정책 의제 도출 Su-Gyeong Roh, Soon-Goo Hong, Ji-Won Lim 노수경, 홍순구, 임지원 (동아대)	

E3 [KIISS-Paper Session] Recommender System & AI

추천시스템과 인공지능

	Resort Cross-Selling Prediction Model using Explainable Artificial Intelligence	
E3.1	Techniques	202
	리조트 교차판매 예측모형 개발 및 XAI를 활용한 해석	
	Boram Kang, Hyunchul Ahn (Kookmin University)	
	강보람, 안현철 (국민대)	
E3.2	Nonlinear Vector Alignment Methodology for Mapping Domain-Specific Terminology into General Space	204
	전문어의 범용 공간 매핑을 위한 비선형 벡터 정렬 방법론	
	Junwoo Kim, Byungho Yoon, Namgyu Kim (Kookmin University)	
	김준우, 윤병호, 김남규 (국민대)	
E3.3	Effect of Data Scaling Methods on Bankruptcy Prediction	206
	Scaler 종류에 따른 부도 예측 결과에 대한 영향성 분석	
	ChanWoo Song, SeungGyu Ann, JongHyun Park, Hyunchul Ahn (Kookmin University)	
	송찬우, 안승규, 박종현, 안현철 (국민대)	
E3.4	Exploring the Determinants of Online Education Contents Use using Machine Learning and SHAP Techniques	208
	머신러닝과 SHAP 기법을 활용한 온라인교육콘텐츠 이용 결정요인 탐색	
	Joonyoung Maeng, Hyunchul Ahn (Kookmin University)	
	맹준영, 안현철 (국민대)	
E3.5	Anomaly Detection Methodology Based on Multimodal Deep Learning	210
	멀티모달 딥 러닝 기반 이상 상황 탐지 방법론	
	DongHoon Lee, Namgyu Kim (Kookmin University)	
	이동훈, 김남규 (국민대)	
E3.6	A Multi-Criteria Recommender System Using Semi-supervised Aspect-based Sentiment Analysis	212
	준지도학습 방식 속성 기반 감성분석을 이용한 다중 기준 추천시스템	
	Park, Dong Jun, Chung, Yeojin (Kookmin University)	
	박동준, 정여진 (국민대)	
E3.7	Class Imbalance Resolution Method Using Cluster Analysis and Classification Algorithm Recommendation Method	214
	데이터셋 유형 분류를 통한 클래스 불균형 해소 방법 및 분류 알고리즘 추천	
	Jeonghun Kim, Kee-Young Kwahk (Kookmin University)	
	김정훈, 광기영 (국민대)	

Day 2 (Thu. 23rd June)

A1 [Tutorial] Tutorial(Africa Startup)

A1.1	Africa start up, entrepreneurship, market status, market demand	216
	Yen Choi (Netcom Africa)	

B1 [Special Session] NIA Open Data
NIA 공공데이터

- B1.1 Major Achievements of Open Government Data and Strategic Direction of Open Government Master Plan in Republic of Korea 231
공공데이터 추진성과와 디지털플랫폼정부 구현을 위한 공공데이터 기본계획 방향
Yongkun LEE (NIA)
이용건 (NIA)
- B1.2 Achievement of open data operation and management evaluation for improving open data 233
공공데이터 제공 운영 수준 향상을 위한 실태평가 추진성과
MyeongJin Shin (NIA)
신명진 (NIA)
- B1.3 Best Practices of Big Data Analytics for Data-Driven Government 235
데이터 기반 행정 활성화를 위한 공공빅데이터 분석 사례
Seung Hyun Kim (NIA)
김승현 (NIA)

C1 [KIISS-Paper Session] Intelligence Service

- C1.1 Human reasoning evidenced by a cortical surface-based meta-analysis 238
Hyeon-Ae Jeon
신민호, 전현애 (DGIST)
- C1.2 Analysis of Influencing Factors of Consumer Purchase Intention on Cross-Border e-Commerce Platform 239
DengSheng Yu, ShengJuan Zhao, GyooGun Lim
DengSheng Yu(Wenzhou Univ. of Technology), 조승연, 임규건(한양대)
- C1.3 A Study on the Characteristics of the Online Price Comparison Platform Market 240
온라인 가격비교 플랫폼 시장의 특성에 관한 연구
Sanghyun Lim, Choong Kwon Lee, JI EUN JEON
임상현, 이충권, 전지은 (계명대)
- C1.4 Methodology of New Product Development Based on a Predictive Model 241
수요예측 기반의 신제품 개발 방법론 제안: KANO와 Gaussian Process Regression 적용 모델
Dohee Chung, Chan Gyu Lee, Sungmin Yang, Jin Kang
정두희, 이찬규, 양성민, 강진 (한동대)
- C1.5 Boycott or Not? How do paid Advertisement Controversy in Youtuber Industry for Consumer's Boycott Intention 242
Wang Ming, Jaewon Choi
왕밍, 최재원 (순천향대)
- C1.6 Do Mobile Devices Change Shopping Behavior? An Eye-Tracking Approach 243
모바일 채널에서의 소비자 행동 변화 확인: 아이트래킹 접근 방식을 통해
Kyuhong Park, Dongyeon Kim
박규홍 (인하대), 김동연 (가톨릭대)

D1 [ICEC-Paper Session] Machine Learning & Text Mining I

D1.1	Conducting Service Analysis Based on Online Customer Reviews - Topic Modeling	246
	Kyungbae Park (Kyungpook National Univ.), Bogeun Jo (Kyungpook National Univ.), Sungbae Cho (National Information Society Agency), Sung Ho Ha (Kyungpook National Univ.)	
D1.2	Exploring Voice Assistant Users' Goals: A Goal	254
	Seoungmin Han (Korea Univ.), Yoonhyuk Jung (Korea Univ.), Woonki Hong (Korea Univ.)	
D1.3	What do Chinese Airbnb green users focus on?	262
	Juying Wang (Ocean Univ. of China), Cheng Wang (Ocean Univ. of China)	
D1.4	AI Generating and Detecting Manipulated Online Customers Reviews	270
	Olga Chernyaeva (Pusan National Univ.), Taeho Hong (Pusan National Univ.), YoungKi Park (George Washington Univ.), Yonghee Kim (Pusan National Univ.), Gang Ren (Hefei Univ. of Technology)	
D1.5	Exploring the Echo Chamber Effect of ASMR Marketing Content on User: A Text-mining Perspective	276
	Ming Wang (Soonchunhyang Univ.), Hung Chuong Tran (Soonchunhyang Univ.), Jaewon Choi (Soonchunhyang Univ.)	
D1.6	Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI) for e-Commerce:	292
	Venus Jin (Northwestern Univ. in Qatar)	

E1 [ICEC-Paper Session] Economic Analysis of IT

E1.1	Can the Cross-border eCommerce Platform Mitigate the Sellers' Risks?	294
	Yingjian Liu (Xi'an Jiaotong Univ.), Jae Kyu Lee (Xi'an Jiaotong Univ.), Shan Liu (Xi'an Jiaotong Univ.)	
E1.2	Research on the Influencing Factors of Cross-border E-commerce Business Incubation from the Perspective of School-enterprise Cooperation	308
	Shuli Zheng (Zhejiang Univ. of Water Resources and Electric Power), Li Du (Zhejiang Univ. of Water Resources and Electric Power) and Yuwen Zhou (Zhejiang Univ. of Water Resources and Electric Power)	
E1.3	Civic Technology Development in a Community	317
	Jessica Chen (National Chi-Nan Unersivisty), Yuyu Chen (National Chi-Nan Unersivisty)	
E1.4	Impact of Movie Search Volume on Short-term Stock Market Valuation of Movie Companies	325
	Yangyin Lin (Harbin Institute of Technology), Qiang Ye (Harbin Institute of Technology), Hao Xia (Harbin Institute of Technology)	

E1.5	An Economic Analysis of Software Piracy in a Competitive Cloud Computing Market: A Product Bundling Perspective	333
	Zhiyuan Liu (Beijing Jiao Tong Univ.), Yuexiang Yu (Beijing Jiao Tong Univ.), Jikun Lv (Beijing Jiao Tong Univ.), Xiong Zhang (Beijing Jiao Tong Univ.)	
E1.6	The Impact of Information Systems Vulnerability Announcements on Firms' Market Value	334
	Jianlong Chen (Beijing Jiao Tong Univ.), Haijie Xu (Beijing Jiao Tong Univ.), Xiong Zhang (Beijing Jiao Tong Univ.)	

A2 [Startup Session] Korean Startups, Leading AI and E-Commerce AI와 이커머스를 이끄는 한국의 스타트업들

A2.1	Super Simple AI Logistics Competitiveness	336
	이커머스 시대의 인공지능 기반 물류 플랫폼 Jin Soo Park (Colosseum) 박진수 (콜로세움)	
A2.2	Development of global fashion e-commerce platform	337
	글로벌 패션 전자상거래 플랫폼의 변화 Vivien Nam (GOLLALA)	
A2.3	Discussion on AI / E-commerce Start-up	338
	전자상거래 및 인공지능 변화와 스타트업들의 활동 토론 Hansoo Lee (LITALCO) 이한수 (이탈리코)	

B2 [Special Session] Graduate Student Research Colloquium for Publication in High-ranking Journals

B2.1	Detection of interaction-based knowledge for reclassification of service robots: big data analytics perspective	340
	Ming Wang (Soonchunhyang University) 왕밍 (순천향대)	
B2.2	Exploring Consumers' Perceptions of the Influencer Sponsorship Disclosure Posts: the Perspective of Product Involvement and Brand Strength	341
	Xiuping Zhang (Soonchunhyang University) 장수평 (순천향대)	
B2.3	Boycott or Not? How do paid Advertisement Controversy in Youtuber Industry for Consumer's Boycott Intention	342
	Ming Wang (Soonchunhyang University) 왕밍 (순천향대)	
B2.4	The Study on Determinants of User Satisfaction with Interoperable AI Voice Assistants	343
	Elena Kim (Soonchunhyang University) 김 엘리나 (순천향대)	
B2.5	What makes people purchase used products online using C2C used product platform?	345

ofori henry (Ajou University)
Ofori Henry (아주대)

C2 [KIISS-Paper Session] Intelligent Devices and Services
지능형 디바이스와 서비스

C2.1	Proposal for Intelligent Home Beauty Device Development 348 지능형 홈뷰티 디바이스 개발을 위한 방법 Yewon Bang, Jhon Park, Doohee Chung 방예원, 박준, 정두희 (한동대) The Effect of Smart Factory User Satisfaction on Business Performance and Intention to Accept System Advancement of Small and Medium-Sized Manufacturing Firms: Based on the Information Systems Success Model 349 중소 제조기업의 스마트팩토리 사용자 만족이 경영성과와 고도화 수용의도에 미치는 영향: 정보시스템성공모형을 기반으로 Yoon Jae Kim, Chang-Geun Jeong, Sung-Byung Yang 김윤재, 정창근, 양성병 (경희대)
C2.2	
C2.3	Compressing intent classification model for multi-agent in low-resource devices 350 저성능 자원에서 멀티 에이전트 운영을 위한 의도 분류 모델 경량화 Yongsun Yoon, Jinbeom Kang 윤용선, 강진범 (자이냅스)
C2.4	A Study on the OOD of Electric Vehicle Battery through Image Synthesis Based on Patch Mix 351 Patch Mix 기반의 이미지 생성을 통한 전기차 배터리 OOD 연구 Ji Hun Lee, Yeong Kyu Cho, Woo Ju Cho 이지훈, 조영규 (연세대)

D2 [ICEC-Paper Session] Machine Learning & Text Mining II

D2.1	The Heterogeneous Impact of Churn Customers 354 Woong Park (Kookmin Univ.), Hyunchul Ahn (Kookmin Univ.)
D2.2	A Multi-CNN Model Interacting Contents and Ratings for Predicting Review Helpfulness 360 Xinzhe Li (Kyung Hee Univ.), Qinglong Li (Kyung Hee Univ.), Jaekyeong Kim (Kyung Hee Univ.)
D2.3	Marvelous Agglutinative Language Effect on Cross Lingual Transfer Learning 369 Wooyoung Kim (Yonsei Univ.), Chaerin Jo (Yonsei Univ.), Minjung Kim (Yonsei Univ.), Wooju Kim (Yonsei Univ.)
D2.4	Whose words do we listen to, Robot vs. Human? The Effect of Anthropomorphism Level on Behavioral Intention Depending on Conversational Agent's Anthropomorphism Level 377 Eunju Yi (Kookmin Univ.), Do-Hyung Park (Kookmin Univ.)
D2.5	Digital Transformation of Poultry Industry 379

Yu-I Lai (National Taiwan Univ. of Science and Technology), Tzu-Chuan Chou (National Taiwan Univ. of Science and Technology), Chen-Hao Huang (National Taiwan Univ. of Science and Technology)

E2 [ICEC-Paper Session] COVID-19 & IT Applications

- E2.1 Survey on the Effectiveness and Students' Attitudes of Online Education Under the COVID-19 Pandemic: A Case Study of QAU University in China 381
 Yuanyuan Lai (Qingdao Agricultural Univ.), Huiyuan Ding (Qingdao Agricultural Univ.), Jingsuo Li (Qingdao Agricultural Univ.), Yun Zhang (Wuzhou Univ.)
- E2.2 Visual Analysis of Foreign Internet Hospital-Related Research Based on CiteSpace ... 382
 Feiya Ma (Shanghai Univ. of Engineering Science), Ting Yu (Shanghai Univ. of Engineering Science)
- E2.3 NEW MODEL OF SMART ELDERLY CARE: ONLINE TO OFFLINE BUSINESS MODEL DESIGN OF COMMUNITY ELDERLY CARE IN CY DISTRICT OF QINGDAO UNDER COVID-19 390
 Changxin Guo (Qingdao Agricultural Univ.), Yuanyuan Lai (Qingdao Agricultural Univ.), Jinwei Li (Guotai Junan Securities Co. LTD), Ying Li (QAU @ RAU Joint Institute), Mengjia Sun (Qingdao Agricultural Univ.), Nuo Liu (Qingdao Agricultural Univ.)
- E2.4 Omnichannel Reaction to the COVID-19 Outbreak: Evidence from a Retailing Company 400
 KangHo Lee (Korea Univ.), DongWon Lee (Korea Univ.)
- E2.5 A Study on COVID-19 Contact Tracing Applications 408
 Jongki Kim (Pusan National Univ.), Jianbo Wang (Pusan National Univ.)
- E2.6 A Comparative Analysis of Telemedicine Research in China Before and After the COVID-19 Pandemic based on Bibliometrics 421
 Hui Jiang (Shanghai Univ. of Engineering Science), Ting Yu (Shanghai Univ. of Engineering Science), Sasa Liu (Shanghai Univ. of Engineering Science), Yujiao Qiu (Univ. of Pennsylvania), Beibei Li (Shanghai Univ. of Engineering Science)

A3 [Junior Faculty / Researcher] Junior Faculty / Researcher Seminar

- A3.1 In-store shopping with location-based retail apps: perceived value, consumer response, and the moderating effect of flow 430
 Eunhye Kim (Samsung SDS)
 김은혜 (삼성 SDS)
- A3.2 Heaven or Hell for Artists in NFT : A Social Exchange Theory Perspective 431
 Ji-Hoon Yang, Sang-Hyeak Yoon (KOREATECH)
 양지훈, 윤상혁 (KOREATECH)
- A3.3 Who Clicks on the Advertisement of Metaverse Platform Service? 439

	Han-Min Kim, Soonam Lee, Suyoung Ko (Sungkyunkwan University) 김한민, 이수남, 고수영 (성균관대)	
A3.4	Effects of Popularity Cues on Impulse Purchase in Live Streaming Commerce	440
	Liguo Lou, Joon Koh (Ningbo University of Technology) Liguo Lou, 고준 (닝보기술대)	
A3.5	Establish a Model for Detecting Fake News Using Machine Learning; Focusing on User Behaviors and Social Networks	448
	Liguo Lou, Joon Koh (Ningbo University of Technology) Liguo Lou, 고준 (닝보기술대)	

B3 [Special Session] Virtual Humans

B3.1	A Study on the Learning Effect of GAN-Generated Management Education Contents	450
	GAN생성 경영교육 콘텐츠의 학습효과에 대한 연구 Yixi Dong, 배수진, 권오병 (경희대)	
B3.2	The Impact Factor of Media Richness and Authenticity of Human Content on User Satisfaction	452
	가상 인간 콘텐츠의 매체풍부성과 진정성이 만족감에 미치는 영향 연구 Gong Li, 배수진, 권오병 (경희대)	
B3.3	A Study on Measuring the Effectiveness of ESG Management Education by Virtual Humans	454
	가상 인간에 의한 ESG교육의 효과 측정 연구 Jiarui Liu, 배수진, 권오병 (경희대)	
B3.4	A Study on Factors Affecting the Difference in User Satisfaction between Virtual Human and Meta-Human	456
	가상휴먼과 메타휴먼의 사용 만족감 차이에 영향을 미치는 요인 배수진, 권오병 (경희대)	

C3 [KIISS-Paper Session] Big Data Platform 빅데이터 플랫폼
--

C3.1	Derive to improving direction for community care of disabled	459
	장애인 지역사회 통합돌봄 정보시스템 개선 방안 도출 Young-Hyeon Bae, Yeji Choi, Juhee Kim, Seoung Hee Ho 배영현, 최예지, 김희, 호승희 (국립재활원)	
C3.2	Priority Area Prediction Service for Local Road Packaging Maintenance Using Spatial Big Data	461
	공간 빅데이터를 활용한 지방도 포장보수 우선지역 예측 서비스 Minyoung Lee, Jiu Choi, Inyoung Kim, Sujin Son, Inho Choi 이민영, 최지우, 김인영, 손수진, 최인호 (선도소프트)	
C3.3	The Study on Determinants of User Satisfaction with Interoperable AI Voice Assistants	462

	Elena Kim, Jaewon Choi 김엘레나, 최재원 (순천향대)	
C3.4	The Developmental measures and implications of introducing voice-based public services for strengthening the accessibility of the social vulnerable and open public communication*.	464
	Jinsoon Song 송진순 (동아대)	
C3.5	Building a Digital Learning Ecosystem for a Higher Education 디지털 학습생태계 구축을 위한 기초 연구	465
	Hyun Sook Oh, Jong Ho Lee, Gyoo Gun Lim 오현숙, 이종호, 임규건 (한양대)	
C3.6	Analysis and Deriving Priorities of the Optimal Location of Electric Vehicle Charging Stations Using the Open Data 공공데이터를 활용한 공용 전기차 충전소 최적입지 선정 및 우선순위 도출	466
	Kyoungmoon Park, Inho Choi, Yeonjun Kim, Taesun An 박경문 (협성대), 최인호 (선도소프트), 김연준 (충북대), 안태선(협성대)	

D3 [ICEC-Paper Session] AI Applications

D3.1	User Experience with Chatbot: A Systematic Review Guode Sun (Beijing Sport Univ.), Zhao Du (Beijing Sport Univ.), Tianjiao Wang (Beijing Sport Univ.), Jun Liu (Beijing Sport Univ.)	468
D3.2	Toward the AI-enabled digital financial services innovation: The role of positive emotional interactions with users Xi Chen (Yunnan Univ.), Cheng Chen (Yunnan Univ.), Yi Cheng (Yunnan Univ.)	469
D3.3	MV-GNN: Multi-View Graph Neural Networks for CTR Prediction Panyu Zhai (Huazhong Univ. of Science and Technology), Yanwu Yang (Huazhong Univ. of Science and Technology), Chunjie Zhang (Beijing Jiaotong Univ.)	529
D3.4	Classification of Restricted and Unrestricted Content based on Convolutional Neural Network and Long Short-Term Memory (CNN-LSTM) Method Xiu Ping Zhang (Soonchunhyang Univ.), Jaewon Choi (Soonchunhyang Univ.)	530
D3.5	A Study on Vacant House Estimation using Artificial Intelligence : In the case of Gunsan Gyoo Gun Lim (Hanyang Univ.), Jong Hua Noh (Hanyang Univ.), Hyun Tae Lee (Hanyang Univ.), Jae Ik Ahn (Hanyang Univ.), Dengsheng Yu (Wenzhou Univ. of Technology)	542

E3 [ICEC-Paper Session] Service Design & Business Model

E3.1	Value Co-creation of Online Service : A model proposed based on Activity System Model	544
------	---	-----

	Yuhui Meng (Pusan National Univ.), Ying Li (Liaoning Univ.), Jian Mou (Pusan National Univ.), Batool Raheela (Pusan National Univ.)	
E3.2	Command or Suggestion? Exploring the Persuasive Effect of Physicians' Language on Patient Behavior in Online Health Platforms	550
	Wanyue Jiang (Xi'an Jiaotong Univ.), Shan Liu (Xi'an Jiaotong Univ.), Guangsen Si (Xi'an Jiaotong Univ.), Baojun Gao (Wuhan Univ.), Bo Kou (The First Affiliated Hospital of Xi'an Jiaotong Univ.)	
E3.3	A Study on Data-Driven Service Design for the Improvement of Media Literacy	551
	Sangwoo Park (Sungkyunkwan Univ.), Inseop Lee (Sungkyunkwan Univ.), Sanghun Sul (Sungkyunkwan Univ.)	
E3.4	Research on the evolution path of start-up platform structure and user scale	559
	Haiqing Hu (Shandong Normal Univ.), Yanru Chen (Shandong Normal Univ.), Yang Li (Shandong Normal Univ.)	
E3.5	The Moderating Effects of Perceived Humanness on Contactless Service Robots	573
	Taejin Kim (Ajou Univ.), One-Ki Daniel Lee (Univ. of Massachusetts Boston), Juyoung Kang (Ajou Univ.)	
E3.6	Design business model for smart lifestyle mobile application	574
	Elisa Choi (Hanyang Univ.), Minsoo Shin (Hanyang Univ.), Gyugun Lim (Hanyang Univ.)	

A4 [MFDS Session] Imported Food Safety Predict
--

A4.1	AI can enhance screening and detecting the non-compliance food foreign facilities	576
	Sanggoo Cho (nal Food Safety Information Service) 조상구 (식품안전정보원)	
A4.2	Determination of Manufacturing Process Similarity of Imported Food Products Using Word2Vec Algorithm	581
	Jun-Hyun Oh (Sangmyung University) 오준현 (상명대)	
A4.3	Anomaly Detection in Imported Food Customs Clearance using Variational Autoencoder	582
	Sangun Park (Kyonggi University) 박상언 (경기대)	
A4.4	Lessons from Feature Engineering and Machine Learning Modeling for Determination of Defective Health Functional Foods	584
	Kyoungsu Lee (Kyung Hee University) 이경수 (경희대)	

B4 [Special Session] KMU-KIISS AI Professional Certificate Program KMU-KIISS AI 실무능력 인증과정
--

B4.1	Comparative study on air demand forecasting before and after the COVID-19 by deep learning 589 딥러닝을 이용한 코로나 전후 기간 항공 수요 예측 비교 Yongseong, Son (Kookmin University) 송용성 (국민대)
B4.2	Cryptocurrency price prediction using multivariate time series data 590 다변량 시계열 데이터를 이용한 암호화폐 가격 예측 Kihyun, Lee (Kookmin University) 이기현 (국민대)
B4.3	Product demand prediction using deep learning-based time series techniques 591 딥러닝 기반 시계열 기법을 활용한 유통제품 수요예측 Eunha, Jeon (Kookmin University) 전은하 (국민대)

C4 [ICEC-Paper Session] Live Commerce

C4.1	Is Live Commerce Transforming the Shopping Experience?: A Study on Perceived Value of live Commerce, Interaction with Seller, Trust in Seller and E-WOM Intention 593 Eunji Choi (Gachon Univ.), Seongmin Jeon (Gachon Univ.)
C4.2	The effect of live streaming commerce quality on customers' purchase intention: Extending the elaboration likelihood model with herd behavior 601 Qin Yang (Jiaxing Univ.), Young-Chan Lee (Young-Chan Lee)
C4.3	Rethinking determinants of purchase intention: Towards CBEC in Emerging Markets 609 Jie Jian (Chongqing Univ. of Posts and Telecommunications), Ling Lv (Chongqing Univ. of Posts and Telecommunications), Li Wan (Chongqing Univ. of Posts and Telecommunications)
C4.4	Advertising Value of Gaming Influencers 610 Carsten D. Schultz (Univ. of Hagen)
C4.5	Understanding users' negative emotions and continuous usage intention in short video apps indulging 611 Xusen Cheng (Renmin Univ. of China), Xiaowei Su (Renmin Univ. of China), Alex Zarifis (Univ. of Cambridge), Jian Mou (Pusan National Univ.)
C4.6	The Influencing Factors of Cross-border E-commerce Promoting The Transformation and Upgrading of Traditional Foreign Trade 619 Jie Jian (Chongqing Univ. of Posts and Telecommunications), Kehong Liu (Chongqing Univ. of Posts and Telecommunications), Ling Lv (Chongqing Univ. of Posts and Telecommunications)

D4 [ICEC-Paper Session] Fintech & Blockchain & Cryptocurrency

D4.1	Factors Affecting the Success of Blockchain-Based Fundraising Projects	621
	Yan Sun (Kyung Hee Univ.), Sung-Byung Yang (Kyung Hee Univ.)	
D4.2	Mapping the Field of Nonprofit Crowdfunding: A Systematic Review with Bibliometric Analysis	622
	Yin Wang (Beijing Sport Univ.), Zhao Du (Beijing Sport Univ.)	
D4.3	The Flexible Impact of a Tax Deduction on Monetary Donation - the Disparity between Contributions to Campaigns and Gifts to Organizations	623
	Fumitaka Watanabe (Kyoto Univ.), Spring H. Han (Kyoto Univ.), Yasunaga Wakabayash (Bukkyo Univ.)	
D4.4	Leveraging the Predictive Power of Microblog Sentiment for Cryptocurrency Returns	624
	Gisu Kim (Korea Univ.), Dongwon Lee (Korea Univ.)	
D4.5	Research on Health Crowdfunding: A Literature Review	632
	Rui Gu (Univ. of International Business and Economics), Jing Li (Univ. of International Business and Economics), Tao Xue (Soochow Futures Co., Ltd.)	
D4.6	Stork Market and Cryptocurrency Market Prediction Modeling Research	640
	Seyoon Lee (PrideLab), Jun-Gi Park (PrideLab) and Hyejung Lee (Tokyo Univ. of Science)	

E4 [ICEC-Paper Session] IT/IS General

E4.1	Dark Side of Review Length: The Effect of Cognitive Load on Perceived Helpfulness of Rating Inconsistency	642
	Yuqiu Wang (Nankai Univ.), Kai Li (Nankai Univ.)	
E4.2	Understanding the Effect of Goal Setting in IS Compliance Intention Through Stress Theory: The Moderating Effect of Stress Coping	643
	Inho Hwang (Kookmin Univ.), Sungho Hu (Korea Univ.), Sanghyun Kim (Kyungpook National Univ.)	
E4.3	The Impacts of Augmented Reality on Sports Events Spectators' Behavior Intention: A Stimulus-Organism-Response (S-O-R) Perspective	653
	Tianjiao Wang (Beijing Sport Univ.), Zhao Du (Beijing Sport Univ.), Jun Liu (Beijing Sport Univ.), Quanyu Zhong (Beijing Sport Univ.)	
E4.4	A Longitudinal Study of Extended Technology Usage Model in the Context of Student Response System	654
	Dan J. Kim (Univ. of North Texas)	
E4.5	A study on the effecting factors on the performance of the semiconductor companies under covid-19 crisis: TSMC and Samsung case	658
	Ting Yu Chang (Hanyang Univ.), Gyoogun Lim (Hanyang Univ.)	

[DAY 1]

A1 [Tutorial] Tutorial(AI, DX, R&D)

A1.1 AI Sharing without Sharing Data: Research Findings & Business Models

Kyoung Jun Lee
Kyung Hee University
klee@khu.ac.kr

Abstract

There has been rhetoric on sharing and data: "Let's Share Everything", "Open Your Data", and "Share Your Data" etc. But, in reality, usually people do not want open or share her/his own data from privacy and business reasons. Companies neither wants to disclose nor shares their data from business & legal reasons. People and companies open or share their properties only when it is beneficial. When obliged to share their data, people and companies, the self-interested entities, usually share low-quality degraded data.

Data is considered as the new fuel of economy in the 4th industrial revolution era. Many people believe, "When we gather data, we can make good AI!" However, because of the reluctance of people and companies to share or open data, only large corporations and big tech platforms could make good AI. The stronger AI they have, the stronger the conglomerates and big tech platforms, which is a vicious cycle from fairness perspective. This tutorial proposes the alternative to solve the problem: AI sharing platform business model.

AI sharing is a business term of federated learning. An old model of AI development is that each firm develops AI separately with its own data. It is advantageous to large corporations because only large corporations can develop AI systems because they can have a large amount of data and skilled AI engineers. In this situation, SMEs should survive on their own by learning their local data, which is expected to widen AI gap & digital divide. On the other hand, a trustable AI sharing platform with federated learning technology can lower AI development cost and raises the AI performance of the platform participants. The AI sharing platform makes firms share AI rather than Data. SMEs can own data, strengthen its AI, and expand customer contacts.

This tutorial introduces real world success cases and checks the conditions of AI sharing projects of medical AI areas such as EXAM (Dayan et al.

2021), UCADI (Bai et al. 2021), PriMIA (Kaissis et al. 2021), and CAREFL (Liu et al. 2021). In addition, the various application domains of federated learning will be explained such as privacy-preserving traffic flow prediction (Liu et al. 2020), fraudulent credit card detection by sharing AI among banks (Zheng et al. 2021), personal healthcare and monitoring (Qiong et al. 2020, Bonura et al. 2021), and welding robots of smart factory improving AI without revelation of factory knowhow (Fecondo et al. 2021). AI sharing platform related trends will be introduced such as proved R&D cases, non-profit initiatives, business models/frameworks, and start-up companies etc.

This tutorial's main topic is AI-Connect Protocol (Choi et al. 2022) which is under development by Harex Infotech's UCAI (User-Centric AI) Institute and Kyung Hee University's AI-BM Lab (AI-BM.net). Using the patent-pending protocol, the AI sharing platform, the center, standardizes an AI model & sends the initial AI Model to each domain entity. Each entity learns AI Model with its partial data (e.g. 5%) and sends the learned model to the platform. Local entity gets a global model from the center and returns the newly learned model to the center. The center gets the learned results from the locals and constructs a new global model and helps locals update the model regularly or irregularly. Our experiment results using a new AI-Connect Protocol: Iterative Parallel Average (IPA), will be shown. The IPA's performance exceeded that of existing federated learning algorithm (we may call it 'monolithic average' comparing with 'iterative parallel average'). Although the data-shared global AI, which shares all data among entities, AI shows the best performance as expected, but in the real world, such a data sharing does not occur.

Harex Infotech is developing a user-centric general commerce AI engine and its derived services such as hyper-personalized recommendation, target marketing for merchants (Lee, Jeong, Hwangbo, Kim, & Yang 2022), product/service brainstorming for merchant

(Lee, Jeong, Hwangbo, Lee, & Cho 2022), merchant discovery brainstorming, product bundling, cross selling, and event promotion (time/occasion-aware recommendation). The cross-border commerce AI engine (Lee, Hwangbo, Jeong, & Choi 2022) is based on Transformer (Lee, Hwangbo, Jung, Jeong, Park, & Lee 2022), Federated Learning, and Data-Centric AI. It can be thought as a commerce version of 'GPT-3'. The AI sharing platform based on the engine pursues synergy and efficiency by helping economic entities (firms, governments, and health organizations) share AI models, the learned results, and various derived services based on the AI engine.

This tutorial finally will discuss AI Sharing for Glocalization based on our experimental results (Bae 2022). AI sharing can promote 'locality' through the modularization of shared AI engines & service diversification

Key Terms – AI Business Model, AI Sharing, Data Sharing, Deep Learning, Federated Learning.

References

Dayan, I., Roth, H. R., Zhong, A., Harouni, A., Gentili, A., Abidin, A. Z., ... & Li, Q. (2021). Federated learning for predicting clinical outcomes in patients with COVID-19. *Nature medicine*, 27(10), 1735-1743.

Bai, X., Wang, H., Ma, L., Xu, Y., Gan, J., Fan, Z., ... & Xia, T. (2021). Advancing COVID-19 diagnosis with privacy-preserving collaboration in artificial intelligence. *Nature Machine Intelligence*, 3(12), 1081-1089.

Liu, Z., Chen, Y., Zhao, Y., Yu, H., Liu, Y., Bao, R., ... & Yang, Q. (2022). Contribution-Aware Federated Learning for Smart Healthcare. In *Proceedings of the 34th Annual Conference on Innovative Applications of Artificial Intelligence (IAAI-22)*.

Kaissis, G., Ziller, A., Passerat-Palmbach, J., Ryffel, T., Usynin, D., Trask, A., ... & Braren, R. (2021). End-to-end privacy preserving deep learning on multi-institutional medical imaging. *Nature Machine Intelligence*, 3(6), 473-484.

Liu, Y., James, J. Q., Kang, J., Niyato, D., & Zhang, S. (2020). Privacy-preserving traffic flow prediction: A federated learning approach. *IEEE Internet of Things Journal*, 7(8).

Zheng, W., Yan, L., Gou, C., & Wang, F. Y. (2021). Federated meta-learning for fraudulent credit card detection. In *Proceedings of the Twenty-Ninth*

International Conference on International Joint Conferences on Artificial Intelligence.

Qiong Wu, Xu Chen, Zhi Zhou, Junshan Zhang, FedHome: Cloud-Edge based Personalized Federated Learning for In-Home Health Monitoring, Accepted by *IEEE Transactions on Mobile Computing* 2020

Giacomo Fecondo, Chiara Napione, Lucrezia Morabito(2021), Use case execution and KPI evaluation in the Smart Manufacturing domain, European Union's Horizon 2020, cordis.europa.eu/project/id/824988/results

Susanna Bonura, Joao Correia, Walter Hernandez, Petros Papachristou, Christina Kotsiopoulou(2021) Use case execution and KPI evaluation in the Health domain, European Union's Horizon 2020, cordis.europa.eu/project/id/824988/results

Sungwon Bae, AI Sharing for Glocalization: Federated Learning Experiments, Forthcoming Master Thesis of Kyung Hee University, 2022.

Lee, K., Jeong, B., Hwangbo, Lee, G., & Cho, Y., Brainstorming AI: Product Planning Ideation Methodology Using Natural Language Processing Based Recommendation System, 2022 Spring Conference of Korea Management Information Systems Society, 2022.

Lee, K., Jeong, B., Hwangbo, Y., Kim, S., & Yang, M., Target Marketing Methodology as the Dual of User-Centric Hyper-Personalized Recommendation for Multi-Merchant Environment, 2022 Spring Conference of Korea Management Information Systems Society, 2022.

Lee, K., Hwangbo, Y., Jung, H., Jeong, B., & Park, J., TransformRec: User-Centric Recommender System for e-Commerce Using Transformer, International Conference on Electronic Commerce, Daegu, Korea, 2022.

Choi, S., Jeong, B., Hwangbo, Y., Park, K. & Lee, K., AI-Connect Protocol: A New Federated Deep Learning Method for User-Centric AI Service, 2022 Spring Conference of Korea Intelligence Information Systems Society, 2022.

Lee, K., Hwangbo, Y., Jeong, B., & Choi, S., User-Centric Federated Recommendation System Using Multi-Language Data for Cross-Border e-Commerce Environment, Working Paper, 2022.

A1.2 데이터 기반 고객 경험 디자인


차경진
한양대학교

DCX Centered Company

Focus on Customer

데이터기반 고객경험혁신

한양대학교 차경진 교수



DCX Centered Company

Contents

- 1 고객에 대한 관점의 변화
- 2 고객경험은 무엇인가?
- 3 데이터로 만드는 고객 경험(DCX)
- 4 디지털 생태계 모델

“ Banking is necessary, Banks are not. ”



Digital First Framework

사업의 본질부터 실행까지 모든 것을 바꾸어야 합니다

Why Why	Meaning Architecture	01	디지털을 중심으로 Re-Architect
What What	Value Creation Architecture	02	사업과 제품의 본질 고객가치경험
How How	Operation Architecture	03	가치 창출의 과정
			일하는 방식



IDG.tv

“ 업의 본질을 재정의 할 정도로 디지털 고객경험 혁신을 위해 이미 노력하는 회사들이 많다 ”

Dominos
피자를 파는 [이커머스 회사]
e-commerce company that happens to sell pizza

Starbucks
STARBUCKS Coffee -> STARBUCKS
커피 판매문화와 판매망을 선도하는 기업

지금 우리의 현주소인 디지털 세계의 고객,

그들은 누구인가?

그들이 원하는 제품은?
왜 그것을 원하는가?
그들을 어떻게 알 수 있나?
어떤 사람들인가?

고객은 Actor 다

Before

Product (생산/제공) → Media (Channel) → 고객

Now

Action (소비/이용) → Artifacts → Actor

Digital 수명

노력은 온통	행동하는 존재
유망치는 순간	디지털 속의 존재

예) BTS 케이, 구글 앱 사용자

네트워킹이 중요하다

관계 = 연결성이 핵심이다
시절은 미디어이다

(Source: Organic Marketing Lab 2021)

고객 관계의 변화

“ 고객과의 새로운 상호작용을 설계해야 합니다 ”

고객을 위한 가치 창조

고객에 의한 가치 창조

고객은 Actor 다

고객(Buyer)

제품에 관심

돈을 쓴다 (물건을 구매)

팬(Actor)

제품이 갖는 경험, 의미에 관심

예니지와 시간을 쓴다 (활동에 참여, 정보를 생산)

팬 단순히 상품/서비스가 아니라 기업이 제공하는 **총체적 가치를 구매**

기술 정교화와 가격, 품질에서의 차별화 지속 이전은 신인류는 가격 외에 기업 고유의 DNA에 기반한 상품/서비스에 더 높은 가치 부여

고객이해 방법의 변화가 필요합니다

Segmentation
시장 세분화

시장을 고객, 니즈, 특성, 가격 등을 기준으로 세분화

Targeting
표적시장 선택

자신과 제품/서비스를 제공할 표적 시장을 선택

Positioning
제품 포지셔닝

경쟁사만 차별화 할 수 있는 위치를 설정

핀과 사는 40세 여성을 구매 동향이 어떻게 되는지?

모든 세그먼트 고객을 팔 수 있는 것은 없는가?

고객 타겟에 부합되지 않는 것이 생도하지 않나?

디지털 기술, 어떻게 활용할 수 있는가?

고객이해 방법의 변화가 필요합니다

Mass Marketing

Micro Segmentation

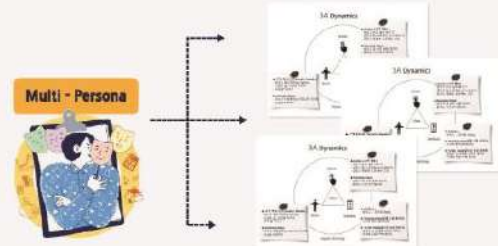
Micro Segmentation

Hyper Personalization

맥락(Context) 이해를 위한 프레임워크

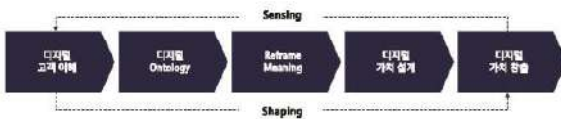


다양한 Context 이해



DCX 가치 창출 방법론

디지털 세대에 적합한 문제 해결 및 가치 디자인 방법론



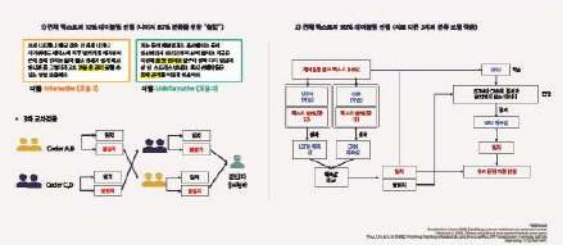
DCX 가치 창출 방법론



데이터 기반 고객 경험 디자인 데이터 분석 과정 요약

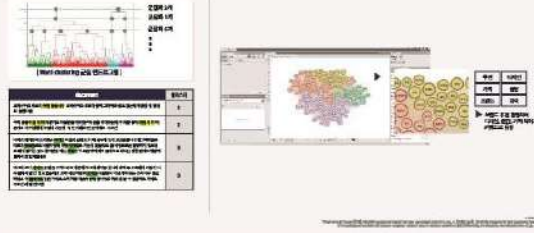


데이터 기반 고객 경험 디자인 데이터 수집 및 전처리 과정(데이터링)



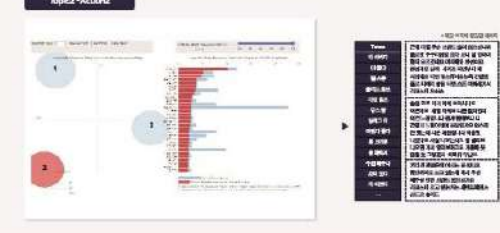
데이터 기반 고객 경험디자인
데이터 군집화(클러스터링), 마이크로 세그먼트(군집별 의미연결망)

데이터 분석



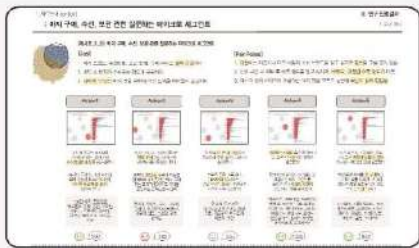
데이터 기반 고객 경험디자인
고객 액션(LDA)

데이터 분석



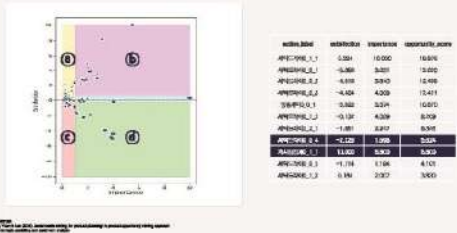
데이터 기반 고객 경험디자인
고객 액션맵(Customer Action Map)

데이터 분석



데이터 기반 고객 경험디자인
기회 영역(Opportunity area)

데이터 분석



DCX 가치 창출 방법론



GS Caltex의 Meaning Re-Architect

Case



현대자동차, 제조에서 Mobility 생태계로

Case



Hyundai
제조업이 아니라 [모빌리티(이동권) 서비스] 회사
(네이버 카넥트가 경쟁 상대)

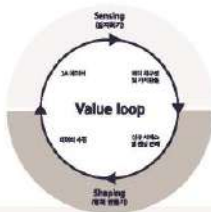


현대차 그룹 주요 MOU 입지 (미래모빌리티 관련)
롯데엔터테인먼트, SK이노베이션(우주나사),
인천공항공사, 현대건설, KT(1차사설협력),
GS칼텍스(미래이커브 서비스개발),
연성모(스마트모빌리티 솔루션 개발),
국립인천공항, 세손비(구름 특약용 원격서비스),
네이버(미래 모빌리티 생태계 구축)

Value Creation: 생태계의 확장과 협업



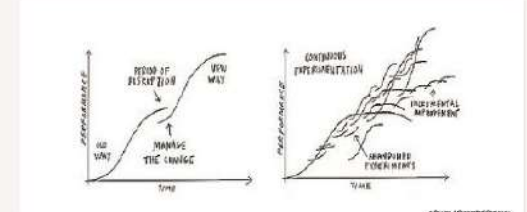
Ongoing Value Loop



Sensing & Shaping의 반복

1. 얼마나 빠르게?
2. 얼마나 정확하게?
3. 얼마나 깊게?
4. 얼마나 정밀하게?

Agile Process



Wrap-up

'고객에 의한' 데이터 기반 고객가치 창출



Thank you



A1.3 중소기업 R&D 성과향상을 위한 정부지원과제 선정평가 및 지원체계 혁신 방안에 관한 연구

장현성
중소기업기술정보진흥원
hsjang@tipa.or.kr

Abstract - 본 논문에서는 중소기업의 R&D 성과 향상을 위하여 정부가 지원하는 R&D과제의 선정평가 및 지원체계 혁신방안에 대하여 논하고자 한다. 성과실적과 연구분야 유사도기반 평가위원 매칭과 지능형 평가모델 기반 예비평가, 연구개발 정보의 디지털 전환을 위한 사업계획서 구조화 및 제품, 기술, 서비스별 성능지표 등 지속전개 가능한 기준정보체계 구축, 비즈니스 분야별 중소기업 현황에 근거한 포트폴리오관리 등 중소기업의 R&D 성과 향상을 위한 스마트R&D평가 지원체계를 제안한다.

Key Terms - 중소기업R&D성과, 평가위원 매칭, 지능형 평가모델, 기준정보체계, R&D포트폴리오, 스마트R&D평가 지원체계

I. 서론

2022년 기준, 중소기업R&D를 지원하기 위한 정부예산은 약 1조8천억원을 상회하고, 매년 그 규모가 증가하고 있다(중소벤처기업부, 2022). 중소기업의 R&D 지원사업 형태는 단일 기업이 주체가 되어 연구개발을 진행하는 기업주도형과 산·학·연 등 유관기관과의 협력을 통한 협력형, 그리고 소부장, 그린뉴딜, 탄소중립 등 사회적 이슈에 대응하기 위한 정책목적형이 있으며, 매년 약 50여개의 다양한 지원사업이 운영되고 있다.

중소기업R&D지원사업은 중소기업기본법 제2조에 의한 중소기업을 대상으로 사업별 최대 4년 이내의 개발 기간과, 20억원 내외의 R&D자금이 연구개발비로 지원하는데, 최근 R&D지원사업에 선정되어 과제를 수행한 중소기업의 성과분석 결과, 정부출연금 1억원당 평균 약 6명의 고용 효과와, 지원받은 금액 대비 약 11배의 과제와 연관된 매출 증대, 그 외에도 수출이나 논문 등 다양한 분야에서 정부지원사업이 중소기업 R&D 역량 향상 및 성과에 긍정적인 영향을 미치는 것으로 나타났다(중소기업기술정보진흥원, 2022).

그럼에도 불구하고, 최근 예산 및 사업물량의 급격한 증가로 인하여 평가운영관리 전반에 걸쳐 여러가지 문제가 나타나고 있는데, 본 논문에서는 이러한 현상에 대한 원인과 대책을 바탕으로 현재 운영 중인 중소기업 R&D 정부지원 사업

을 보다 효과적으로 운영하기 위한 R&D과제의 기획과 평가, 선정 및 R&D 전주기 관리의 프로세스 개선과 함께 빅데이터, 인공지능, 자동화 등 ICT 기술을 활용한 스마트R&D평가 지원체계를 제안하고자 한다.

II. 본론

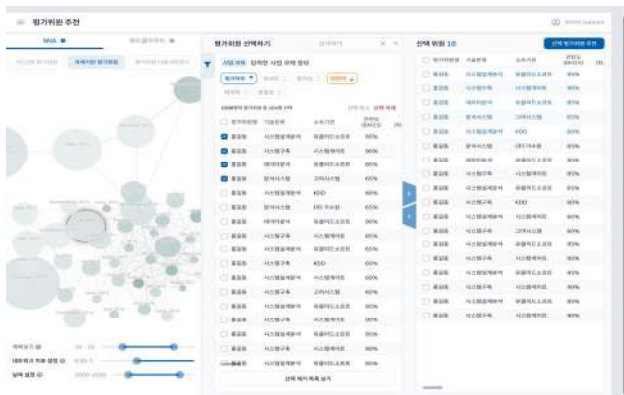
중소벤처기업의 R&D지원을 위한 정부지원사업이 중소기업에게 성과측면에서 효과가 있는 것은 분명하지만, 관련 예산과 사업의 물리적인 양이 증가함에 따라 이를 처리하기 위한 평가업무 프로세스, 인력 그리고 관련 시스템 전반에 걸쳐 여러가지 문제점이 야기되고 있다.

먼저, 중소기업이 제출한 사업계획서를 평가하고 선정하는 과정에서 가장 중요한 요소라고 할 수 있는 평가위원은 공정성을 이유로 일부 평가위원의 상대적으로 많은 평가 횟수에 대한 지적에 대응하기 위하여 1년에 30회를 초과할 수 없도록 평가 횟수 상한제를 운영하고 있다, 또한 평가위원 풀에서 기술분야별로 랜덤하게 선정된 평가위원은 분과당 5명으로 구성되는데, 이 과정에서 평가위원의 과거 평가실적에 대한 피드백이 전혀 반영되지 않는다. 즉, 과거에 평가한 과제에 대한 피드백 루프가 없기 때문에 좋은 평가점수로 선정된 과제가 좋은 성과로 이어졌는지, 평가결과와 전혀 다른 성과가 나왔는지 평가위원에게도 피드백이 되지 않을 뿐 만 아니라, 평가시스템 내부에서도 이를 관리하지 않는다. 즉, 평가위원의 평가가 R&D에 어떤 영향을 미치는지 아무도 관리하지 않기 때문에 좋은 과제를 발굴할 수 있는 기회에 대한 손실 뿐 만 아니라, 성과를 기대하기 어려운 미진한 과제를 걸러내는데도 결림돌로 작용한다. 현재 평가위원에게 부여된 등급과 해당 평가위원의 평가결과에 따른 기업의 R&D성과 사이엔 유의한 관계가 없는 것으로 확인되어, 이를 개선이 시급하다. 과거 실적을 바탕으로 각 사업별 성과기반 평가위원을 분류하고, 중소기업의R&D수행 후 기업실적을 동적으로 지속적으로 반영한 결과물 토대로 우수평가위원 그룹을 관리하고 운영하는 방안을 제시한다.

평가위원과 관련된 또 하나의 문제점은 전문 분야 매칭의 한계이다. 현재는 평가위원이 스스로

평가 가능한 기술분야를 최대 3개까지 지정할 수 있도록 되어있는데 본인의 전문분야와 거리가 있는 경우도 많고, 중소기업으로부터 제시된 과제 분야와 거리가 있는 경우가 많아 평가위원이 과제를 잘 파악하지 못하는 경우가 발생하기도 한다. 문제를 해결하기 위하여 사업계획서의 내용을 분석하여 유사한 기술과 제품, 서비스 중심으로 성과를 구성하고, 평가위원의 논문 등 전문분야의 유사도를 비교하여 최적의 평가위원이 매칭하는 방법을 제안한다.

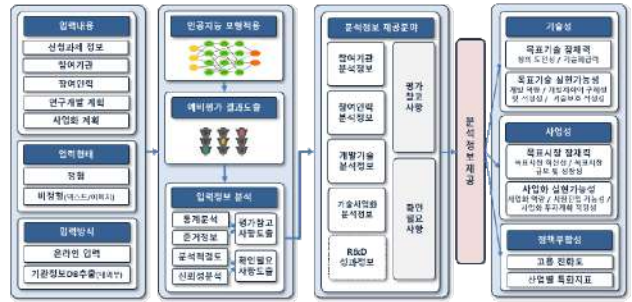
중소기업의 R&D과제는 다른 부처의 R&D와는 달리 다양한 제품과 기술, 서비스가 많아 이를 분류하고 평가위원을 수작업 매칭하는 데 한계가 있었으나, 통계 및 빅데이터 분석, NLP(Natural Language Processing), 인공지능 등 정보기술을 활용하여 최적의 평가위원 매칭으로 보다 높은 R&D성과를 기대할 수 있게 되었고, 자동화된 평가위원 매칭 시스템은 평가를 운영하는 간사의 수작업 업무를 대체하여 업무효도 높일 수 있게 되었다. <그림 1>



<그림 1> 성과□전문분야기반 평가위원 자동매칭

중소기업의 정부지원 R&D평가 및 운영관리에 있어 또 하나의 주요 문제점은 수 많은 과제를 평가하기 위하여 사업의 규모에 따라 다르지만 일반적으로 많게는 수백 여개의 분과를 구성하여 평가를 진행하기 때문에 평가결과의 표준화 및 정규화가 불가능하다. 즉, 특정분과에서 우수한 과제로 평가된 과제가 다른 분과에서 좋은 결과를 받지 못해 탈락한 과제보다 우수하다고 말할 수 있는 객관적 타당성을 제시하기 어려운 것이 현실이다.

문제를 해결하기 위하여 평가위원들이 본인이 평가해야 하는 분과만의 과제 중에서 우수한 과제를 선정하는 것이 아니라, 해당 사업에 접수된 모든 과제 중에서 해당 분과에 배정된 과제가 객관적으로 어떤 수준의 과제인지를 비교 분석할 수 있도록 지능형 예비평가모형을 제안한다.



<그림 2> 지능형 예비평가모형 작동방식

설계된 지능형 예비평가모형은 과제계획서 내용을 구조적으로 분석하여 객관적, 통계적으로 시각화된 데이터를 제시하여 과제가 제시하는 내용을 전체 사업에 제안된 모든 과제계획서와 짧은 시간내 상세하게 분석 가능하다. 또한 과거에 진행되었던 사업별 과제들의 평가결과 및 성과데이터를 포함한 학습데이터를 기반으로 평가하고자 하는 과제의 평가결과 및 성과데이터를 예측할 수 있어 평가위원은 이를 바탕으로 보다 객관적이고 투명한 의사결정을 할 수 있다. <그림 3>



<그림 3> 지능형 예비평가화면 예시

이렇게 사업계획서 데이터 기반의 예비평가를 구현하기 위해서는 사업계획서의 구조화 및 성능지표 등 기준정보 표준화가 필요한데, 특히 기준정보의 표준화는 지속적으로 전개 가능한 구조로 구축되어야 한다. 예를 들어 특정 기술이나 제품, 서비스에 대한 기본적인 성능지표의 표준화가 제시되어도 시간이 흐름에 따라 새로운 기술, 제품, 서비스가 요구될 경우, 이에 대한 새로운 성능지표 또한 지속적으로 갱신되어야 하기 때문이다. 이러한 제약조건을 해결하기 위하여 기준정보 온라인 심의위원회를 운영하고자 한다. 즉, 과제계획서 입력 시 기본적으로 과거 과제로부터 추출 및 표준화된 성능지표가 제시되는데 제시하는 과제의 내용이 이에 해당하면 선택하여 입력한다. 그러나 기존 성능지표에 해당사항이 없어, 신규로 새로운 성능지표를 추가할 경우, 성능지표 입력과 동시에 온라인 상에서 이를 심의할 수 있는 온라인

심의위원회가 작동한다. 온라인 심의위원회에서는 신규 성능지표를 검토하여 Accept/Reject/Modify 등의 기능이 작동되도록 구현하였으며, 향후 과제가 누적되어 진행될수록 기준정보는 더욱 확장되고 정제되어 지속전개가 가능하게 된다. <그림 4>



<그림 4> 지속전개가능한 기준정보의 표준화

III. 결론

앞서 언급한 중소벤처기업의 R&D성과향상을 위한 혁신방안 외에도 실제 진행된 중소기업R&D과제의 현황데이터를 기반으로 우리나라 중소벤처기업 R&D과제의 방향을 제시하는 포트폴리오 관리 기능, 평가일정계획 및 평가에 필요한 체크리스트 등의 공유 및 축적을 통하여 평가와 관련된 위험 예방 및 평가업무 전문가 양성을 도울 수 있는 스케줄러기반 평가계획관리 기능, RPA(Robotic Process Automation) 기반 요건검토 등 시간이 많이 걸리는 단순 수작업 행정업무의 무인자동화, 선정된 과제를 지속적으로 관리하여 사고나 실패를 예방하는 과제전주기 미세관리 기능과, 문서나 보고서처럼 정량화, 데이터화 되어있지 않은 정보들을 디지털 전환하고 R&D 평가 및 지원과 관련된 모든 자원을 효율적으로 배치하면서, 가용한 자원의 활용을 최적화하며 서로 유기적으로 연계되어 결국 중소기업R&D 성과향상을 더욱 가속화 할 수 있도록 지원하는 새로운 프로세스와 기능 체계, 즉 스마트R&D평가 지원체계를 제안한다. <그림 5>



<그림 5> 스마트R&D평가 지원체계 개념도

제안하는 스마트R&D평가 지원체계는 2020년 개념설계를 시작으로 현재 스케줄러기반 평가계획관리와 RPA기반 평가운영관리 자동화 기능이 실제 업무에 적용되어 운영 중이며, 2022년 현재, 앞서 제시한 성과기반 평가위원 자동매칭 및 지능형 예비평가, 기준정보 표준화 및 지속 전개가능 체계 구축을 진행하고 있다. 향후 2023년까지 제시된 모든 혁신방안을 완성하여 실무에 적용하는 것을 목표로 추진하고 있다.

앞으로도 추가적인 문헌연구 및 사례연구와 함께, 진행 중인 IT기술이나 알고리즘에 대한 상세한 내용을 연구논문으로 제시하고, 관련 전문가 및 기관과의 협업으로 더 나은, 미래의 바람직한 R&D지원체계를 구축하여, 중소기업의 R&D역량 향상은 물론, R&D성과의 향상을 도모하고자 한다.

IV. 참고문헌

- “2022년 중소기업R&D 지원사업 안내,” 중소벤처기업부, 2022
- “중소기업R&D 성과조사분석 연구,” 중소기업기술정보진흥원, 2022

[DAY 1]

B1 [Special Session]
인텔리전스 대상 기업 세션 I

B1.1 AI 기반 마이데이터 (하나합)

함 종 권

하나은행 데이터&제휴투자본부 마이데이터유닛 유닛리더

국문초록

2022년 1월 5일부터 API방식을 통한 본격적인 금융 마이데이터 사업 서비스가 시작됐다. 마이데이터 사업 서비스를 시작하기 위해서는 금융당국으로부터 사업에 대한 허가를 반드시 받아야 한다. 지금까지 본허가를 받은 업체는 은행, 증권, 신용카드, 빅테크/핀테크사 등 총 56개사이며 이중 45개 업체의 마이데이터 서비스가 출시된 상황이다. 마이데이터는 정보주체가 본인정보를 적극 관리·통제하고 이를 신용, 자산, 건강관리 등에 주도적으로 활용하는 것을 의미한다. 마이데이터 사업은 “개인정보 전송요구권”에 근거하고 있다. “개인정보 전송요구권”은 정보주체가 본인 데이터에 대한 전송을 요청하면, 개인정보처리자는 보유한 데이터를 개인 또는 개인이 지정한 제3자에게 전송하는 정보주체의 권리이다.

마이데이터가 가져올 긍정적인 변화는 정보주체가 정보 활용을 수동적으로 동의하는 방식에서 전송·활용을 능동적으로 선택한다는 점에서 정보의 자기결정권이 높아진다는 점이다. 또한 데이터의 자유로운 이동에 따라 소비자의 서비스 선택 폭이 넓어지고 서비스 질의 개선과 가격 합리화 촉진 등 “서비스 경쟁 활성화”로 이어질 수 있다.

하나은행은 마이데이터 기반 개인 자산관리 서비스 “하나합”을 지난해 12월 공식 출시했다. 하나합은 다양한 금융자산을 한 곳으로 모아(합) 관리하며, 금융서비스를 즐긴다는 의미이다.

하나은행은 기존에 소수 고액 자산가에게만 제공되던 자산관리 서비스를 디지털을 통해 모든 손님들에게 제공한다는 계획이다. 구체적으로 자산관리 성향을 진단하는 ‘자산관리스타일’서비스, 고객개인의 지출을 분석하는 라이프스타일분석 서비스, 이루고 싶은 목표를 설정해 외화 자산을 불러주는 환테크 챌린지 서비스 등을 선보였다. 향후 축적된 마이데이터를 활용해 분석 영역을 확장하고, AI 분석 모형을 접목해 맞춤형 상품 추천이 가능하도록 할 예정이다.

한편, 금융산업은 인공지능 시장에서 가장 큰 비중을 차지하고 있는 분야로써, ① 방대한 양의 데이터 처리를 통해 인사이트를 찾아내 새로운 수익을 창출하고 ② 소비자에게 향상된 개인화 서비스를 제공하는 등 고객 경험·가치를 제고시키며 ③

업무 프로세스 자동화를 통해 운영비용을 절감하고 ④ 복잡한 금융 규제와 컴플라이언스 요구사항에 효과적으로 대응하기 위한 목적으로 도입되고 있다.

향후 AI도입과 활용을 위한 금융부문 투자는 확대될 것으로 예상되며, 관련 시장 역시 높은 성장률을 보이며 빠르게 성장할 것으로 전망된다. 특히 금년 1월에 본격 출범한 마이데이터 사업으로 인해 금융 시장의 지형이 변화할 것으로 기대되고 있는 가운데 마이데이터 및 플랫폼 시장은 향후 금융 AI의 발전 방향에도 큰 영향을 끼칠 것으로 예상된다.

주제어

마이데이터, 본인신용정보관리업, 신용정보법, 개인신용정보전송요구권, 하나합, 디지털 자산관리, AI 분석 모형

B1.2 초간단 AI 물류경쟁력, 콜로세움

박진수
콜로세움

콜로세움 COLOSSEUM

콜로세움은 전국의 물류센터 네트워크와 AI솔루션으로 이커머스 상품의 보관, 포장, 배송, 반품 처리까지

다 알아서 해주는 풀필먼트입니다.

콜로세움 COLOSSEUM

오늘의 이커머스 물류를 초간단하게 만듭니다

콜로세움은 AI와 빅데이터 기술을 기반으로 전국의 전문 물류센터를 연결하여, 고객 맞춤 물류서비스를 다 알아서 제공해드립니다.

B1.3 LGCNS의 계속사용인증(CuC) 보안서비스

박병권
LGCNS

1. LG CNS AI CuC 개요

LG CNS AI CuC (계속사용인증) 은

- 사용자의 다양한 정보를 실시간으로 수집하여
- 인공지능이 사용자의 상황인지하고
- 필요한 조치와 제어를 자동으로 수행하는

“**AI기반 언택트 비즈니스 지원 솔루션**” 입니다.

1 상황정보 수집

- 웹캠, 마이크
- 스마트폰 카메라, 마이크
- PC화면
- 시스템 이벤트

2 상황 인지

- 안면, 배경 인식/검증
- 사용자 부재, 제3자 검출
- चेस्처 인식, 사물 검출
- 데이터 학습 모델

3 사용자 제어

- 화면 및 통신의 차단/연결
- 권한의 획득/제거
- 콘텐츠의 재생/정지
- 피드백 자동 발행

기존인증체계의 문제점

최초 인증 후, 사용 종료까지 사용자 본인여부, 부재여부 등의 판단 없이 시스템 접근이 가능함

- 업무의 정보의 유출
- 시험 중 부정행위 발생
- 재택 근무 중 업무 태만

“화상회의 솔루션을 이용한 문제해결을 기대하지만, 직접 모든 사용자를 빈틈없이 모니터링 하는 것은 불가능”

AI CuC의 지능형 관제

인공지능이 사용자의 상황을 실시간 감지하고, 필요한 제어를 실행함으로써 보안 위험 및 원격업무의 편의성 향상

- 실시간 신원 인증으로 화면 및 네트워크 자동 차단
- 사용자 행위(제스처)인식으로 부정행위 감지
- 사용자 부재 여부에 따른 영상의 재생, 정지
- 이상징후의 자동녹화 및 영상 분석기반의 사후 관제

2. LG CNS AI CuC 프로세스

“AI CuC는 LG CNS DAP Vision과 AI경량화를 기반으로 한 시간의 협업으로 다양한 사용자 상황인지를 통해 안전한 언택트 환경을 구축할 수 있습니다.”

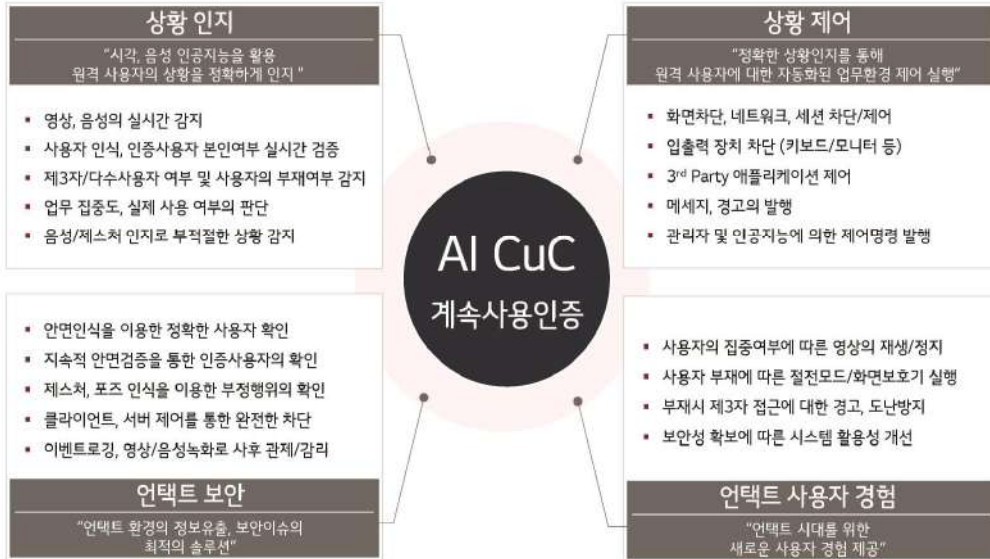
◆CuC의 상황인지/제어 프로세스

	AI기반 상황인지	AI기반 상황제어	
<p>사용자 영상 사용자 음성 PC화면</p> <p>사용자</p>	사용자 상태 수집	제어 실행	<p>실시간 알림 실시간 영상 실시간 시스템 사용이력</p> <p>관리자</p>
	AI 추론	상황 대응 정책	
	사용자 상황인식	사용자 상황분석	
관리 기능			
<p>정책관리 AI 모델 관리 사용자 관리</p>		<p>사용자 제어 서버 제어</p>	
<p>인공지능 학습·추론</p> <p>LG CNS DAP Vision</p>		<p>영상·음성 처리</p> <p>실시간 영상관제 사후 영상분석</p>	
		<p>관제기록 이상징후 이력</p>	

8. AI CuC 의 활용 - 특징

“AI CuC는 언택트 사용자환경의 새로운 기준을 제시합니다.”

언택트 시대에 맞춰 '계속사용인증'은 강화된 보안을 통해 시스템과 개인정보를 보호합니다.
AI 기반 상황인지 시스템으로 사용자가 처한 상황에 알맞은 제어로 대응하여 진화된 사용자 경험을 제공합니다.



LG CNS

8.1 AI CuC 의 적용분야

“AI CuC는 언택트 사용자환경에서 다양한 분야에 적용할 수 있습니다.”

Zero Trust의 실현을 통해 시스템과 개인정보를 보호하고, Pandemic에 대비합니다.

Zero Trust 실현



Pandemic 대비

LG CNS

B1.4 케어마인드가 꿈꾸는 미래

신윤제
(주)케어마인드

모든 사람들이 건강에 대한 두려움 없이
자신감 있는 일상을 즐길 수 있게

케어마인드가 꿈꾸는 미래

CAREMIND

회사개요

건강 관리 니즈와 공포가 높은 환자들을 위한 디지털 헬스케어 스타트업입니다.

일반현황

회사명	(주)케어마인드
설립일자	2017년 06월
대표이사	신윤제
투자액	누적 50억원
주요사업	AI 기반의 질환 맞춤형 케어 서비스 제공 의료(RWD) Data 가공/판매, 체험단 등
임직원 수	17명
소재지	서울시 서초구 서초동 1575-12번지 8층
홈페이지	https://www.icaremind.com/

2017	케어마인드 법인 설립 네오위즈그룹 계열사, 네오플라이 Angel 투자 유치
2018	스마트벤처캠퍼스 사업화 지원 선정(창업진흥원) 유망청년 스타트업 경진대회 정보통신산업진흥원장상 수상 경기도 스타트업캠퍼스 주관 데모데이 우수상 수상
2019	수술 후 환자 케어 서비스(에포타) 공식 런칭 매쉬업엔젤스 Seed 투자 유치
2020	서울창조경제혁신센터, 스타트업빌리지 지원 선정 Pre-A (롯데액셀레이터, 마젤란기술투자, 카이스트창업투자)
2021	에이플러스스 그룹 우수 스타트업 선정 IBK 창공 혁신 창업기업 선정 Series-A (롯데벤처스, IBK기업은행)
2022	비대면스타트업 육성사업 선정(한국보건산업진흥원) 창업도약패키지 지원사업 최종 선정(중소벤처기업부)

성형 후 회복관리 서비스 에포터

수술 후 경과를 기록하면 AI 기반으로 회복 진행도를 예측, 관리해주는 서비스
매일 기록된 병원 밖 건강 데이터를 활용하여 개인 맞춤 케어를 제공합니다.






누적 다운로드
200,000만 ↑

- ✓ AI 기반의 수술 경과 예측 알고리즘 탑재
- ✓ 병원 제휴 비대면 주치의 상담 서비스 제공
- ✓ 수술 전/후 주의사항 및 병원정보, 성형후기 등 콘텐츠 제공
- ✓ 실제 성형환자 대상의 커뮤니티 운영 중

Service


회복실 - AI 기반의 수술 후 환자 예후 관리 서비스

Step1
수술 후 기록




수술 후 사진을 촬영하고
세부 정보를 입력합니다

Step2
상태 분석



AI 예측 알고리즘이
판단해줍니다

Step3
회복실



회복단계별 정보와
주치의 상담 기능을
제공합니다

B1.5 AI 기반 에너지 효율화 솔루션 리조트 실증

이호준 (그린데이터)

아난티
ANANTI
솔루션 실증

AI 기반 에너지 효율화 솔루션 리조트 실증

(Demonstration of AI-based energy efficiency solution for the resort industry)

2022.05.25

그린데이터
g
공동개발사

AI 기반 에너지 효율화 솔루션 리조트 실증

(Demonstration of AI-based energy efficiency solution for the resort industry)

2022.05.25

연구실증기관: 아난티
연구공동개발사: 한국그린데이터

1. 서론(솔루션 개발배경)

에너지효율 향상책 마련으로 인한 지속적이익률 증가, 친환경성 확보를 위해 친환경 에너지 효율 개선 전략을 수립함으로써 에너지 사용 효율을 극대화하여 ESG 경영 및 ESG 경영 실현에 기여하며, ESG 경영을 위한 AI 기반 에너지 효율화 솔루션 도입을 통해, 에너지 효율 개선을 위한 리포트형 EMS 개발 및 구축을

배경: 사내의 지속적인 발전
2009년 이후 전기요금인상률, 산업용 1부

현황 분석
리포트형 EMS 개발

인도 에너지수도사업현황
2022년 4월 기준

인도 에너지수도사업현황
2022년 4월 기준

2. 솔루션 아키텍처

리포트형 EMS 도입 및 구축을 위한 데이터를 Sagemaker를 통해 수집하여 분석하여, 리포트형 EMS 사용의 정확도 및 효율성 개선을 위한 데이터 수집, 구조화 및 시각화를 개발 및 적용

3. 성과 및 시사점

2022년 4월부터 2022년 4월까지 인도 에너지 수도사업에 대해 리포트형 EMS 도입을 통해, 에너지 효율 개선을 위한 리포트형 EMS 개발 및 구축을

리포트형 EMS 도입 전 사용량 비교

구분	2022년 4월	2022년 5월	2022년 6월
전력 사용량	11,120 kWh	10,847 kWh	10,774 kWh
가스 사용량	1,120 kWh	1,120 kWh	1,120 kWh
합계	12,240 kWh	11,967 kWh	11,894 kWh

리포트형 EMS 도입 후 사용량 비교

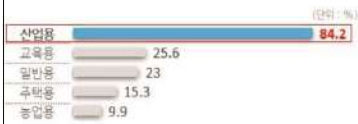
구분	2022년 4월	2022년 5월	2022년 6월
전력 사용량	10,847 kWh	10,774 kWh	10,774 kWh
가스 사용량	1,120 kWh	1,120 kWh	1,120 kWh
합계	11,967 kWh	11,894 kWh	11,894 kWh

Appendix

에너지 요금 현실화 정책으로 인한 지속적인 비용 증가, 이산화탄소 배출 규제 강화로 인한 에너지 효율 개선 의무화 동향으로 인해 에너지 다소비업종으로 분류된 리조트 산업에 속한 아난티 그룹도 에너지 효율화 개선을 위한 시스템 도입이 필요한 상황, 에너지 효율 개선을 위한 리조트형 EMS 개발 및 구축수행

배경 : 사업의 지속가능한 발전

2000년 이후 전기요금 인상률, 산업용 1위



이산화탄소 배출 규제 강화 전망(산업/상업)



추진내용 : A.I 기반 리조트형 EMS 개발

현황 분석



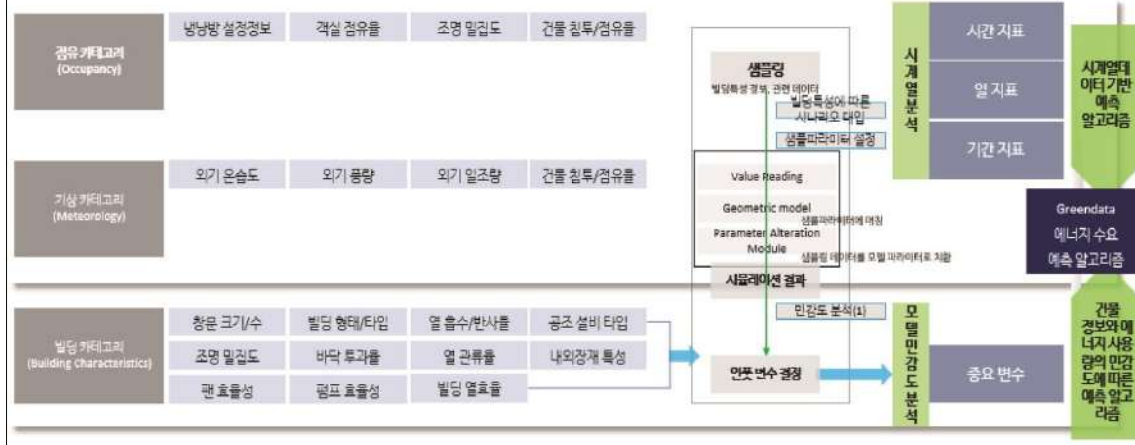
리조트형 EMS 개발



성과 : 비용 절감 + 운영효율 증가



리조트 내 다양한 타입 및 특성의 건물에 대한 데이터를 Sequential 예측 모델에 반영하여, 리조트 에너지 사용의 정확도와 확장성 개선에 중점을 두며 아래와 같은 구조로 알고리즘을 개발 및 적용



2021년 4월부터 2022년 4월까지 전년도 대비 전기와 수도사용량에 대해서 아난티 플랫폼별로 비교하였을 때, 프로젝트를 대상 플랫폼인 아난티 코드에서 유의미한 에너지 사용량 감소 경향이 나타남

플랫폼별 전기 사용량 비교



플랫폼별 수도 사용량 비교



[DAY 1]

C1 [ICEC-Paper Session] Social Media

C1.1 How Social Media Capability Influence the Firm Performance of SMEs: The Moderating Role of Social CRM System Adoption

Yang, N. Y.^a and Sia, C. L.^b

^a Department of Information Management, National Taiwan University
E-mail: d08725006@ntu.edu.tw

^b Department of Information Management, National Taiwan University
E-mail: siachoonling@ntu.edu.tw

Abstract

Drawing on resource-based view theory, this study aims to investigate how social CRM can help SMEs to enhance social media capability and finally improve business performance. In this research, we aim to bridge the knowledge gap in the social media literature. Overall, this study aims to answer the following two research questions: (1) By leveraging social media capability, we are wondering if firms can have better performance on both online customer engagement and innovation. (2) If firms adopt a social CRM system, does it amplify the impact of social media capability on firm performance? The results will help firms' IT managers to strategize and focus on factors in the social CRM system adoption stage for enhancing firm's performance.

Keywords: Social media capability, social CRM, SMEs, firm performance

Introduction

In the era of the digital revolution, for many small and mid-size enterprises (SMEs), the fastest and most cost-effective way is leveraging online marketing. One of the most common ways is to use social media to transform business activities and create business value. Social media plays an important role in driving more exposure and awareness of organizations to their customers. From an information system (IS) perspective, social media is a tool to constitute social information systems for executing business activities with their surrounding organizational and managerial structures. Therefore, most business owners hope to use social media platforms to expose their products or services and conduct marketing activities. As a result, success on social media depends on whether there is a simple and easy marketing campaign. This study focuses on SME firms' social media capability, which refers to dynamic organizational capability that helps a firm leverage social media application to sustain the firm's competitive advantage (Wang and Kim, 2017).

Although social media seems to be one of the affordable tools for firms that have limited resources to use (such as SMEs), since customers are using different media platforms to communicate with each other and receive new information online, relationships with customers are becoming more challenging to manage. Besides, take the current circumstances as an example, due to the covid 19 pandemic, SMEs' business activities are restricted (such as visiting customers in person, holding physical events), thus it's particularly important for firms to retain the existing customers or find potential customers on different social media platforms during this period.

Therefore, SMEs start to seek new solutions, such as investing in social customer relationship management (social CRM) technology for enhancing their business performance (Wang and Feng, 2012). Investing resources in CRM not only can help firms to maintain the stability of internal communication with customers during the pandemic period, but also can care for their customers one-

on-one instantly, update their content and needs, avoid omissions, and even continue to deepen the relationship with customers through complete customer records during the non-pandemic period.

When speaking of the social CRM system, it can be identified as an upgraded version of CRM that introduces social media into the concept of CRM and uses social media as the main channel of communication with customers. As social media has become the mainstream of the times, social CRM uses social media as a medium to reach customers more effectively and solves the problem that traditional CRM has: the difficulties to reach customers using communication media such as SMS and email. Although adopting social CRM can help firms to strengthen interactions with customers, and obtain more data on potential customers and existing customers, finally perform more refined analysis, it still remains unclear how social CRM systems interact with firms' social media capability that enables SMEs to enhance their overall performance.

Consequently, the purpose of this study is to investigate how social CRM can help SMEs to enhance social media capability and finally improve business performance. In this research, we aim to bridge the knowledge gap in the social media literature. Overall, this study aims to answer the following two research questions: (1) By leveraging social media capability, we are wondering if firms can have better performance on both online customer engagement and innovation. (2) If firms adopt a social CRM system, does it amplify the impact of social media capability on firm performance? This research will make several contributions: (1) We conceptualize social media capability and study its effects on firm performance from a firm's perspective and capability's view. (2) We study the moderating effect of the social CRM system adoption and test whether a well social CRM can strengthen the impact of social media capability on firm performance.

Literature Review

Social Media Capability

To understand how a firm leverages its resources and capability to achieve its goal and good performance, in this paper we build on the resource-based view theory (Barney, 1991). Resource-based view theory (RBV) refers to a firm's need to require internal resources to perform specific actions and obtain its competitive advantages. According to this theory, the resources and capabilities of a firm are valuable, rare, and distinctive, also they are seen as an essential source that helps a firm to have a competitive advantage and well performance (Barney, 1991). In addition, capability refers to a firm's ability to integrate and deploy its resources and assets to achieve competitive advantages. Further, from IS literature perspective, Melville et al. (2004) indicated that if firms can deploy IT and complementary organizational resources, IT business value can be generated. Hence, in applying the RBV theory to our research context, we combine social media technologies and a firm's ability together for developing business activities, namely social media capability.

Social media capability refers to a firm's ability to use social media platforms to execute business activities (Benitez et al., 2018). That is, a firm needs to have the ability to share reliable and timely information on its social media platforms to fulfil its customers' needs. Based on previous studies and our knowledge, firms often leverage the following platforms in their daily business: Facebook, Instagram, Twitter, YouTube, and corporate blogs. In addition, the term "social media capability" has been used widely in recent IS literature. For example, Benitez et al. (2020) evaluate social media capability (potentially an IT capability) as a role to amplify the impact of CSR activities on employer reputation. Another example is Benitez et al. (2018) found how social media capability moderates the relationships between IT infrastructure and knowledge ambidexterity.

Social Media Effectiveness

When speaking of social media effectiveness, the concept of effectiveness can be traced back to the theory of efficient action (Kotarbinski, 1965). According to this theory, action can be defined as efficient or effective when the performed activities achieve the established goals.

Therefore, to apply this theory to social media studies, firms can take into account the social media engagement rate and posts (including content and frequency) to measure the campaign effectiveness. All the popular social media platforms provide several metrics to help understand user's engagement.

For example, on Facebook, firms can measure the campaign with the numbers of clicks, likes, comments, and shares. We can assume that the higher the engagement level, the higher the reached goals. In addition, firms should also choose the appropriate measures of effectiveness carefully based on the social media platform or its type of business (Lipsman et al., 2012).

Social CRM System Adoption

Previous researchers have indicated, social CRM builds on the traditional CRM that uses social media tools to better support customer relationship management (Askool et al., 2010). With the development of social media, the customer relationships management by enterprises is no longer satisfied with the traditional one-way model of “business-consumer”. The social networks relationship management and interactive method have become the trending approach of customer relationship management. The term - social CRM has a wide range of definitions given by researchers. For example, Ojelabi et al. (2018) define a social CRM system as a tool that allows firms better control the way they communicate with the customers on the Internet and social media platforms, and also provides them with the tools to build relationships. Under this circumstance, this study tries to find out whether social CRM system adoption will help SMEs to enhance performance.

Theoretical framework

According to previous literature review, this study draws on the resource-based view theory and develops a theoretical model presenting the outcomes of the social CRM system adoption in the context of SMEs. The research model for this study is shown in Figure 1.

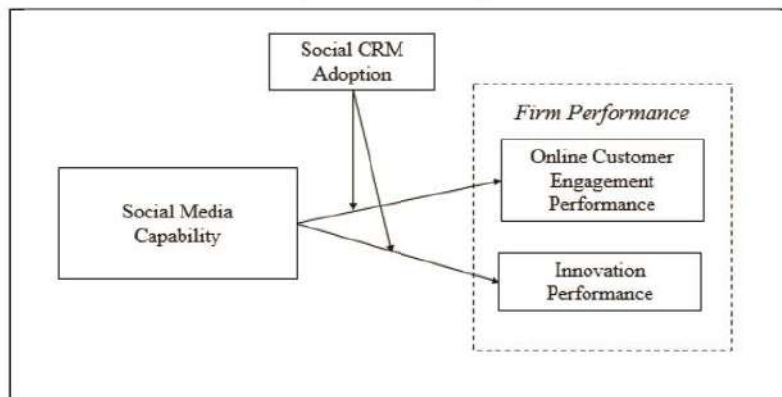


Figure 1. Research Model

Social Media Capability and Firm Performance for SMEs

According to Benitez et al (2018), social media capability refers to a firm’s ability to use social media platforms, such as Facebook, Twitter, and corporate blogs to conduct business activities or marketing promotions. In addition, Rapp et al. (2013) find that marketing capabilities lead to the development of strong customer relationships that positively influence customer satisfaction and loyalty. Therefore, we assume that the firm can leverage its social media capability by posting marketing campaigns on its social media platforms to foster themselves to engage customers in collaborative conversations, enhancing customer relations. Furthermore, when firm use social media to interact with existing customers and potential customers, they can obtain more customer information and integrate that information with their internal knowledge into their optimized product/service development process, then they are able to expand their information sources (Cui and Wu, 2015). Therefore, if firms employ their social media capabilities, this will help them enhance innovation.

Hypothesis 1 (H1): There is a positive relationship between social media capability and online customer engagement performance for SMEs

Hypothesis 2 (H2): There is a positive relationship between social media capability and innovation performance for SMEs

The Moderator Role of Social CRM Adoption in the Relationship between Social Media Capability and Firm Performance for SMEs

As we have previously discussed, firms can leverage social media capability to better serve their customers and enhance firm performance. However, firms can further adopt social CRM systems to help them effectively strengthen their relationships with customers. Besides, Wincent et al., (2012) have pointed out it’s particularly important for SMEs to employ social CRM systems, as they have limited social media resources compared to other large firms with considerable budgets. Hence, we propose that enhancing firm performance by using social media should be amplified via effective social CRM.

Hypothesis 3 (H3): Social CRM adoption positively amplifies the relationship between social media capability and online customer engagement performance for SMEs

Hypothesis 4 (H4): Social CRM adoption positively amplifies the relationship between social media capability and innovation performance for SMEs

Research Method

The proposed research model will be tested by using linear regression, which is appropriate for this study as linear regression can help to investigate the relationships between multiple variables by relating one variable to a set of variables. We list the equation below and the measurements of each variable are also listed in the following table.

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3(X_1 \times X_2) + e$$

Where:

Y – Online customer engagement performance

X1 – Social Media Capability

X2 – Social CRM adoption

b – Slope

e – Residual (error)

Table 1. Variable Measurement

Variables	Measurement
Online Customer Engagement Performance (Y1)	The engagement rate with customers on social media
Innovation Performance (Y2)	Numbers of product updates
Social Media Capability (X1)	For capability evaluation, I will measure the effectiveness of customer actions on social media for business performance. This variable will be measured by effectiveness*attractiveness, the detailed explanations are listed below.
Social CRM Adoption (X2)	Successful CRM adoption can be measured by system quality, usage rate, and compatibility

For social media capability evaluation, I will measure the effectiveness of customer actions on social media for business performance. In terms of the behavior analysis, whether clicks, posts or reaches can make a higher volume of exposure. This paper will introduce the effectiveness of action analysis, which is derived from praxeology theory. The effectiveness of click actions defined

$$E_p = \frac{S_p}{C_p}$$

Where E_p represents the effective business performance S_p affected by the clicks C_p of the product-related posts. The business performance, including sales number, customer satisfaction and service quality will be categorized for various service deliveries. While content improvement will increase business performance, attracting potential customers is another issue. Attractiveness (A_p) defines by measuring the number of reactions (Likes or Repost) by reaching social media through the post. The ratio of the reaction in different product content

$$A_p = \frac{L_p}{R_p}$$

The proportion between the numbers of reactions L_p reached the page and the total reached number R_p indicates the attractiveness of the posting action for focal products. To identify the realistic posting effectiveness, the posts will be categorised by the product characteristics.

Expected Contributions

This research-in-progress paper proposes an analytical framework and enhances our knowledge in the context of social CRM system adoption for SMEs. This study is expected to make several contributions. First, drawing on the social media capability and resource-based view theory, we have investigated whether social media capabilities can help to enhance firms' innovation performance and online customer engagement performance. Second, whether social CRM system adoption will help SMEs to enhance their performance. In addition, the results of this study also provide several practical implications to help firm's IT managers to strategize and focus on factors in the social CRM system adoption stage for enhancing firm's innovation and online customer engagement performance. To sum up, the proposed model from this study expects to shed light on future social CRM system's research and offer practical guidelines for firms.

References

- Askool, S., and Nakata, K. 2010. "A Conceptual Model for Acceptance of Social CRM Systems Based on a Scoping Study," *AI & SOCIETY* (26:3), pp. 205–220.
- Barney, J. 1991. "Firm Resources and Sustained Competitive Advantage," *Journal of Management* (17:1), pp. 99–120.
- Benitez, J., Castillo, A., Llorens, J., and Braojos, J. 2018. "IT-Enabled Knowledge Ambidexterity and Innovation Performance in Small U.S. Firms: The Moderator Role of Social Media Capability," *Information & Management* (55:1), pp. 131–143.
- Benitez, J., Ruiz, L., Castillo, A., and Llorens, J. 2020. "How Corporate Social Responsibility Activities Influence Employer Reputation: The Role of Social Media Capability," *Decision Support Systems* (129), p. 113223.
- Cui, A. S., and Wu, F. 2015. "Utilizing Customer Knowledge in Innovation: Antecedents and Impact of Customer Involvement on New Product Performance," *Journal of the Academy of Marketing Science* (44:4), pp. 516–538.
- Lipsman, A., Mudd, G., Rich, M., and Bruich, S. 2012. "The Power of 'Like,'" *Journal of Advertising Research* (52:1), pp. 40–52.
- Melville, N., Kraemer, K., and Gurbaxani, V. 2004. "Review: Information Technology and Organizational Performance: An Integrative Model of IT Business Value," *MIS Quarterly* (28:2), Management Information Systems Research Center, University of Minnesota, pp. 283–322.
- Ojelabi, R., Oyeyipo, O., Afolabi, A., and Amusan, L. 2018. "Presence of Social Client Relationship Management within the Nigerian Construction Industry," *Buildings* (8:4), p. 60.
- Rapp, A., Beitelbacher, L. S., Grewal, D., and Hughes, D. E. 2013. "Understanding Social Media Effects across Seller, Retailer, and Consumer Interactions," *Journal of the Academy of Marketing Science* (41:5), pp. 547–566.
- Tadeusz Kotarbinski. 1965. *Praxiology : An Introduction to the Sciences of Efficient Action*, Oxford, New York, Pergamon Press.
- Wang, Y., and Feng, H. 2012. "Customer Relationship Management Capabilities," *Management Decision* (50:1), pp. 115–129.

- Wang, Z., and Kim, H. G. 2017. "Can Social Media Marketing Improve Customer Relationship Capabilities and Firm Performance? Dynamic Capability Perspective," *Journal of Interactive Marketing* (39), pp. 15–26.
- Wincent, J., Anokhin, S., and Örtqvist, D. 2012. "Supporting Innovation in Government-Sponsored Networks: The Role of Network Board Composition," *International Small Business Journal: Researching Entrepreneurship* (31:8), pp. 997–1020.

C1.2 How destination marketing on social media affects behavioral intention

Ivelina Ilieva
Assoc. Prof. Spring Han Ph.D.
Kyoto University
Completed research paper

Abstract

Social media is becoming more prominent in the daily lives of consumers and can play a major role in forming impressions about tourism destinations. This is especially true during the current pandemic, when traveling is restricted and people increase the time they spend online. Recently, there has been a shift towards more visual content on social media, as apparent by the fast-growing popularity of social networks like Instagram, which is largely a photo sharing site. This shift indicates that destination marketing organizations need to take into consideration how photos of their destinations can influence consumers' destination image. The goal of this paper is to find out whether the perception of destination and visit intention change after seeing photos of a destination and determine the effect that social media has on these components.

Key words: social media, destination image, destination familiarity, behavioral intention

Introduction

The development of information technology and access to the Internet has changed the available information regarding tourism, as well as affected the way people plan and make travel decisions. The constant advancement of the Internet has influenced the development of social media websites such as blogs, forums, social networks, and YouTube, which have become a reliable source of information and have gained immense popularity among tourists (Pan et al, 2007). Travelers post and share comments, opinions, and experiences related to their travels and the destination on these platforms, including during the trip, which ultimately provides valuable information for others.

The COVID-19 pandemic and the lengthy quarantines have temporarily halted and restricted tourism; however, tourists still crave and desire to travel. As a result, they turn to social media to revisit traveling and to get travel inspirations. The adoption of social media and engagement on these platforms are growing worldwide. A report by eMarketer shows that the number of active social media users across the globe exceeds 4.2 billion and more than 49% of the population used social media platforms regularly in 2021 (eMarketer, 2022). Social media has become a valuable tool for online communications, providing tourists with a platform to interact and share their opinions, to collaborate and contribute by developing, rating and commenting on tourism experiences. Two of the most popular social media platforms are Facebook and Instagram, both of which provide the opportunity to share photos and videos and can be used very effectively to promote tourism destinations, reaching around 2 billion users. Social media is increasingly influential in many aspects of tourism, especially for reservations, exchange of impressions and experiences, and also marketing for tourism destinations (Harrigan et al., 2017).

The development of social media and media applications has been an important driving force that determines the way that information and services related to tourism offers and destinations are being conveyed and delivered as well as the ways in which tourists choose, evaluate, participate and define the image and identity tourism destinations. Through images and language that shape experiences and values, it affects the way tourism offerings and destinations are imagined, perceived, produced,

consumed and evaluated. In other words, tourism suppliers no longer control the production and consumption of tourism experiences. Instead, tourism experiences are devised from a dynamic and interactive process of creating, sharing, distributing and exchanging content and resources (Sigala, 2016).

The purpose of this study is to understand the effect of social media on tourists' perception of a destination as well as the direct and indirect influence it has on behavioral intention. It focuses on the impact of various dimensions of destination image and the overall assessment of the destination. The research focuses on the Asian market, namely Chinese, Korean and Japanese tourists. Bulgaria is selected as a tourism destination, since it is an emerging and relatively unknown for the region market destination. Most tourists have little exposure to media related to Bulgaria and hence this research can more accurately capture its role.

It also aims to fill a number of gaps in literature, regarding several issues. In recent years, research concerning Asian tourism focuses mainly on China and overlooks the dynamics and development of other established and emerging countries. Furthermore, most studies look into the differences between Asian and Western travelers but tend not to consider the distinct differences among Asian nationalities (Reisinger et al, 2009). The study's findings aim to help better understand this emerging market and to highlight the importance of embracing a sense of diversity across Asian countries.

In addition, the research paper intends to provide relevant findings for destination marketing specialists of Bulgaria. Such investigation allows to recognize the strengths and weaknesses of the destination image regarding this particular segment (Echtner and Ritchie, 2003). As a result, the findings should give the keys for a successful market communication strategy and more efficient efforts in destination promotion that would aid for a stronger position on the Asian market.

Social media

Social media is changing how consumers see destinations, especially those they haven't visited yet. The increased time spent by consumers on social media is leading to more of their "beliefs, ideas and impressions" of destinations being moderated by the posts, images and videos they see online (Bizirgianni, 2013). Notably, visual representations are considered to be more communicative online than text, because "processing pictures requires fewer cognitive resources and they sometimes say much more than words" (Frias, 2007). Social media platforms are often used when organizing a trip as they establish a link of communication between the tourist and the tourism locations. The main reason for this is that people often use social media before planning their travels, while traveling and in the end of their travels, making it an effective tool for tourists, as well as a publicity for the destinations visited (Ketter, 2016). Photographs posted on social media platforms are considered as prominent factors that engage social media users in cognitive, affective, and behavioral activities. According to Lo et al. (2011) 89% of tourists document their travels, and more than 41% of them share their photos on social media, which has a notable effect on the perception of the destinations by other users and their desire to visit.

The inclination towards social media platforms such as Facebook, Twitter, Instagram, and TikTok, etc. have removed the boundaries and limitations on access to the distribution of information. Furthermore, Li et al. (2017) noted that "Trivago and TripAdvisor are some of the more popular tourism social media platforms that enable hospitality and tourism firms to promote their brand to customers and establish connections with tourists beyond the service encounter." It is the attribute of "many-to-many" of social media that has transformed the processes of advertisement and consumption. This is prominent in the way consumers create an image or mental picture of what the destination and its tourism products will look like even before visiting.

Social media influencers have been described in literature as third-party endorsers that influence and shape the attitudes of their audience (Freberg et al., 2011). Influencers are considered as opinion leaders on social media platforms such as Facebook, Instagram, and YouTube. They tend to have a strong connection with their audience and thus are considered to be more reliable, credible and knowledgeable than regular celebrity endorsers (Lim et al., 2017). They often share aspects of their

personal life and interact with their followers and therefore are considered to be more believable and easier to relate with. Social media Influencers are known to post very regularly, therefore their endorsements can be integrated into their updates more seamlessly and will be viewed as electronic word of mouth rather than advertisement (De Veirman et al., 2017). Previous studies show that electronic word of mouth in the hotel industry is a strong predictor of online hotel booking for all ages (Confente & Vigolo, 2018). Over the past several years there has been an increase in utilizing social media influencers to promote products and services. This includes a wide range of products and industries, including destinations. There are many large multinational corporations and even government departments that use influencers to increase awareness or reach new customers. There have been multiple highly successful campaigns such as Yao Chen partnering with Tourism New Zealand or the influencer campaign implemented by Curacao (Tourism New Zealand, 2012). Influencers can play a major role and become a driving force of growth in destination marketing. However, while previous research has proven that influencers are effective in other industries, travel decision is a more complex process and there has not been enough research to conclusively say how effective influencers are in promoting destinations.

Destination image

Image is a construct that is commonly applied in marketing and expresses people's "perceptions of products, objects, behaviors and events driven by beliefs, feelings, and impressions" (Baloglu & Brinberg, 1997). Destination image plays an essential role in marketing tourist destinations and is still among the most widespread research topics in tourism. Destination image has become an essential element of destination marketing strategies and an important field of research due to its intrinsic multidimensionality (Hunter, 2008) and several authors have come up with definitions to describe it. Crompton (1979) defines destination image as a concept comprised of the sum of beliefs, ideas, and impressions that a tourist has of a destination. This definition relates to the individual, whereas other definitions acknowledge that images can be shared by groups of people. From a marketing perspective, it is essential to understand those aspects of image that are shared with other members of a particular group. This understanding aids the segmentation of markets and helps to formulate marketing strategies. Therefore, Lawson and Baud Bovy's definition (1977), which incorporates both the personal impression and the stereotyped ideas shared by groups, can be chosen as one of the most traditional definitions for the concept. They define destination image as "the expression of all objective knowledge, impressions, prejudice, imaginations, and emotional thoughts an individual or group might have of a particular place".

Several scholars consider destination image to be a multidimensional construct (Hosany et al., 2006). This multi-attribute approach of destination image acts as basis for most researches on the topic. The two main concepts are those proposed by Echtner and Ritchie (1991) and Gartner (1993), with the latter gaining more popularity among tourism scholars (Zhang et al., 2014). According to Gartner (1993) destination image consists of two components - cognitive and affective image. Recent studies suggest that the coexistence of both components may help to explain the image a tourist has of a destination that is not entirely defined by its physical attributes (Baloglu, 1997).

Affective image refers to the feelings a tourist has about a destination (Lin et al., 2007). Furthermore, Klenosky (2002) states that before making their travel decision, tourists form a more positive affective destination image when the emotions inflicted by the destination corresponds with their motives and pursued benefits. Russell and Pratt (1980) suggested that affective image can be used to explain behavioral intentions, an argument supported by Ekinici and Hosany (2006), according to who affective image is a predictor of intention to recommend a destination to others.

Cognitive image reflects people's perceptions, beliefs and attitudes towards a destination (Martin & Bosque, 2008). In addition, Pike (2008) states that cognitive image refers to what the individual knows or believes about the destination and the associated knowledge that could or could not be obtained from a past visit. Several empirical studies show that the two destination image components

have a significant relation. While some authors claim that the affective and cognitive components have a hierarchical relation, with cognitive image preceding affective image (Gartner, 1993), the extant literature is still not definitive regarding the connection between these components.

Echtner and Ritchie (1993) propose when studying destination image, researchers should include not only attribute-based components, but a holistic construct of image as well. Holistic image is defined as “a composite of various products and attributes woven into a total impression” (MacKay & Fesenmaier, 1997). Many scholars have stated that the holistic depiction of images is greater than the sum of its elements (Fakeye & Crompton, 1991). However, there are opposing views regarding the relation between the three images - cognitive, affective, and holistic. For example, Baloglu (1997) argues that cognitive and affective images pre-empt holistic image, while McCleary (1999) highlights the mediating role of affective image in the connection between the other two constructs. Therefore, considering the lack of conclusive evidence about the relationship between holistic image and the two destination components, researchers have suggested that both should be incorporated when analyzing the positioning of a destination (Qu, Kim, & Im, 2011).

Destination familiarity

The concept of familiarity is commonly associated with other related concepts, such as awareness, knowledge and expertise (Sharifpour et al., 2014). Some scholars have even linked familiarity with experience, defining it as “the number of product-related experiences that have been accumulated by the consumer” (Alba & Hutchinson, 1987). As a result, familiarity is often considered as a single dimension of past visits, the number of past visits, or has been expressed as the difference between repeaters and newcomers (Prentice, 2006). Other scholars have proposed that familiarity does not require actual experience. Non-visitors may also be aware and knowledgeable about a destination, thanks to education, mass media, travel guides and connections with other individuals (Gursoy, 2011). The Internet is also often used by all customer segments when planning a trip. Therefore, familiarity can also be established as a result of information search and is related to the amount of time spent processing that information (Baker et al., 1986).

Many scholars describe familiarity as subjective knowledge, which expresses how much individuals believe they know and, therefore, often relate familiarity to consumer self-confidence (Brucks, 1985). By viewing it as affect-as-information, researchers interpret familiarity as a multidimensional construct and consider it to be a combination of three concepts: experiential, self-described and informational familiarity (Prentice, 2004). Prentice (2004) further expanded the construct by adding three additional familiarity dimensions: self-assured, expected, and proximate. Self-assured familiarity alludes to the level of assurance concerning visiting a destination. Expected familiarity relates to the degree of coziness, comfort, and attractions anticipated. Proximate familiarity refers to the extent to which tourists feel a bond with a destination and whether they can identify with it. Jansen (2011) defined proximate familiarity as the existence of an emotional attachment to a destination or having friends or relatives who live there. Therefore, it relates to the concept of place attachment and affiliation, which refers to the affective connection between individuals and specific places.

Behavioral Intention

It is widely accepted that behavioral intention is the immediate determinant and best predictor of behavior (Fishbein & Ajzen 1975). Behavioral intention, defined as an individual’s expected or planned future behavior, expresses the intention of a particular type of behavior in a given situation and can be described as the likelihood to act (Fishbein & Ajzen 1975). Studies of tourists’ behavioral intention focus mostly on two topics: destination choice intention (Lam and Hsu 2006) and post purchase behavioral intention (Kozak, 2002), with the latter receiving the majority of attention. Following Ajzen and Fishbein (1975), Petrick, Morais, and Norman (2001) propose that the future intentions of

consuming a product is more valuable than the actual consumption, indicating the need for further research regarding behavioral intent.

The impact of the destination image elements on tourists' behavioral intentions is still relatively fragmented in existing literature (Ekinici & Hosany 2006). This is important because if certain destination components are more influential than others on the development of intention, then more attention should be given to their management to achieve more positive perceptions and increase visitation. According to some scholars, destinations with positive images have a higher chance of being included and selected during the decision-making process (Baloglu & McCleary, 1999). Both cognitive and affective images are considered to have an effect on behavioral intention (Assaker et al., 2011). Some studies demonstrate that familiarity positively affects visit intention (Chen & Lin, 2012). In addition to external information sources, one's perceived knowledge about a destination is also a key factor for decision-making (Sharifpour et al., 2014).

Methodology

In order to conduct the research, a questionnaire was developed. The questions explore the perception of the participants regarding destination image components— affective, cognitive and holistic, destination familiarity and behavioral intention in the case of Bulgaria. It utilizes social media by presenting the participants with photos of Bulgaria from travel blogs and the website of the official tourism organization of the country and asking the participants to evaluate the constructs before and after viewing the photos. The questionnaire was distributed through a survey platform and a total of 57 responses were received, evenly distributed among the countries (33% Japanese respondents, 33% Korean respondents, 33% Chinese respondents). The majority of the respondents, 49.13%, fall in the age category 25-35 years old, 49.12% are female and 50.88% male, and the majority have a post-graduate degree as their highest degree of education – 57.9%.

Findings

The first two questions of the survey focus on the participants' awareness and previous experience visiting Bulgaria. Only 1.75% of the participants had visited Bulgaria before and 85.96% state that they have heard of Bulgaria. There is a notable discrepancy between the three nations – 100% of the Chinese participants answered that they have heard of Bulgaria, compared to 89.47% of Koreans and only 68.42% of Japanese.

The respondents were asked to evaluate how familiar they are with the destination. The highest score is received by I am always aware of this place, with a 2.58, on a Likert scale from 1 to 7 (1-lowest; 7-highest). The lowest score is 1.70, received by My friends and family tell me that I know this place very well. This shows that the overall perceived familiarity with the destination is quite low. After reviewing the photos, the score of every factor shows an increase. The average scores for each country are equal – 2.35. While the increase is small, it shows a positive change and infers that a greater exposure to destination-related social media increases the perceived familiarity of the tourists.

Regarding the affective destination image, Bulgaria receives the highest average score on the scale Distressing-relaxing, 5.19. Korean participants gave the lowest average score – 4.48, followed by Japan – 4.78 and China - 5.34. All scores given after viewing the photos are higher on average, but by country some decrease. The average score decreased for China to 5.20, increased slightly for Korea to 4.55 and increased by 0.62 for Japan, making it the highest average score - 5.40.

Before viewing the photos, Korean participants give the lowest average score overall to the cognitive image – 4.39, followed by China - 4.49 and Japan – 5.09. While the average scores are rather close, the individual factors are evaluated quite differently. Interesting historical attractions receives the lowest score from Chinese participants - 3.38, but also receives the highest score from Korean participants along with Interesting cultural attractions – 5.36. It is also important to notice that a very high percent of the participants selected "I cannot answer" – 48.87% of Korean participants, 60.15%

Japanese and a remarkable 75.94% Chinese. After viewing the photos, the average score for each country increases slightly. The effect of social media appears to be inconsistent which could be attributed to the significantly lower percent of participants who selected “I cannot answer” during the second evaluation: Korea - 25.56%, Japan – 34.59%, China 49.25%.

When asked to evaluate the overall holistic image of Bulgaria, Japan gave the highest score – 4.84, and Chinese and Korean participants both gave 4.58. There is a small increase in the scores after viewing the photos. China gives the highest score – 4.95, followed by Japan – 4.89 and Korea – 4.79. This shows a positive correlation between social media exposure and holistic destination image.

In the evaluation of the behavioral intention of the participants, the scores are not very high. Korea has the highest average score – 3.78, followed by China – 3.63 and Japan – 3.30. The highest score is given to Want to travel to Bulgaria – 4.51, while the lowest scores vary. The second evaluation shows an increase in every individual factor. Subsequently, the average score of each country also increases, with Japan showing the biggest increase of 0.49. Korea still has the highest average score – 3.90 and China and Japan both give an average score of 3.79.

In order to further examine the results, an analysis was carried out through SPSS. A correlation analysis shows that familiarity has the weakest correlation with behavioral intention, while holistic or overall image has the strongest correlation, with the highest Pearson Correlation index. The results for affective and cognitive image are very close to holistic image, with a slightly lower Pearson Correlation index.

Table 1 Correlation between familiarity and behavioral intention

	Would give good reference to others	Want to visit	Would encourage family and friends to come	Have intention of coming back
This place is very familiar to me	0.249	0.104	0.386	0.558
I know this place very well	0.221	0.046	0.421	0.495
I am always very well informed about this place	0.204	0.092	0.371	0.526
I am always aware of this place	0.258	0.301	0.433	0.446
My friends and family tell me that I know this place very well	0.31	0.071	0.31	0.301

Table 2 Correlation between holistic image and behavioral intention

	Would give good reference to others	Want to visit	Would encourage family and friends to come	Have intention of coming back
Overall image	0.482	0.462	0.468	0.257

A dependable t-test was also carried out with the results of each construct before and after viewing the photos to determine whether the increase is significant. All elements of familiarity, as well as affective and cognitive image show a p-value less than 0.05, which proves that the increase in the scores before and after viewing the photos is significant. On the other hand, holistic image and behavioral intention have higher p-values. This shows that while the scores have increased on average, this increase is not significant. The only exception is Would encourage family and friends to come, which has a p-value 0.049.

Table 3 Dependable t-test analysis for affective image

	Mean	Std. Deviation	95% Confidence Interval of the Difference		t	Sig. (2-tailed)
			Lower	Upper		
Sleepy-arousing	-0.6379	2.19807	-1.21588	-0.05998	-2.21	0.031
Gloomy-exciting	-0.8276	2.28756	-1.42907	-0.2261	-2.755	0.008

Unpleasant-pleasant	-0.9655	2.39858	-1.59619	-0.33484	-3.066	0.003
Distressing-relaxing	-0.7069	2.64249	-1.4017	-0.01209	-2.037	0.046

Table 4 Dependable t-test analysis for behavioral intention

	Mean	Std. Deviation	95% Confidence Interval of the Difference		t	Sig. (2-tailed)
			Lower	Upper		
Would give good reference to others	-0.3103	1.36635	-0.66961	0.04892	-1.73	0.089
Want to visit	-0.2586	1.26436	-0.59107	0.07383	-1.558	0.125
Would encourage family and friends to come	-0.3103	1.17289	-0.61874	-0.00195	-2.015	0.049
Have intention of coming back	-0.2241	1.57884	-0.63927	0.191	-1.081	0.284

Conclusion

The results of the research show that social media does affect the image perception of a destination. Moreover, this effect is substantial, proving that social media can be successfully utilized to influence the attitude and feeling of tourists towards a place. However, behavioral intention proves to be a lot more difficult to affect and control. More exposure or a different type of media is necessary to persuade tourists and shift their visit intention. Further research is necessary to expand on this issue.

The analysis of the affective and cognitive destination images show that Asian tourists hold a rather positive image of Bulgaria as a tourism destination. However, one of the most notable results from the current study is significant lack of respondent awareness and familiarity about Bulgaria. Some of the respondents indicated in the answers that they had not heard of Bulgaria and a large percent struggled to form a destination image perception, particularly cognitive destination image.

Regardless of the fact that Bulgaria is still an unfamiliar and distant destination for Asian tourists, it is promising that their perception changes positively after viewing the photos. On this basis it can be concluded that Bulgaria has the necessary attributes, and with proper marketing, can become a desirable destination for this market. In order to attract more tourists, broad information about the country should be induced first and the results of this survey show that the groundwork for this has been laid. Information about a destination is supposed to minimize the tourist's uncertainty before visiting the place and therefore make the tourist destination more familiar and attractive. Information about the country's competitive attributes such as safeness, hygiene, quality of tourism services, the level of the country's development and especially tourist attractions should be widely spread in the target countries, so that Asian tourists can have a better general understanding of Bulgaria.

The results also show a lot of differences between the three markets, further solidifying that the Asian market should not be grouped as a whole and each country needs to be studied separately to establish a way to attract tourists. Similarly, a different marketing approach needs to be established for each country.

References:

- Baker, W., Hutchinson, J., Moore, D., & Nedungadi, P. (1986). Brand familiarity and advertising: effects on the evoked set and brand preference. *Advances in Consumer Research*, 13(1), 637-642.
- Baloglu, S. (1997). The relationship between destination images and sociodemographic and trip characteristics of international travellers. *Journal of Vacation Marketing*, 3(3), 221e233.
- Bizirgianni, I. & Dionysopoulou, P. (2013). The influence of tourist trends of Youth Tourism through social media (SM) & Information and Communication Technologies (ICTs). *Procedia – Social and Behavioral Sciences*, 72, 652-660.

- Brucks, M. (1985). The effects of product class knowledge on information search behavior. *Journal of Consumer Research*, 12, 1–16.
- Crompton, J. L. (1979). An assessment of the image of Mexico as a vacation destination and the influence of geographical location upon that image. *Journal of Travel Research*, 17, 18–23.
- Echtner, C. M. and Ritchie, J. R. B. (2003). The Meaning and Measurement of Destination Image. *Tourism Management* 14(1): 37-46.
- Ekinci, Y., and S. Hosany. (2006). Destination Personality: An Application of Brand Personality to Tourism Destinations. *Journal of Travel Research*
- Fakeye, P. C., & Crompton, J. L. (1991). Image differences between prospective, first time, and repeat visitors to the Lower Rio Grande Valley. *Journal of Travel Research*, 30(2), 10e16.
- Fishbein, M., and I. Ajzen. (1975). *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*. Boston: Addison-Wesley.
- Gartner, W. C. (1993). Image formation process. In M. Uysal, & D. Fesenmaier (Eds.), *Communication and channel systems in tourism marketing*. New York, NY: The Haworth Press.
- Gursoy, D. (2011). *Modeling tourist information search behavior: A structural modeling approach*. Saarbrücken: Lambert Academic
- Hosany, S., Ekinci, Y., & Uysal, M. (2006). Destination image and destination personality: An application of branding theories to tourism places. *Journal of Business Research*, 59, 638–642.
- Hunter, W. C. (2008). A typology of photographic representations for tourism: Depictions of groomed spaces. *Tourism Management*, 29
- Jansen, H. J. (2011). *Tourist familiarity in Amsterdam: Route choice behaviour of (un) familiar domestic tourists within Amsterdam's inner city (Master's dissertation)*. The Netherlands: Universiteit Utrecht.
- Ketter, E. (2016) Destination image restoration on facebook: The case study of Nepal's Gurkha Earthquake. *Journal of Hospitality and Tourism Management*, Issue: 28 (2016) p.66-72
- Klenosky, D. B. (2002). The “pull” of tourism destinations: a means-end investigation. *Journal of Travel Research*, 40(4), 396e403.
- Kozak, M. (2002). “Comparative Analysis of Tourist Motivations by Nationality and Destinations.” *Tourism Management*, 23: 221-32.
- Lam, T., and C. Hsu. (2006). Predicting Behavioral Intention of Choosing a Travel Destination. *Tourism Management*, 27 (4): 589-99.
- Lawson, F., and Baud-Bovy, M. (1977), *Tourism and Recreational Development*. London: Architectural Press.
- Lin, C., Morais, D., Kerstetter, D., & Hou, J. (2007). Examining the role of cognitive and affective image in predicting choice across natural, developed, and themepark destinations. *Journal of Travel Research*, 46.
- Lo, I. S., McKercher, B., Lo, A., Cheung, C., & Law R. (2011). Tourism and online photography. *Tourism Management*, 32, 725–731.
- MacKay, K. J., & Fesenmaier, D. R. (1997). Pictorial element of destination in image formation. *Annals of Tourism Research*, 24(3).
- Prentice, R. (2004). Tourism familiarity and imagery. *Annals of Tourism Research*, 31 (4), 923–945.
- Prentice, R. (2006). Evocation and experiential seduction: Updating choice sets modeling. *Tourism Management*, 27, 1153–1170.
- Reisinger, Y., Mavondo, F. T., & Crotts, J. C. (2009). The importance of destination attributes: Western and Asian visitors. *Anatolia*, 20(1)
- Sharifpour, M., Walters, G., Ritchie, B., & Winter, C. (2014). Investigating the role of prior knowledge in tourist decision making: A structural equation model of risk perceptions and information search. *Journal of Travel Research*, 53(3), 307–322.
- Stern, E., & Krakover, S. (1993). The formation of a composite urban image. *Geographical Analysis*, 25(2), 130e146.

C1.3 How to Choose the Right Person? Social Media Marketing Optimization Framework

Kitae Kim^a and Sung-Hyuk Park^b

^a School of Management Engineering, College of Business, Korea Advanced Institute of Science and Technology (KAIST)

E-mail: kitae.kim@kaist.ac.kr

^b School of Management Engineering, College of Business, Korea Advanced Institute of Science and Technology (KAIST)

E-mail: sunghyuk.park@kaist.ac.kr

Abstract

Influencer selection is a critical business problem for firms running social media marketing. However, managers face two challenges. First, quantifying the value of unstructured data, such as texts, is a time-consuming and challenging task. Second, they have to choose influencers without seeing the advertising content. This paper proposes a data-driven influencer selection framework for social media marketing to overcome the challenges. The proposed framework consists of a social media response (e.g., view, likes, and comments) prediction and a simple multi-object optimization model. The authors validate the framework using a unique influencer marketing dataset acquired from Korea's extensive social media marketing company. The results show that the proposed framework outperforms human decisions. This study contributes to social media research and industry by providing a new social media marketing optimization framework.

Keywords: Social media, marketing, influencer, prediction, optimization

C1.4 Understanding the Usage of In-app Community in Photo and Video Editing Apps

Yang, N. Y.^a and Sia, C. L.^b

^a Department of Information Management, National Taiwan University
E-mail: d08725006@ntu.edu.tw

^b Department of Information Management, National Taiwan University
E-mail: siachoonling@ntu.edu.tw

Abstract

With the rapid growth of social media use, the demand for both photo & video editing apps is also continuously growing. Many mobile app developers joined this industry and figured out the ways to keep their users engaged and continuance usage. One of the strategies is to incorporate social community functions into their apps for enhancing user experience and interaction. However, literature regarding how the in-app community will affect mobile apps users' perception and behavior is very limited. Therefore, by drawing on the uses and gratifications theory, this study aims to bridge this gap and seeks to enhance our knowledge on the gratifications obtained in the context of in-app community for photo & video editing apps via introducing the sense of community into the association between gratifications obtained (social, utilitarian, and hedonic gratifications) and behavioral outcomes (continued use intention and Word-of-mouth intention). That is, the findings of this study help us understand which factors users are concerned about when using the in-app community features.

Keywords: In-app community, Continuance usage, WOM intention, Editing app

Introduction

With the rapid growth of social media use, people are continuing to share their photos or videos on social media platforms such as TikTok, Instagram, YouTube, for entertaining themselves and staying in touch with others. Using photo and video editing apps helps them to enhance their social media presence and enhance their content creation on the app. According to Statista, the revenue of the global photo & video apps market is US\$16,042 million in 2021 and is projected to reach US\$25,149 million by 2025 (Statista, 2021). Considering the demand for both photo & video editing keeps growing, many mobile app developers joined this industry and figured out the way to keep the user engaged and continuance usage.

Incorporating social community functions into photo & video editing apps may help to enhance user experience. Those apps are like task-oriented apps, whose main functions are not social network-oriented, but to help users complete certain types of tasks (Caraway et al., 2017). Having an in-app social community allows users to interact with others without switching to a social media app. Besides, community building is a promising avenue for enhancing user engagement (Gruss et al., 2020). Consequently, an increasing number of mobile app developers start to incorporate social community functions into their apps. For example, VSCO, a photo-editing app with over 100 million registered users, provides an in-app community function to its users, aiming to encourage users to share their content creations, and thus improve user engagement and retention of the app.

However, empirical research into how in-app communities affect user engagement and continuous usage with mobile apps is still very limited. Previous literature only showed user engagement in online brand communities can help to develop the app continuance usage. Addressing these gaps, this study draws on the Uses and Gratification Theory (UGT; Katz et al, 1973) and takes photo & video editing apps as examples to investigate how in-app community features might foster user satisfaction, and finally have positive marketing outcomes. Specifically, this paper proposes a model to analyze how the three gratification dimensions (hedonic gratification, utilitarian gratification, and social gratification) of the in-app community contribute to users' sense of community. Finally, the impact of users' sense of community on individuals' continuance usage and WOM intention of apps is analyzed.

Literature Review

Uses and Gratifications Theory

Uses and gratifications theory (UGT) was originally developed from mass communications research, studying the reasons why people use traditional media, such as newspapers, radio, and television. This theory seeks to explain how people use particular types of media and content to satisfy their social and psychological needs (Katz et al., 1974). Later, as electronic communication technology has evolved rapidly, UGT has been applied to a variety of media types (Ruggiero, 2000). We can see this theory has been widely used on digital media, such as the Internet (Leung, 2003), social networking sites (Park et al., 2009), and most recently, mobile applications.

Early research with the UGT approach identified the key motivations that people use for mass media are for seeking information, entertainment, and socialization (Katz et al., 1974). While recently, studies on newer forms of digital media also pointed out similar motivations. In terms of mobile apps specifically, Chen et al. (2020) showed that through the mediation of usage habit and satisfaction of an exercise app, users' perceived usefulness, enjoyment, and sense of social belonging will lead to continued use intention. Similarly, Lee and Kim (2019) found that in addition to a motivation for entertainment gratification and hedonic-related factors, mobile app atmospherics are also important factors. In sum, users will continue to use such apps if their gratifications and needs are fulfilled. However, so far there's no study investigating what motivates users' continuance intention for photo & video editing apps. This study applies a UGT lens aimed at identifying the motivational factors that may influence editing app users to continue use.

Sense of Community

Moreover, some app developers start to integrate the in-app community features into their apps since community building has been identified as an effective user engagement strategy (Gruss et al., 2020). In-app community is one type of online community. According to Williams and Cothrel (2000), the online community can be defined as a group of people who share common interests or purposes in online platforms. Furthermore, people will feel belonging to a community if they share common interests and passions, which can be defined as a sense of community (Koh et al., 2015). In the context of photo & video editing apps, the in-app community is mainly for users who are interested in photography or videography to share their personal creations. In addition, the community provides an environment in which users can exchange ideas with each other regarding their creations, and also have new inspirations by exploring others' work. However, theoretical understandings of in-app communities toward the sense of community are still very limited. Hence, this study aims to understand the antecedents and consequences of the sense of community in the context of in-app communities for photo & video editing apps.

Theoretical framework

Based on the previous literature review, this study draws on the UGT and develops a theoretical framework presenting the drivers and consequences of the sense of community within the in-app community. First, the factors that affect the sense of community are divided into social, utilitarian, and hedonic gratifications. Second, the consequences of a sense of community are examined by

investigating the post-adoptive behavior of continuance intention and the likelihood to recommend (i.e., WOM) of the photo & video editing apps. The research model for this study is shown in Figure 1.

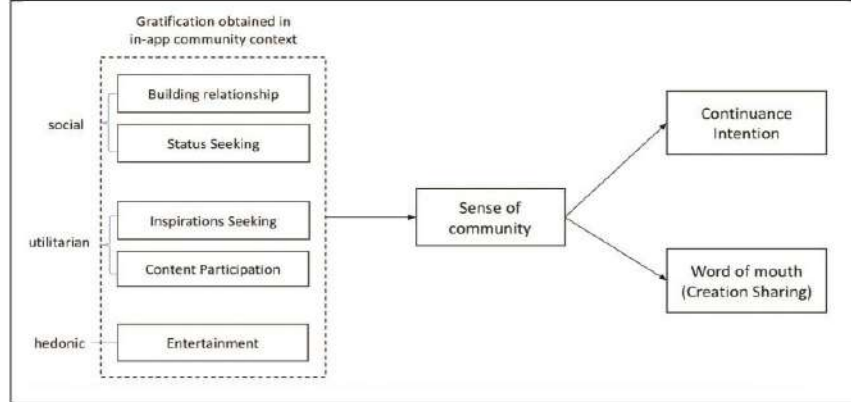


Figure 1. Research Model

People tend to interact with people who have the same interests for making friends and building longer relationships. According to UGT, people can have a sense of belonging by interacting with others (Rubin, 1986). The present studies have also pointed out that maintaining relationships is a key driver for people to join a virtual community (Dunne et al., 2010). Taken together, this study argues that when users' social gratification of relationship-building is fulfilled, their sense of belonging to the community will be increased. Moreover, in the context of the creator community, a lot of photographers or videographers seek to showcase their work and earn recognition from people who are also experts in this field. That is, creators tend to obtain peer recognition and establish status within the community. Previous research has recognized one of the incentives for users to contribute content in online communities is to enhance their reputation and popularity (Rafacli & Ariel, 2008). Thus, it is hypothesized that higher peer recognition, or status-seeking, will increase the sense of belonging of the community.

Utilitarian gratification refers to fulfilling users' utility expectations. Prior studies have identified that this gratification motivates users to participate in virtual communities such as social platforms. For example, researchers have verified users can fulfill their information needs by seeking information, which in turn affects their continuing usage intentions (Hossain et al., 2019). With regards to content creators and app users, looking for new inspirations or useful information is an essential way to help them enhance their creations. Moreover, users can collect in-app content with similar topics based on their interests. Therefore, we can assume that the more relevant inspirations users can find in the community, the more sense of belonging of the community they'll have. In addition to browsing the app for inspiration, creators also can share their work to the in-app community or react to others' creations such as click likes, leave comments, or use other users' creation editing settings to create new content. These activities can be defined as content participation. Previous studies have shown that social media platforms allow users to express themselves, and such participation positively influences users' emotional commitment. Besides, users can be involved with the production, creation, and participation of user-generated content (Shao, 2008). We, therefore, hypothesized that content participation will positively affect users' sense of community.

Apart from social and utilitarian gratifications to users, engaging in the in-app community can also fulfill users' entertainment needs. As creators often share creative works with the community, other users will feel fun and interesting through browsing their creations. Moreover, prior studies have found that enjoying sharing creations is one of the main reasons for people to contribute content online. Similarly, Nov et al. (2010) identified enjoyment as an intrinsic motivator driving users to share photos

within online communities. A possible explanation is that after users share their creations, they can become involved in making fun of others or discussing ideas with peers. Accordingly, the gratification of entertainment is expected to contribute a significant positive role to influence users' sense of community.

Motivational affordances facilitate individuals' psychological outcomes, such as a sense of community, which leads to behavioral outcomes (Koivisto & Hamari, 2019). Specifically, this study explores two outcomes: continued use intention of the app and word-of-mouth intention (WOM). Users who are highly engaged with in-app communities tend to have a higher sense of belonging to the community. Previous studies have found that users' stronger sense of belonging toward a virtual community will make them put more effort into the community, and enhance their knowledge contribution behaviors (Sharratt & Usoro, 2003). In the context of photo & video editing apps, the primary activity of the in-app community is to let users engage in social interactions through photo or video creation sharing. Based on previous research results, we expect users' sense of community will result in greater intention to continue usage and recommend the app to others in the context of the in-app photo and video sharing community.

Research Method

In order to test the model and the hypothesized relationships, an online questionnaire approach will be utilized to collect the data. The reason why we take an online survey method is the factors we investigate in this study are related to the respondents' perceptions (e.g. the sense of community) and psychology (gratification-based factors) which should be measured by self-report. Participants in this study must have experience in using the in-app community feature for photo or video editing apps. Moreover, they'll be asked to answer which app they're thinking about while answering this questionnaire and how often they use it. A seven-point Likert scale is adopted to measure all adapted items from previous literature, and we modify the measured items to fit our research context. In addition, the developed questionnaires for the survey will be pre-tested before collecting final responses. Finally, we'll use the structural equation modeling (SEM) technique with AMOS to test all the proposed hypotheses.

Expected Contributions

This study proposes an analytical framework and enhances our knowledge on the gratifications obtained in the context of in-app community for photo & video editing apps via introducing the sense of community into the association between UGT obtained (social, utilitarian, and hedonic gratifications) and behavioral outcomes (continued use intention and WOM intention). This paper extends past studies on users' virtual community participation particularly in mobile apps communities by adapting the uses and gratifications theory and elaborating in more detail about gratifications as driving factors and outcomes of user participation to in-app communities. Thus, it helps us understand which factors users are concerned about when using the in-app community features.

This study makes several theoretical contributions to the existing mobile apps and virtual communities literature. First, recent studies have noted the lack of research into user engagement within mobile apps (Ho & Chung, 2020). In addition, currently, there is little empirical evidence on how the in-app community will affect mobile apps users' behavior. Therefore, this study aims to bridge this gap by examining users' fulfillment factors that users engage with the in-app community in the context of photo & video editing apps. Furthermore, it is unique in introducing gratification-based factors like users' motivation to identify the sense of community as a mediator for examining users' intention to continue using the app and WOM intention. In sum, through the lens of UGT, this research aims to make a contribution and establish a framework to explain how users' interaction with the in-app communities will lead to their behavioral outcomes.

The findings of this study also provide several practical implications to help photo & video editing app developers and managers to do the decision-making for enhancing their users' continuance intention. First, managers can consider integrating an in-app community feature to boost apps' user engagement and retention. Moreover, as the sense of community is a key factor of users' continuance intention, managers are recommended to foster a sense of community within their apps. This could be achieved,

for example, by showing users exciting and personalized content in the feed or holding community events for bringing users who have the same passions much closer. Once users feel connected and have a sense of belonging, they'll start to engage more with the apps and share their own creations. In addition, managers can identify the priority of gratifications that will contribute to users' sense of belonging, and make the app feature optimization plan accordingly. To sum up, the proposed model from this study expects to shed light on future in-app communities' research and offer practical guidelines for managers.

References

- Caraway, M., Epstein, D. A., and Munson, S. A. 2017. "Friends Don't Need Receipts," *Proceedings of the ACM on Human-Computer Interaction* (1:CSCW), pp. 1–17.
- Chen, C.-C., Hsiao, K.-L., and Li, W.-C. 2020. "Exploring the Determinants of Usage Continuance Willingness for Location-Based Apps: A Case Study of Bicycle-Based Exercise Apps," *Journal of Retailing and Consumer Services* (55), p. 102097.
- Cothrel, R. L. W. and J. 2000. "Four Smart Ways to Run Online Communities," *MIT Sloan Management Review*.
- Dessart, L., Veloutsou, C., and Morgan-Thomas, A. 2015. "Consumer Engagement in Online Brand Communities: A Social Media Perspective," *Journal of Product & Brand Management* (24:1), pp. 28–42.
- Dunne, Á., Lawlor, M., and Rowley, J. 2010. "Young People's Use of Online Social Networking Sites – a Uses and Gratifications Perspective," *Journal of Research in Interactive Marketing* (4:1), (S. Harridge-March, ed.), pp. 46–58.
- Erickson, T., and Kellogg, W. A. 2000. "Social Translucence: An Approach to Designing Systems That Support Social Processes," *ACM Transactions on Computer-Human Interaction* (7:1), pp. 59–83.
- Gruss, R., Abrahams, A., Song, Y., Berry, D., and Al-Daihani, S. M. 2019. "Community Building as an Effective User Engagement Strategy: A Case Study in Academic Libraries," *Journal of the Association for Information Science and Technology* (71:2), pp. 208–220.
- Ho, M. H.-W., and Chung, H. F. L. 2020. "Customer Engagement, Customer Equity and Repurchase Intention in Mobile Apps," *Journal of Business Research* (121), pp. 13–21.
- Katz, E., Blumler, J. G., and Gurevitch, M. 1973. "Uses and Gratifications Research," *Public Opinion Quarterly* (37:4), pp. 509–523.
- Koh, J., Kim, Y.-G., and Kim, Y.-G. 2003. "Sense of Virtual Community: A Conceptual Framework and Empirical Validation," *International Journal of Electronic Commerce* (8:2), pp. 75–94.
- Lee, Y., and Kim, H.-Y. 2018. "Consumer Need for Mobile App Atmospherics and Its Relationships to Shopper Responses," *Journal of Retailing and Consumer Services*.
- Leung, L. 2003. "Impacts of Net-Generation Attributes, Seductive Properties of the Internet, and Gratifications-Obtained on Internet Use," *Telematics and Informatics* (20:2), pp. 107–129.
- Lin, Y.-H., Hsu, C.-L., Chen, M.-F., and Fang, C.-H. 2017. "New Gratifications for Social Word-of-Mouth Spread via Mobile SNSs: Uses and Gratifications Approach with a Perspective of Media Technology," *Telematics and Informatics* (34:4), pp. 382–397.
- Nov, O., Naaman, M., and Ye, C. 2010. "Analysis of Participation in an Online Photo-Sharing Community: A Multidimensional Perspective," *Journal of the American Society for Information Science and Technology* (61:3), pp. 555–566.
- Park, N., Kee, K. F., and Valenzuela, S. 2009. "Being Immersed in Social Networking Environment: Facebook Groups, Uses and Gratifications, and Social Outcomes," *CyberPsychology & Behavior* (12:6), pp. 729–733.
- Ruggiero, T. E. 2009. "Uses and Gratifications Theory in the 21st Century," *Mass Communication and Society* (3:1), pp. 3–37.

C1.5 Understand Users' Sharing and Continuance Intention toward Commodity-Oriented AR Filters on Social Media: an Integrated Perspective of Stimulus-Organism-Response Theory

Yang, N. Y.^a and Sia, C. L.^b

^a Department of Information Management, National Taiwan University
E-mail: d08725006@ntu.edu.tw

^b Department of Information Management, National Taiwan University
E-mail: siachoonling@ntu.edu.tw

Abstract

As Augmented Reality (AR) technology constantly develops and innovates, it appears on social media in the form of filters. Snapchat, Facebook, and Instagram have launched AR filters in recent years, and it has become an essential feature within social media platforms. Therefore, the demand for brands to use AR filters to engage with their customers is also continuously growing. By drawing on the stimulus-organism-response (S-O-R) framework, this study aims to understand how commodity-oriented AR filters' attributes (multiple products presentation and AR filter interactivity) can impact users' sharing and continuance intention through perceived informativeness and perceived immersed. The results will help brand managers to focus on specific factors to develop and implement AR filters effectively.

Keywords: Augmented reality, AR filters, SOR theory, social media

Introduction

Augmented Reality, or AR as it's popularly called, is an emerging technology and is being fully utilized by many companies to provide users with a more 3D-oriented, personalized, and interactive experience. In addition, with the rapid growth of smartphone and tablet use, it helps to boost the AR technology-based mobile apps to grow at a faster pace, especially in the APAC region, which has the highest growth rate in the global mobile AR market in the coming years. Social media companies also take advantage of this emerging trend and help to drive the overall growth of AR technologies. One key application of AR in social media platforms is AR face filters (or "lenses"). At first, Snapchat brought AR filters into the mainstream by letting users add a digital overlay filter on top of their real-time images displayed by a mobile camera. The other social media platforms such as Instagram and Facebook soon followed and integrated this AR feature. Later on, Facebook launched Spark AR Studio in 2019 which allows everyone, including brands, celebrities, and individuals, to create original AR filters for free. According to Spark AR Studio, more than 600 million people use AR filters on Facebook and Instagram every month.

Considering the usage of AR filters keeps growing, an increasing number of companies are investing in this technology and implementing their own AR filters on social media to promote their products, connect the customers and interact with them closely (Rauschnabel et al., 2019; Cowan et al., 2021). Also, AR technology has been proved to facilitate consumer-brand relationships and boost user-generated content in favor of the brand (Scholz and Duffy, 2018). For instance, by using the AR filters,

users can imitate in-store shopping and have a virtually try-on experience, which can trigger connections with brands and positive electronic word-of-mouth (eWOM). In addition, as users take lots of time on social media platforms every day, sharing branded AR filters can make them like a crew of brand ambassadors and enable it to go viral.

As more brands and companies increasingly utilize augmented reality on social networks, particularly AR filters, it also attracts IS and marketing scholars' attention for research on AR. Previous literature about AR filters has mainly focused on investigating the factors that lead to users' purchase intention or brand attitude. For instance, Phua and Kim (2018) examined the effects of AR geofilter advertisements on consumers' brand-related preferences, the results found that self-brand congruity and self-referencing significantly impacted brand attitude and purchase intention. However, empirical research into how users interact with commodity-oriented AR filters and what factors drive their sharing intention is still very limited. Addressing these gaps, this study draws on the stimulus-organism-response framework (S-O-R; Mehrabian and Russell, 1974) to investigate how AR filters might foster users' perceived informativeness and perceived immersed, then finally have positive behavior outcomes. Specifically, this paper proposes a model to investigate how the two attributes (multiple products presentation in AR filter and AR filter interactivity) of the commodity-oriented AR filters as "stimulus" contribute to users' perceived informativeness and immersed. Finally, the impact of users' perceived informativeness and immersed on individuals' sharing and continuance intention of AR filters is analyzed.

Background

Commodity-oriented AR filters on social media platforms

AR filters can be defined as a mask-like augmented reality that which users can add a layer with virtual objects on top of their real-life photos or videos, which is a very popular feature on social media platforms such as Instagram and Snapchat. Unlike traditional filters that are applied to photos for editing the color of the photo, AR filters are a real-time feature and thus can provide an interactive and engaging user experience. Besides, many retailers (e.g. glasses, clothing, make-up) have implemented a similar feature called "virtual try-on" into their branded apps or websites for commercial purposes. However, unlike virtual try-on features, commodity-oriented AR filters are used by social media platform users for entertainment and purchase-oriented purposes, which allows brands to create their own filters for engaging with their potential customers and fans.

Previous studies on AR filters have mainly focused on investigating the factors that lead to users' purchase decision or brand attitudes. For example, Dodoo and Youn (2021) uncovered several consumers' motivations interacting with Snapchat AR advertising filters which result in their attitude toward ad engagement and purchase motivation. Similarly, Flavián et al. (2021) found perceived usefulness of AR filters fostered behavioral intentions towards brands. However, while recent studies have explored AR filter adoption by using the uses and gratification theory, theoretical understandings of AR filters' attributes toward users' perceived informativeness and immersed are still very limited. The concept of informativeness and immerse are often used to investigate stimulus objects such as websites, products, advertisements, and purchasing scenarios (Zaichkowsky, 1986; Jiang et. al, 2010). Hence, extended from previous studies, this study aims to examine how the stimuli of commodity-oriented AR filter attributes can affect users' perceived informativeness and immersed separately, and the consequences of perceived informativeness and immersed in the context of using commodity-oriented AR filters on social media platforms.

Stimulus-organism-response (S-O-R framework)

The S-O-R framework was originally developed from environmental psychology research, which explains the environmental cues (the "stimuli") that activate an individual's mental reactions (the "organism"), resulting in their behavior outcomes (the "response") (Mehrabian and Russell, 1974). Later, this framework has also been widely used in the information systems (IS) field to explain users' reactions to their environment, such as investigating users' behavior toward website experience, E-commerce shopping experience, mobile apps interaction, and so on. To be more specific, stimuli in an online context often refer to the factors such as information technology attributes (e.g., web or app

design, system features or quality), social media features (e.g., interactivity, social presence), and product display (e.g. product presentation or format). The organism is a set of an individual's internal states, which includes the factors like cognitive and affective reactions (Triantoro et al., 2019), trust and attitude (Kaur et al., 2017), and so on. Responses reflect users' willingness or behavioral reactions, such as purchase intentions and participation intentions (Xue et al., 2020).

While AR technology usage is on the rise, many studies have also applied the S-O-R framework to explore how the properties of AR affect user behaviors. In addition, previous research has indicated this framework is appropriate to study how the system features or attributes of immersive technology may evoke users' psychological reactions, leading to their behaviors (Suh and prophet, 2018). Similarly, Loureiro et al. (2019) found the S-O-R framework served as the core theoretical framework within AR research. Although this framework has been widely used by previous AR research, they only focused on studying certain types of AR (e.g. AR mobile apps, AR games), and the research on commodity-oriented AR filters with this framework is very limited. Therefore, consistent with previous studies that have applied the S-O-R framework in the AR context, we believe that the proposed S-O-R framework can serve as a useful theoretical lens to characterize users' behavioral decision-making process of how stimuli (AR filter attributes) affect their internal states, leading to their behavioral intention. The research framework is shown in Figure 1.

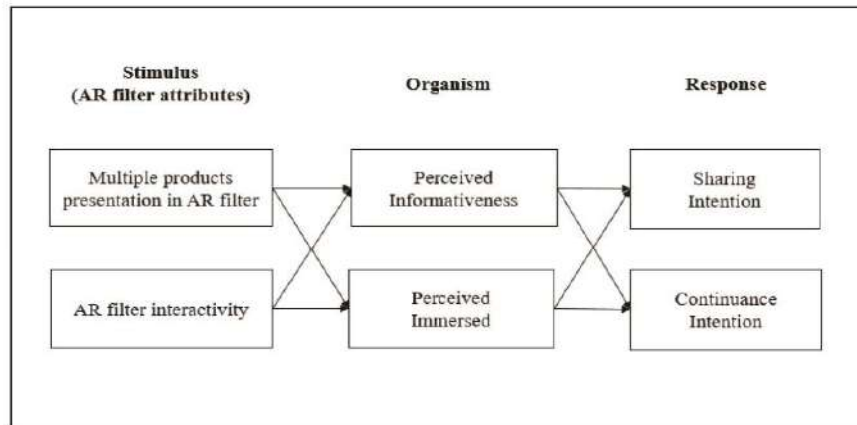


Figure 1. Research Model

Theoretical framework

According to the previous literature review, this study draws on the S-O-R model and develops a theoretical framework presenting the drivers and consequences of perceived informativeness and immersed within the commodity-oriented AR filters. First, the AR filter attributes act as stimuli that evoke users' cognitive and affective internal state are divided into multiple products presentation in AR filter and AR filter interactivity. Second, the consequences of perceived informativeness and immersed are examined by investigating the post-adoptive behavior of continuance intention and the likelihood to share the photo or video with such filters.

Stimulus: AR Filter Attributes (Multiple Products Presentation and Interactivity)

As previously outlined, AR filters is one type of AR technology applications on social media platforms. Azuma (1997) defined AR as an information system which combines real and virtual objects as well as provides an interactive experience in real time. Accordingly, in commodity-oriented AR filters (sales-oriented business context), we distinguish and label their main attributes as multiple products presentation and interactivity.

Vivid products presentation is often associated with the aesthetic appeal and the quality of online product presentations within the e-commerce environment (Jiang and Benbasat 2007). Likewise, in the AR filter context, users can interact with the graphic effects of 3D animations to see the virtual products, which may provide the feeling of realism and immersion. Previous research has indicated that more vivid and higher quality of product presentation can expose more information to users, which stimulates users' cognitive elaboration processes (Nisbett and Ross 1980). Thus, this study extends previous findings and proposes that the multiple products presentation of the 3D images on AR filters, the richer product information that users could have. In other words, when users experience useful and good quality through interacting with or trying on multiple products on AR filters, they tend to believe this feature is helpful to improve their knowledge about the product, and consequently increase their perceived informativeness. In addition, product presentation is proven to have a positive effect on creating enjoyment for using AR systems such as the virtual try-on (Flavian et al., 2017). Therefore, we expect that multiple products presentation that users derive from using AR filters increases their perceived informativeness and perceived immersed:

H1: Multiple products presentation in commodity-oriented AR filters positively influences users' (a) perceived informativeness and (b) perceived immersed.

Another AR filters attribute is interactivity, which refers to how quickly users can control content as well as easily adapt the virtual environment in real-time through using the technological systems (Spielmann and Mantonakis, 2018). Also, depending on how well AR provides high interactivity and vividness, users may perceive a sense of involvement (a high immersion state), which influences user technology perceptions (Yim et al., 2017). Moreover, prior research revealed that enhanced interactivity empowers users with the ability to manipulate products for visual examination as well as gather more effective information, which allows users to be involved in the cognitive processing of information. Furthermore, McLean et al. (2019) found AR interactivity through the retailers' app provides an entertaining experience for users. Therefore, users in AR filters settings may experience different levels of interactivity that leads to involvement while using this feature. Based on the extant literature, we can hypothesize that:

H2: The interactivity of commodity-oriented AR filters positively influences users' (a) perceived informativeness and (b) perceived immersed.

Organism: Perceived Informativeness and Perceived Immersed

According to the SOR framework, organism refers to individuals' cognitive and affective mental states (Mehrabian and Russell, 1974). In this study, the organism is represented by AR filter users' perceived informativeness and perceived immersed which can be seen as two important mediators for information processing. Extant studies have found that cognitive and affective responses can stimulate customers' positive behavioral intentions, such as purchase intention on shopping websites (Jiang et al., 2010). That is, when users have perceived enjoyment and useful benefits from the interaction with the systems, they are more likely to develop positive responses (Casaló et al., 2017b). In the context of present study, high perceived informativeness suggests that users are actively processing useful information through AR filters and are engaged in the filter using processes. Therefore, high perceived informativeness is likely to result in favorable responses, including continuance usage and sharing intention. On the other hand, perceived immersed reflects the heightened emotional feeling states associated with a specific using activity. In the information system usage setting, users' sense of pleasure as an immersed involvement is positively related to continuance intention (Wang et al., 2014). Thus, the greater the users feel immersed, the higher the users' intention to continue use and share such AR filters will be. Hence, we propose the following hypothesis.

H3: Perceived informativeness positively influence users' (a) continuance intention and (b) sharing intention

H4: Perceived immersed positively influence users' (a) continuance intention and (b) sharing intention

Research Method

In order to test the model and the hypothesized relationships, an online questionnaire approach will be utilized to collect the data. The reason why we take an online survey method is the factors we investigate in this study are related to the respondents' perceptions (e.g., perceived informativeness and immersed) and stimulus (technology-based factors) which should be measured by self-report. Participants in this study must have experience in using the commodity-oriented AR filter features in social media apps. Moreover, they'll be asked to answer which app and filter they're thinking about as well as how often they use it while answering this questionnaire. A seven-point Likert scale is adopted to measure all adapted items from previous literature, and we modify the measured items to fit our research context. In addition, the developed questionnaires for the survey will be pre-tested before collecting final responses. Finally, we'll use the structural equation modeling (SEM) technique with AMOS to test all the proposed hypotheses.

Expected Contributions

This research-in-progress paper proposes an analytical framework and enhances our knowledge in the context of AR filters for social media apps via introducing perceived informativeness and immersed into the association between AR attributes obtained (multiple products presentation and AR filter interactivity) and behavioral outcomes (continued use intention and sharing intention). This paper extends past studies on users' AR feature usage particularly in mobile apps by adapting the S-O-R framework and elaborating in more details about AR attributes as driving factors and outcomes of users' behaviors toward branded AR filters. Thus, it helps us understand which factors users are concerned about when using the AR filter features.

This study will make several theoretical contributions to the existing AR literature. First, recent studies have noted the lack of research into users' real behaviors toward AR filters such as sharing them publicly on social media platforms (Sergio et al., 2022). Second, there is little empirical evidence on how the commodity-oriented AR filters' attributes will affect mobile apps users' behavior through perceived informativeness and immersed for entertainment purposes instead of shopping purposes. Therefore, this study aims to bridge this gap by examining stimulus factors that users engage with the AR filter in the context of social media apps. Furthermore, it is unique in introducing AR attributes that acted as stimuli to identify informativeness and immersed as a mediator for examining users' intention to continue using the filter and sharing intention. In sum, through the lens of S-O-R theory, this research aims to make a contribution and establish a framework to explain how users interact with the commodity-oriented AR filters will lead to their behavioral outcomes.

The findings of this study also provide several practical implications to help AR filters' managers to strategize and focus on factors for enhancing users' continuance and sharing intention. For example, managers can invest in interactivity of AR filters to foster users' feeling toward informativeness or immersed. Once users feel immersed and have a sense of involvement, they may share such filters on social media platforms and reuse this brand's filter for the next time. In addition, managers can identify the priority of AR filter attributes that will contribute to users' perceived informativeness and immersed, then make the filter optimization plan accordingly. To sum up, the proposed model from this study expects to shed light on future AR filters' research and offer practical guidelines for brands.

References

- Azuma, R. T. 1997. "A Survey of Augmented Reality," *Presence: Teleoperators and Virtual Environments* (6:4), pp. 355–385.
- Casaló, L. V., Flavián, C., and Ibáñez-Sánchez, S. 2017. "Antecedents of Consumer Intention to Follow and Recommend an Instagram Account." *Online Information Review* (41:7), pp. 1046–1063.
- Connolly, T., Nisbett, R., and Ross, L. 1981. "Human Inference: Strategies and Shortcomings of Social Judgment.," *Administrative Science Quarterly* (26:2), p. 302.

- Cowan, K., Javornik, A., and Jiang, P. 2021. "Privacy Concerns When Using Augmented Reality Face Filters? Explaining Why and When Use Avoidance Occurs," *Psychology & Marketing* (38:10), pp. 1799–1813.
- Dodoo, N. A., and Youn, S. 2020. "Snapping and Chatting Away: Consumer Motivations for and Outcomes of Interacting with Snapchat AR Ad Lens," *Telematics and Informatics* (57), p. 101514.
- Ibáñez-Sánchez, S., Orús, C., and Flavián, C. 2022. "Augmented Reality Filters on Social Media. Analyzing the Drivers of Playability Based on Uses and Gratifications Theory," *Psychology & Marketing* (39:3), pp. 559–578.
- Jiang, Z., and Benbasat, I. 2007. "Research Note—Investigating the Influence of the Functional Mechanisms of Online Product Presentations," *Information Systems Research* (18:4), pp. 454–470.
- Jiang, Z., Chan, J., Tan, B., and Chua, W. 2010. "Effects of Interactivity on Website Involvement and Purchase Intention," *Journal of the Association for Information Systems* (11:1), pp. 34–59.
- Kaur, S., Kumar Lal, A., and Singh Bedi, S. 2017. "Do Vendor Cues Influence Purchase Intention of Online Shoppers? An Empirical Study Using S-O-R Framework," *Journal of Internet Commerce* (16:4), pp. 343–363.
- Loureiro, S. M. C., Guerreiro, J., Eloy, S., Langaro, D., and Panchapakesan, P. 2019. "Understanding the Use of Virtual Reality in Marketing: A Text Mining-Based Review," *Journal of Business Research* (100), pp. 514–530.
- McLean, G., and Wilson, A. 2019. "Shopping in the Digital World: Examining Customer Engagement through Augmented Reality Mobile Applications," *Computers in Human Behavior* (101), pp. 210–224.
- Mehrabian, A., and Russell, J. A. 1974. *An Approach to Environmental Psychology*, M.I.T. Press.
- Pantano, E., Rese, A., and Baier, D. 2017. "Enhancing the Online Decision-Making Process by Using Augmented Reality: A Two Country Comparison of Youth Markets," *Journal of Retailing and Consumer Services* (38), pp. 81–95.
- Phua, J., and Kim, J. (Jay). 2018. "Starring in Your Own Snapchat Advertisement: Influence of Self-Brand Congruity, Self-Referencing and Perceived Humor on Brand Attitude and Purchase Intention of Advertised Brands," *Telematics and Informatics* (35:5), pp. 1524–1533.
- Rauschnabel, P. A., Felix, R., and Hinsch, C. 2019. "Augmented Reality Marketing: How Mobile AR-Apps Can Improve Brands through Inspiration," *Journal of Retailing and Consumer Services* (49), pp. 43–53.
- Scholz, J., and Duffy, K. 2018. "We ARE at Home: How Augmented Reality Reshapes Mobile Marketing and Consumer-Brand Relationships," *Journal of Retailing and Consumer Services* (44), pp. 11–23.
- Spielmann, N., and Mantonakis, A. 2018. "In Virtuo: How User-Driven Interactivity in Virtual Tours Leads to Attitude Change," *Journal of Business Research* (88), pp. 255–264.
- Suh, A., and Prophet, J. 2018. "The State of Immersive Technology Research: A Literature Analysis," *Computers in Human Behavior* (86), pp. 77–90.
- Triantoro, T., Gopal, R., Benbunan-Fich, R., and Lang, G. 2019. "Would You like to Play? A Comparison of a Gamified Survey with a Traditional Online Survey Method," *International Journal of Information Management* (49), pp. 242–252.
- Wang, Q., Zhou, X., and Zhang, X. 2014. "Study of How Experience Involvement Affects Users' Continuance Intention to Use Mobile Reading," *Journal of Systems Science and Information* (2:6), pp. 532–542.
- Yim, M. Y.-C., Chu, S.-C., and Sauer, P. L. 2017. "Is Augmented Reality Technology an Effective Tool for E-Commerce? An Interactivity and Vividness Perspective," *Journal of Interactive Marketing* (39), pp. 89–103.
- Zaichkowsky, J. L. 1986. "Conceptualizing Involvement," *Journal of Advertising* (15:2), pp. 4–34.

C1.6 Exploring changes in sharing experiences to social media: Focusing on the case of domestic tourists in Jeju Island before and after Covid-19

Indicate Submission Type: Completed Research Paper

Park, U. C.^a, Choi, M. H.^b and Cha, K. J.^{c}*

^a Business School, Hanyang University

E-mail: call0712@hanyang.ac.kr

^b Business School, Hanyang University

E-mail: cshcsh4032@hanyang.ac.kr

^{c} Business School, Hanyang University*

E-mail: kjcha7@hanyang.ac.kr

Abstract

This study uncovered a multidimensional customer experience and sharing tendency of each experience by applying LDA topic modeling. Importance-Satisfaction-Correlation (ISC) map, which effectively shows the importance, satisfaction, and sharing tendency of each experience suggested in this study. ISC quantitatively shows the e-WOM performance of managers and suggests themes to be managed in the future. ISC map is applied to explore the sharing experience of Jeju Island domestic tourists before and after Covid-19. The results show that even though there was no dramatic change in the tourist destination itself, the experience of domestic tourists traveling on Jeju Island changed and the sharing tendency increased immediately after the Covid-19.

Keywords: Social media mining, Sharing experience, Tourism experience, Covid-19

Introduction

Developments of the smartphone and Internet allow numerous people to share various experiences in social media platforms such as social networks (e.g., Instagram), micro blogs (e.g., Tweets). Thanks to this phenomenon, companies can listen and interact with their customers faster and less expensively than ever before (Osatuyi, 2013). User-generated contents (UGCs) which is written by customers on social media is regarded as a more reliable source of information than other online sources since it was created willingly and without compensation (Yoo & Gretzel, 2011). UGCs can help prospective customers easily find products and services that meet their requirements or interests (Dellarocas, 2003). Customers can also avoid making risky judgments based on UGCs without first-hand experience (Cheung & Lee, 2012).

Although experiments employing UGCs are gaining popularity, present research still has numerous limitations. First, previous studies lacked verification of whether UGCs are reliable and representative for experiment purposes. In the real world, customers sometimes write fake reviews to obtain kickbacks or to avoid trouble, which can lead to serious research errors (Schuckert et al., 2015). Even if customers remove advertising UGCs that they did not voluntarily fill out, it is still necessary to verify whether this data is representative of the customer to be analyzed, but most studies have not done so. They believed that if the sample size was large enough, UGCs would adequately reflect customer experience. Second, few researchers have quantitatively investigated the sharing of customer experiences. Research on sharing behavior is just as significant as research on UGCs of customers (Sotiriadis, 2016). For example, in a tourism context, UGCs which is the result of sharing tourist experience on social media is prized

by destination marketers because it leads to increased place awareness and helps make travel experiences more perceptible (Wang et al., 2017). Thus, understanding what types of experiences tourists wish to share on social media will thus be useful information for practitioners in tourism.

The purpose of this study is to present a methodology that can quantitatively analyze experience sharing to social media. In this study, social media sharing experience is identified and defined by the Latent Dirichlet Allocation (LDA) based topic modeling method. The importance value and satisfaction value of each tourist experience are calculated using the topic-document matrix and topic-keyword matrix of LDA. And by comparing UGCs with the trends in the target customer data, the reliability of the UGCs and the strength of the experience sharing behavior is calculated. To demonstrate this approach, we selected and applied travel trends and blog review data of domestic tourists in Jeju Island, Korea's largest tourist destination, from 2019 to 2021. In the 21st century, one of the terrible issues common to people around the world regardless of nationality is the Covid-19. We speculated the travel experiences of domestic tourists in Jeju island before Covid-19, the immediately after the Covid-19 break, and the with Covid-19. Through this experiment, we aim to answer the following four research objectives: (1) to investigate qualitatively and quantitatively the sharing content and tendency to share travel experiences by Jeju Islanders; (2) to judge Naver Blog be regarded as appropriate data for analyzing domestic tourists' experiences on Jeju Island; (3) to identify the travel experiences before (2019) and after the Covid-19 outbreak (2020, 2021) and explore how the importance, satisfaction, and sharing tendencies of travel experiences have changed; (4) to understand how restrictions on overseas travel due to Covid-19 have affected Koreans' sharing of Jeju Island travel experiences.

Methodology

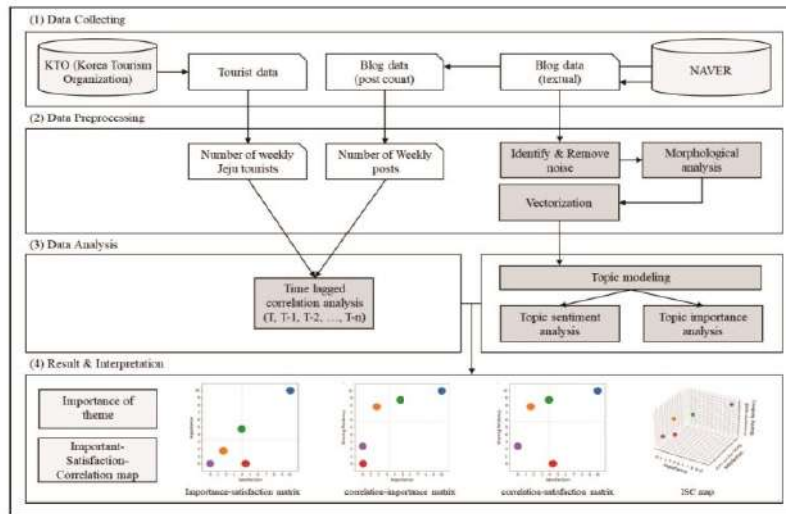


Figure 1. Proposed Research Model

Study sites & Data collection

Study sites

Jeju is an essential destination for Korean tourism study (Moon & Han, 2018) since it is not only a fascinating destination for overseas tourists, but also a popular domestic tourist destination. Jeju island, selected as a 'place like overseas travel' for the purpose of visiting, is relatively luxurious compared to other domestic travel destinations. In particular, as overseas travel is restricted due to the COVID-19

pandemic, people who want to satisfy their desire to travel spotlighted domestic travel, and Jeju island has emerged as an attractive destination.

Data collection

For both qualitative and quantitative approaches, this study used two types of data, the number of people who visited Jeju island, and posts of blogs related to Jeju trip during the same period. Travel experiences were analyzed through text mining techniques in blog posts, and tourist data was used to verify the sharing strength and representativeness of these experiences. The blogs collected are Naver Blogs, a platform operated by the search engine Naver. Although Google dominates the search engine market worldwide, the Republic of Korea has its own search engine platform, Naver. Naver provides a social blog service, Naver Blog, which is the largest blog service in Korea, has 30 million active blogs with 870,000 new posts being created every day as of 2021. Blog posts are widely exposed to people using Naver search engines because blog posts are mainly displayed in Naver search results along with community service cafes, and so on.

The period of data collected is 26 weeks, high demand season of Jeju travel, each from April 1 to September 30 of three years, 2019, 2020 and 2021. The data collecting timeframe was set for each three years since it is targeted for the before Covid-19, the immediately after the Covid-19 break, and the with Covid-19. The data of visitors on Jeju island is found through mobile telecommunication data provided by the Korea Tourism Organization Data Lab. Naver blog data was collected by a crawler we developed with selenium using python. A search term which was used for data collection was 'Jeju island travel', and all publicly available Naver blog posts including the search term were used for analysis. Among the crawled Naver blog data, we filtered out posts that were not related to Jeju Island travel or were advertisements. The results are summarized in Table 1. During the survey period, a total of 80697 unique ids that posted Jeju Island travel related posts on Naver blog were counted.

Table 1. Summary of Blog posts

Period	Upload Count	Mean of Uploads	Std of Uploads	Mean of Contents Length	Std of Contents Length
2019.04 ~ 2019.09	38693.00	1480.08	150.81	1217.12	880.29
2020.04 ~ 2020.09	35204.00	1183.78	269.21	1183.78	1222.46
2021.04 ~ 2021.09	67983.00	1222.46	417.68	1222.46	915.05

Topic similarity & merging

LDA discovers underlying topics in a large collection of documents through unsupervised learning. Even if the LDA model divides the topics, there are cases where merging the topics is useful since they are assessed to be related for research reasons. A criterion for determining this is required if a researcher arbitrarily merges similar topics, as this might substantially weaken the impartiality and trustworthiness of the research. In addition, in this study, since there are LDA models from three different periods and the results need to be compared, a criterion for judging topic similarity between different LDA models as well as topics within the same LDA model is also required.

When merging similar topics within the same period, the Within Period Topic Similarity (WPTS) proposed by Song et al. (2014) was used as a criterion for judging whether the merging of topics was appropriate. The formula for WPTS is:

$$WPTS = Sim(Topic_A, Topic_B) = \frac{\sum_{i=1}^n w_{Ai}w_{Bi}}{\sqrt{\sum_{i=1}^n (w_{Ai})^2} \sqrt{\sum_{i=1}^n (w_{Bi})^2}} \quad (1)$$

Where $Topic_A = \{w_{A1}, w_{A2}, w_{A3}, \dots, w_{An}\}$, $Topic_B = \{w_{B1}, w_{B2}, w_{B3}, \dots, w_{Bn}\}$

And, when comparing topics from different periods, we used the Between Period Topic Similarity (BPTS) proposed by John as a criterion to determine whether topics with similar characteristics were inherited to determine the comparability between topics. The formula for BPTS is:

$$BPTS = Sim(Topic_A|P_t, Topic_B|P_{t+1}) = \frac{\sum_{i=1}^n (w_{Ai}|P_t)(w_{Bi}|P_{t+1})}{\sqrt{\sum_{i=1}^n (w_{Ai}|P_t)^2} \sqrt{\sum_{i=1}^n (w_{Bi}|P_{t+1})^2}} \quad (2)$$

Where $Topics_{P_t} = \{Topic_A: 0 \leq A < n\}$, $Topics_{P_{t+1}} = \{Topic_B: 0 \leq B < n\}$ given time P_t .

Topic based importance, satisfaction, sharing tendency score

We quantified the topics representing the travel experience of tourists derived through LDA-based topic modeling into three scales. Importance, Satisfaction, and Sharing Tendency are precisely that, and by measuring the scores of these three scales, we can make a comprehensive assessment of tourists' travel experiences and social media sharing behavior.

The degree of importance for a tourism topic can be calculated to the extent that travelers refer to the tourism topic. We calculated the importance of a tourism topic as the sum of the probabilities that all tourist reviews contributed to the tourism topic, as suggested by Jeong et al. (2019).

Topic importance is calculated as:

$$TI_t = \sum_{i=0}^{\#ofDocuments} TDMatrix_{t,i} \quad \text{Where } t = \text{Topic\#} \quad (3)$$

Where $TDMatrix_{t,i}$ denotes the topic-document matrix outputted by topic modeling.

Satisfaction with the tourism topic can be defined by multiplying the probability that each word contributes to the tourism topic and the emotional score of those words. We employed the KNU sentiment lexicon for giving sentiment scores to words. KNU is used for Korean sentiment analysis in a variety of research (Choi & Kim, 2021; Lee et al., 2022). We calculated the satisfaction of a tourism topic as the sum of the sentiment values of the keywords that constitute their corresponding tourism topic, as suggested by Jeong et al. (2019).

Topic satisfaction is calculated as:

$$TS_t = \sum_{i=0}^{\#ofDocuments} SentimentMatrix_{t,i} \quad \text{Where } t = \text{Topic\#} \quad (4)$$

Where $SentimentMatrix_{t,i}$ denotes the topic-keyword matrix which is outputted by topic modeling weighting sentiment score of keywords based on KNU.

In this study, we defined the sharing tendency of tourists as the degree to which tourists share their tourism experience on social media. We calculated sharing tendency by defining the temporal correlation coefficient between topic importance and tourists. And min-max scaling was performed to compare the sharing tendency score defined in this way between tourism topics.

Topic sharing tendency is calculated as

$$TST_{t,l} = C_t(X_t, Y_{t+l}) = \frac{\sum_{i=0}^T (X_i - \bar{X})(Y_{i+l} - \bar{Y})}{\sqrt{\sum_{i=0}^T (X_i - \bar{X})^2} \sqrt{\sum_{i=0}^T (Y_{i+l} - \bar{Y})^2}}, \quad \text{Where } l = \text{Time lags} \quad (5)$$

Where X_i, Y_{i+l} denotes the number of blog post per week and weekly number of tourists after l week respectively. And all values were normalized on a scale of 0-10 to increase comparability between themes.

Concept of ISC map

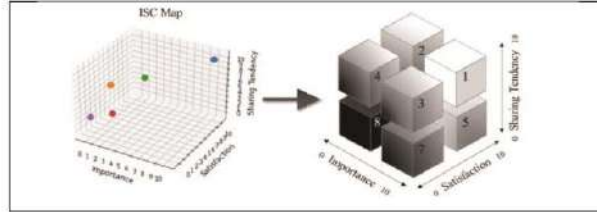


Figure 2. formation of area in ISC map

The Importance-Satisfaction matrix was used to prioritize and identify topics to focus on by comparing relative importance and satisfaction scores (Jeong et al., 2019). As part of the verifying process for the reliability of Importance-Satisfaction matrix, we grafted correlation components of target. To better comprehend the tendency to share the theme on social media, a correlation was performed for each theme. The fact that there is a statistically significant sharing tendency is evidence that the analysis results of each theme represent the Jeju island travel experience of Koreans. Figure 2 is the result of visualizing a matrix expressed by three elements: importance, satisfaction, and correlation, and projecting them into a map simultaneously. The strength of ISC map is that it is divided into eight areas, which allows stakeholders to graphically identify well-managed themes, themes that need to improve the tourism experience, and themes that need to promote, as well as design integrated marketing products for existing products.

Experiment

Removal of inappropriate data and determination of data suitability

We used two methods to filter out data suitable for research purposes by removing noise data specific to UGCs. First, we found a certain pattern of advertisements, which were written repeatedly in a short time. As a result of inspecting the distribution of accounts per post, to prevent data from being filled with specific user's opinions, we determined that the posts of accounts that created 10 or more posts within the specific period were excluded from the analysis. Second, posts with commercial keywords determined by the research team, for example, "preuser", "compensation" and "contact information" were deleted in rule base method. The results of the correlation analysis are shown in Table 2, and through this, it can be seen that the Naver blog is appropriate to analyze the experience of Jeju island domestic tourists if there is a time lag of 1 week for all three years. We can also find the overall sharing tendency rising dramatically in 2020, immediately after covid-19, and then return to before covid-19 in 2021.

Table 2. Temporal correlations coefficient between the number of posting and tourists

Period	Time lag 0	Time lag 1	Time lag 2
2019.04 ~ 2019.09	0.22	0.54**	0.27
2020.04 ~ 2020.09	0.84**	0.86**	0.75**
2021.04 ~ 2021.09	0.38	0.56**	0.42*

Significance of correlation coefficient different from zero: * = P < 0.05, ** = P < 0.01.

Overall tourist sharing experience

We apply LDA to finding out dimensions of experience shared by tourists across blog textual data. Initially, the number of topics was specified using the coherence score and the perplexity score as criteria, but the results did not sufficiently reveal tourism experience. Researchers judged them in a stepwise procedure from 5 to 50 through an iterative process. By looking at the top 20 highly weighted words for each topic, the LDA topics were identified for showing the best travel experience by year.

Among them, topics that are comparable with each other before Covid-19, the immediately after the Covid-19 break, and the with Covid-19, which can represent the change in the experience of the Jeju travel, the purpose of the study, were selected and grouped. Table 3 summarizes the number of predefined topics for LDA topics and the number of useful ones. Most of the topics deemed meaningful were general aspects of customer behavior that were prevalent in the tourism field (Disegna & Osti, 2016). Table 4 shows the common themes that researchers found by looking at the LDA topic modeling results. With these themes, topics with a common theme within the same period were merged, and comparisons were made between the merged themes and the same topics in different periods. Even if the researcher judged similar topics, the WPTS and BPTS values were referred to when merging topics within the same period and comparing themes of different periods. WPTS by year is summarized in Table 5. When we merge topics within the same period, if the similarity is less than $(\mu + 2\sigma)$, we do not merge and delete topics. When applying BPTS, which is the standard for year-to-year comparison, topics below 0.3 were deleted without comparison even if the researcher determined that they were the same theme.

Table 3. Topic parameter by year and number of useful topics judged by the researcher

	2019.04 ~ 2019.09	2020.04 ~ 2020.09	2021.04 ~ 2021.09
N. of Topics	22	24	28
N. of Meaningful Topics	8	9	14

Table 4. Theme description

Theme name	Example Keywords
Food	pork, rockfish, cutlassfish, braised, abalone, seafood, coffee shop, bread
Transportation	rental car, rental car enterprise, availability, reservation, airport, airline ticket, cancel, covid19
Lodging	accommodation, hotel, guesthouse, pension (Korean rental cottage), reservation, resort, view, swimming pool
Entertainment	experience, festival, osulloc, arte museum, kayak, exhibition, green barley, art gallery, aquarium, tour, horseback riding
Landmark & Sites	udo island, peanut, scooter, harbor, ice cream, electric car, island, haenyco
Snap	snapshot, photographing, photographer, wedding, photo studio, photo retouch, rental, dress
Covid19	diary, covid19, itinerary, covid19 vaccine, memory, mask, arrival

Table 5. A comparison of within period topic similarity (WPTS)

Period	2019.04 ~ 2019.09	2020.04 ~ 2020.09	2021.04 ~ 2021.09
Mean	0.07	0.06	0.06
Std	0.09	0.01	0.09
Threshold $(\mu + 2\sigma)$	0.25	0.23	0.26

Interpretation of Theme distribution and ISC map

Multiple themes appeared collectively rather than just one theme in one document due to the characteristics of blogs (Nardi et al., 2004). To illustrate tourism tactics through the interpretation of the relationships between the theme of the experience, social network analysis was used to sort the themes that arose together using a co-occurrence matrix, and changes in the theme's area over time on the ISC map were utilized. Figure 3 is a visualization of a co-occurrence matrix by calculating

undirected weights, where higher values are showed as thicker edges. The connection between all nodes is equal to degree 4, and the mutual simultaneous appearance of *food*, *transportation*, and *lodging* is stronger than *snap* and *sites* for 3 years. *Food*, *transportation*, and *lodging*, the more general experience of travel, appeared as a collective rather than exclusively when travel experiences are shared.

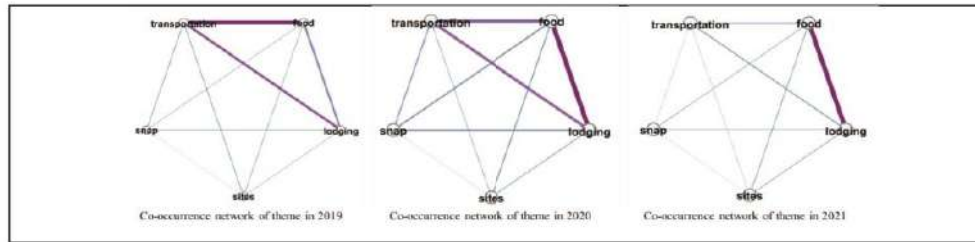


Figure 3. Co-occurrence network of theme in 2019, 2020, 2021

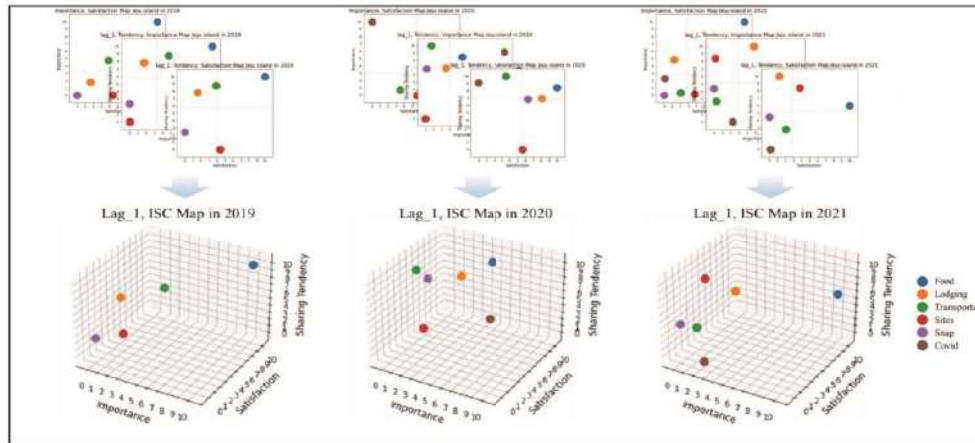


Figure 4. Importance, satisfaction, correlation matrix and ISC map

And applying the ISC map shown in Figure 4, we analyzed how the importance, satisfaction, and sharing tendency of tourism experience themes change before and after covid-19. Above all, *food* is a representative and satisfying experience that most tourists show off. To get a satisfying food experience in Jeju trip is very important for domestic tourists. The following theme to note is *lodging*, which is likewise particularly important during the three years and has a strong tendency to be shared. However, as the satisfaction level swings, intensive improvement and management of it is required. In the case of the *sites*, satisfaction is high, but importance is constantly low, we can guess that if only people can participate, more powerful sharing behavior will emerge. That is, *sites* have high expectations for advertisements compared to other themes. While *snap* should be enhanced both in terms of development and promotion, but it might simply be considered a poor subculture. Due to its low priority compared to other themes, long-term monitoring is needed to ensure that its importance changes. In terms of performance management for the tourism experience, *food* theme was well managed regardless of Covid-19. In the case of *lodging*, satisfaction increased after Covid-19, and in the case of *transportation*, satisfaction gradually decreased after Covid-19. It can be interpreted that the activity in accommodation due to covid-19, gave a satisfactory experience, but did not take care of tourists' concerns about covid-19-related sanitation.

Conclusion

This study explores how domestic travel experience sharing behavior has changed in a situation where foreign tourism is restricted due to Covid-19, based on UGCs and tourist data. The experiment results show that the sharing tendency changes dramatically depending on the circumstances of travelers, even though there is no significant change in tourist destinations. The contributions of this study are three folds. First, this study presented a critical view on UGCs suitability and presented a methodology to verify it. Second, unlike the existing review analysis, the multidimensional experience of tourists was quantitatively analyzed through text mining analysis of blogs among social media. Finally, ISC map was presented, which quantitatively suggests importance, satisfaction, and sharing tendency of the themes that managers need to manage.

References

- Cheung, C. M., & Lee, M. K. (2012). What drives consumers to spread electronic word of mouth in online consumer-opinion platforms. *Decision support systems*, 53(1), 218-225.
- Choi, I., & Kim, W. C. (2021). Detecting and Analyzing Politically-Themed Stocks Using Text Mining Techniques and Transfer Entropy—Focus on the Republic of Korea's Case. *Entropy*, 23(6), 734.
- Dellarocas, C. (2003). The digitization of word of mouth: Promise and challenges of online feedback mechanisms. *Management science*, 49(10), 1407-1424.
- Disegna, M., & Osti, L. (2016). Tourists' expenditure behaviour: the influence of satisfaction and the dependence of spending categories. *Tourism Economics*, 22(1), 5-30.
- Jeong, B., Yoon, J., & Lee, J. M. (2019). Social media mining for product planning: A product opportunity mining approach based on topic modeling and sentiment analysis. *International Journal of Information Management*, 48, 280-290.
- Lee, S., Park, S., & Kwak, M. (2022). Revealing the dual importance and Kano type of attributes through customer review analytics. *Advanced Engineering Informatics*, 51, 101533.
- Moon, H., & Han, H. (2018). Destination attributes influencing Chinese travelers' perceptions of experience quality and intentions for island tourism: A case of Jeju Island. *Tourism management perspectives*, 28, 71-8.
- Nardi, B. A., Schiano, D. J., Gumbrecht, M., & Swartz, L. (2004). Why we blog. *Communications of the ACM*, 47(12), 41-46.
- Osatuyi, B. (2013). Information sharing on social media sites. *Computers in Human Behavior*, 29(6), 2622-2631.
- Schuckert, M., Liu, X., & Law, R. (2015). Hospitality and tourism online reviews: Recent trends and future directions. *Journal of Travel & Tourism Marketing*, 32(5), 608-621.
- Song, M., Heo, G. E., & Kim, S. Y. (2014). Analyzing topic evolution in bioinformatics: investigation of dynamics of the field with conference data in DBLP. *Scientometrics*, 101(1), 397-428.
- Sotiriadis, M. D. (2017). Sharing tourism experiences in social media: A literature review and a set of suggested business strategies. *International Journal of Contemporary Hospitality Management*.
- Wang, S., Kirillova, K., & Lehto, X. (2017). Travelers' food experience sharing on social network sites. *Journal of Travel & Tourism Marketing*, 34(5), 680-693.

[DAY 1]

D1 [KIISS-Paper Session]

암호화폐와 핀테크 1

D1.1 암호화폐 투자를 위한 CNN 기반 로보 어드바이저

원종관
부산대학교 경영학과
jongkwan1@pusan.ac.kr

홍태호
부산대학교 경영학과
hongth@pusan.ac.kr

국문초록

블록체인 기술을 기반으로 개발된 대표적인 암호화폐인 비트코인은 높은 가격 변동성으로 인해 투자자 및 일반 대중으로부터 큰 관심을 받아왔고, 머신러닝 및 딥러닝 방법론을 활용한 가격 및 등락 예측 관련 연구들이 활발하게 진행되고 있다. 본 연구에서는 예측력과 설명력을 동시에 향상시키기 위해 최근 금융과 관련된 다양한 분야에서 예측성과의 우수성을 인정받고 있는 LSTM(Long Short Term Memory)과 CNN(Convolutional Neural Networks)을 활용해 예측 모형을 구축하고, 설명 가능한 인공지능(explainable Artificial Intelligence, XAI) 기법을 활용해 예측 모형이 산출한 결과 값의 판단 근거를 제시한다. 실증 연구에서 LSTM과 CNN을 기술적 지표(technical indicators)와 구글 검색량에 적용해 일주일 후 가격 등락 예측모형을 구축하였으며, 그 예측성과를 ANN(Artificial Neural Networks), SVM(Support Vector Machines)을 적용한 모형들과 비교하였고, 그 결과 LSTM과 CNN을 활용해 구축한 모형들이 높은 예측성능을 보였다. 이어 XAI 기법인 SHAP(SHapley Additive exPlanations)를 예측 성과가 가장 우수한 딥러닝 모형에 적용해 각 입력 변수들이 모형의 의사결정 과정에 어떤 영향을 미치는지 전역적 해석 및 지역적 해석을 통해 제시하였으며, 딥러닝 예측 모형의 예측값 및 XAI 적용을 통해 해석한 내용을 바탕으로 실생활에 활용할 수 있는 투자자문형 로보 어드바이저를 제시했다. 본 연구는 이미지 분류에 높은 예측성과를 인정받고 있는 CNN과 투자자 및 대중의 심리를 반영하는 지표인 구글 검색량을 활용해 예측성과를 향상시켰다는 점과, SHAP를 활용해 예측 결과에 대한 설명력 및 해석 가능성을 향상시켜 금융 도메인에서의 딥러닝 활용 가능성과 투자자의 수용성을 향상시켰다는 점에서 의의가 있다.

주제어

암호화폐 가격 등락예측, 딥러닝, 설명 가능한 인공지능, SHapley Additive exPlanations(SHAP)

Acknowledgement (사사)

"본 연구는 과학기술정보통신부 및 정보통신기획평가원의 대학ICT연구센터육성지원사업의 연구결과로 수행되었음" (IITP-2022-2020-0-01797)

D1.2 전이 엔트로피 및 네트워크 위상을 활용한 테마별 암호화폐 및 토큰의 시스템적 위험의 정보 흐름 분석

최인수
KAIST
jl.cheivly@kaist.ac.kr

이준협
한양대학교
andy11@daum.net

조영환
KAIST
jamesemp@kaist.ac.kr

최현수
동국대학교
crossparker1@naver.com

김우창
KAIST
wkim@kaist.ac.kr

Abstract – 우리는 전이 엔트로피를 사용하여 테마별 암호화폐 및 토큰의 시스템적 위험의 정보 흐름을 분석한다. 본 연구에서 활용한 테마별 암호화폐는 탈중앙화 금융(DeFi), NFT, 메타버스, Play-to-earn, 에코시스템(Solana, Avalanche, PolkaDot) 간의 변동성의 전달을 분석한다. 전이 엔트로피로 나타내는 본 연구의 접근 방식은 그룹 내의 시스템적 위험의 전이를 표현하게 된다. 본 연구에서는 시스템적 위험을 엔트로피 최대 예상 손실 금액(Entropic Value-at-Risk)로 정의하는데, 이는 조건부 최대 예상 손실 금액과 최대 예상 손실 금액의 상한을 표기하므로 보다 강건한(robust) 위험의 전이를 표현할 수 있다. 본 연구의 경험적 분석은 2019년부터 2021년까지 3년 간의 테마 암호화폐와 토큰의 일일 수익률 데이터를 사용한다. 전이 엔트로피는 정규성을 기반으로 해야하는 벡터자기회귀모형의 단점을 보완하며, 비선형 역학을 공개할 수 있으며 예측에 유용한 기초를 제공할 수 있음을 보여준다.

Key Terms – *Cryptocurrency, Entropic Value-at-Risk (EVAR), Information Transfer, Network Topology, Systemic Risk, Transfer Entropy*

I. 서론

우리는 암호화폐 및 토큰의 시스템적 위험의 인과관계를 분석하고자 하였다. 본 연구의 경험적 분석은 2019년부터 2021년까지 3년 간의 테마 암호화폐와 토큰의 일일 수익률 데이터를 사용한다. 이 때 우선적으로 해당 수익률 데이터에 대해 정규성 검정을 하였으나 해당 기간 내에서 정규성을 만족하는 데이터는 한 개도 없었다. 이에 전이 엔트로피를 활용하였는데, 전이 엔트로피는 정규성을 기반으로 해야하는 벡터자기회귀모형의 단점을 보완하며, 비선형 역학을 공개할 수 있으며

예측에 유용한 기초를 제공한다. 본 연구에서 활용한 테마별 암호화폐는 탈중앙화 금융(DeFi), NFT, 메타버스, Play-to-earn, 에코시스템(Solana, Avalanche, PolkaDot) 간의 변동성의 전달을 분석한다. 전이 엔트로피로 나타내는 본 연구의 접근 방식은 그룹 내의 시스템적 위험의 전이를 표현하게 된다. 본 연구에서는 시스템적 위험을 엔트로피 최대 예상 손실 금액(Entropic Value-at-Risk)로 정의하는데, 이는 조건부 최대 예상 손실 금액과 최대 예상 손실 금액의 상한을 표기하므로 보다 강건한(robust) 위험의 전이를 표현할 수 있다

II. Highlights

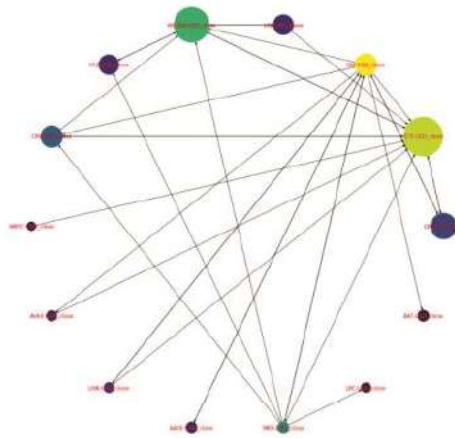


그림 1 생태계(ecosystem) 관련 암호화폐 / 토큰 하방 리스크 네트워크 (2021.01.01. – 2021.12.31.)

본 연구에서는 효율적 이전 엔트로피를 가중치로 한 계량 네트워크를 시각화하여 테마별 암호화폐 및 토큰의 하방 리스크 정보 전이에 대해서 확인할 수 있었다.

특히 하방 리스크의 관점에서는 기존에 알려진 수익률 기반의 정보 흐름과는 다르게 네트워크 내 핵심 역할을 하는 암호화폐 및 토큰이 기술적 중심에 있지 않은 암호화폐 및 토큰이라는 점이 주목할 만한 전체적으로는 여러 영역에 걸쳐진 암호화폐 및 토큰들이 중심성 지표(PageRank) 기준으로 강세를 보이는 것을 확인할 수 있다. 이러한 하방 리스크 관점에서 이러한 요소들은 위험을 분산화할 수 있는 일종의 신호(signal)로 활용이 가능하다. 이외에도 해당 내용을 응용하여 내향 연결이 있는 지표를 활용하여 하방 리스크의 증감에 대해서 예측해 본 결과 네트워크를 이용한 경우 더욱 효율적인 예측이 가능함을 확인할 수 있었기에 향후 연구 방향은 해당 연구 방향으로 진행하고자 한다.

III. 참고문헌

Aharon, D. Y. and Demir, E. (2021). Nfts and asset class spillovers: Lessons from the period around the covid-19 pandemic. *Finance Research Letters*, page 102515.

Aroui, M.E.H., Lahiani, A., Nguyen, D.K., 2011. Return and volatility transmission between world oil prices and stock markets of the GCC countries. *Econ. Model.* 28 (4), 1815–1825.

Aste, T. (2019). Cryptocurrency market structure: connecting emotions and economics. *Digital Finance*, 1(1):5–21.

Badshah, I.U., Frijns, B., Tourani-Rad, A., 2013. Contemporaneous spill-over among equity, gold, and exchange rate implied volatility indices. *J. Futur. Mark.* 33 (6), 555–572.

Banternghansa, C., McCracken, M.W., 2010. Real-time forecast averaging with ALFRED. FRB of St. Louis Working Paper No. 2010-033A. (October).

Barnett, L., Barrett, A.B., Seth, A.K., 2009. Granger causality and transfer entropy are equivalent for Gaussian variables. *Phys. Rev. Lett.* 103 (23), 238701.

Basta, M., Molnar, P., 2018. Oil market volatility and stock market volatility. *Financ. Res. Lett.* 26, 204–214.

Berkowitz, J., Kilian, L., 2000. Recent developments in bootstrapping time series. *Econ. Rev.* 19 (1), 1–48.

Britton, B. (2021). Investors call scam after collapse of new cryptocurrency squid. *NBC News*. August 21.

Chunxia, Y., Xueshuai, Z., Luoluo, J., Sen, H., He, L., 2016. Study on the contagion among American industries. *Physica A* 444, 601–612.

Clement, R.T., Winkler, R.L., 1986. Combining economic forecasts. *J. Bus. Econ. Stat.* 4 (1), 39–46.

Creti, A., Joëts, M., Mignon, V., 2013. On the links between stock and commodity markets' volatility. *Energy Econ.* 37, 16–28.

Diebold, F.X., Mariano, R.S., 1995. Comparing predictive accuracy. *J. Bus. Econ. Stat.* 13 (1), 134–144.

Dimpfl, T., Peter, F.J., 2013. Using transfer entropy to measure information flows between financial market. *Stud. Nonlinear Dyn. Econ.* 17, 85–102.

Dimpfl, T., Peter, F.J., 2014. The impact of the financial crisis on transatlantic information flows: an intraday analysis. *J. Int. Financ. Mark. Inst. Money* 31, 1–13.

Dowling, M. (2021a). Fertile land: Pricing non-fungible tokens. *Finance Research Letters*, page 102096.

Dowling, M. (2021b). Is non-fungible token pricing driven by cryptocurrencies? *Finance Research Letters*, page 102097.

Fernandez-Perez, A., Frijns, B., Tourani-Rad, A., 2017. Precious metals, oil and the exchange rate: contemporaneous spillovers. *Appl. Econ.* 49 (38), 3863–3879.

Genre, V., Kenny, G., Meyler, A., Timmermann, A., 2013. Combining expert forecasts: can anything beat the simple average? *Int. J. Forecast.* 29 (1), 108–121.

Hall, P., Horowitz, J.L., Jing, B.-Y., 1995. On blocking rules for the bootstrap with dependent data. *Biometrika* 82 (3), 561–574.

Hammoudeh, S.M., Yuan, Y., McAleer, M., Thompson, M.A., 2010. Precious metals-exchange rate volatility transmissions and hedging strategies. *Int. Rev. Econ. Financ.* 19 (4), 633–647.

He, J., Shang, P., 2017. Comparison of transfer entropy methods for financial time series. *Physica A* 482, 772–785.

Henderson, B.J., Pearson, N.D., Wang, L., 2015. New evidence on the financialization of commodity markets. *Rev. Financ. Stud.* 28 (5), 1285–1311.

Kwon, O., Yang, J.-S., 2008. Information flow between stock indices. *Europhys. Lett.* 82 (6).

Lee, J., Strazicich, M., 2003. Minimum lagrange multiplier unit root test with two structural breaks. *Rev. Econ. Stat.* 85 (4), 1082–1089.

Lips, J., 2017. Do they still matter? - impact of fossil fuels on electricity prices in the light of increased renewable generation. *J. Time Ser. Econ.* 9 (2).

Liu, M.-L., Ji, Q., Fan, Y., 2013. How does oil market uncertainty interact with other markets? An empirical analysis of implied volatility index. *Energy* 55, 860–868.

D1.3 부도예측모형에서 도메인 지식을 통합한 반사고적 예시 기반 설명력 증진 방법

조수현
이화여자대학교 일반대학원 빅데이터분석학
soohyuncho7117@gmail.com

신경식
이화여자대학교 경영학부
ksshin@ewha.ac.kr

국문초록

부도예측모형은 여러 금융기관의 신용평가모형의 지식기반(knowledge base)로 이용되고 있으며 최근 머신러닝 기법의 발전으로 이를 도입하여 고도화하려는 다양한 시도가 진행 중이다. 그러나 실제 이러한 모형이 도입되기 위해서는 모형을 이용하는 사용자와 설명제공 대상인 고객의 이해와 수용이 전제되어야 한다. 그러나 사용자에게 제공되는 설명이 현실적 가능성(feasibility)이 결여되어 있다면 모형의 신뢰성과 수용도에 부정적인 영향을 미친다. 이에 따라 본 연구는 도메인 지식을 설명 생성 알고리즘에 통합하여 현실적으로 타당한 설명을 사용자에게 제공하고자 한다. 본 연구에서는 머신러닝 기반의 부도예측 모형에 설명력을 더하는 방법으로 반사고적 예시 기반의 로컬영역에서의 설명을 제공하는 모델을 제안한다. 제안 모델은 모형에 이용된 재무변수의 특성을 설명력 생성 알고리즘에 통합하여 설명의 현실적 가능성을 확보하고 이를 통해 사용자의 이해와 수용을 도모하고자 한다. 또한 본 연구에서는 반사고적 예시(counterfactual example)기반 설명을 위해 유전알고리즘(GA)를 이용하며 다목적함수를 목적함수로 설정하여 반사고적 예시(counterfactual example)의 주요 기준이 되는 항목을 반영하고 있다. 본 연구는 대표적인 머신러닝 기법인 인공신경망을 이용해 부도예측모형을 학습시킨 뒤, 사후적 방법(post-hoc)으로 설명을 위한 알고리즘을 도입하여 기존의 모형 설명 알고리즘인 LIME과 현실적 가능성이 결여된 반사고적 예시 기반 알고리즘과 비교하였다. 더 나아가 제안방법의 금융/회계 분야의 종사자를 대상으로 서베이를 진행하여 제안 방법의 설명의 질을 정성적으로 평가하였다.

주제어

부도예측모형, 설명 가능한 인공지능(XAI), 로컬영역 설명력, 반사고적 예시

[DAY 1]

E1 [KIISS-Paper Session]
인공지능과 딥러닝 1

E1.1 트랜잭션 데이터 기반 머신러닝 자동화 방법론

박경빈
국민대학교 경영대학
pkb0126@naver.com

조윤희
국민대학교 경영대학
www4u@kookmin.ac.kr

Abstract - 트랜잭션 데이터는 고객의 행위와 직접적으로 관련되어 많은 기업에서 활용하는 비즈니스 데이터이다. 그렇게 때문에 트랜잭션 데이터는 효과적인 마케팅을 위한 필수적인 데이터이다. 하지만 트랜잭션 데이터는 구조상 원천 데이터를 가공해야만 머신러닝 모형에 적용할 수 있다. 즉, 특성 공학 과정에 다른 형태의 데이터보다 더 많은 시간과 노력을 투자해야 한다. 이러한 어려움을 극복하기 위해 특성 공학 과정을 자동화하는 많은 연구들이 진행되고 있지만, 트랜잭션 데이터에 대한 연구 사례는 다른 형태의 데이터의 연구 사례에 비해 적다. 이에 따라 본 논문에서는 트랜잭션 데이터와 텍스트 데이터의 구조적 유사성을 기반으로 텍스트 데이터 분석에서 높은 성능을 보인 워드 임베딩(Word Embedding) 기법을 사용하였다. Word2Vec과 Glove를 활용하여 트랜잭션 데이터에서의 Item을 벡터화하고, 중심연결법(Centroid)을 통해 아이템 벡터들과 클래스 라벨 벡터의 코사인 유사도를 계산하였다. 그 후, Softmax를 사용하여 클래스 라벨을 예측하는 확률을 구하는 실험을 진행하였다. 본 연구에서 제안한 방법의 성능 비교 실험 결과 각 사용자 별 트랜잭션이 충분히 발생한 경우에 본 연구에서 제안한 방법이 더 높은 성능을 보였다. 따라서 본 연구는 트랜잭션 데이터에 특화된 새로운 분류 문제 해결 알고리즘을 제안하였다는 시사점을 가진다. 또한, 본 연구에서 제안하는 방법을 통해 특성 공학과 모델링 과정을 자동화함으로써 전체적인 머신러닝 과정의 효율성을 높일 수 있으며, 본 연구에서 제안한 방법의 예측 결과를 특성 공학과 모델링 작업의 준거로 활용할 수 있다.

Key Terms - AutoML, Transaction data, Word embedding, SVD, Classification Analysis

I. 서론

트랜잭션 데이터는 고객들의 물품 구매 여부 또는 여러 물품들에 대한 고객들의 선호가 기록된 정형 데이터로, 고객의 행위와 직접적으로 연관되어 고객을 이해하고 효과적인 마케팅 활동을 수행

하는 데에 필수적인 데이터이다(김준우, 2015; 안길승 외, 2016). 따라서 트랜잭션 데이터를 분석해 의미 있는 결과를 도출하는 것은 기업의 향후 의사결정에 있어 중요한 요인으로 작용한다. 본 연구에서는 특성(feature)을 생성하거나 가공하는 특성 공학 과정과 모델링 과정을 거치지 않고, 트랜잭션 데이터 자체를 이용해 머신러닝 분류 문제를 해결하는 알고리즘을 개발하고자 한다. 이는 트랜잭션 데이터를 인공 신경망 기반의 워드 임베딩 기법인 Word2Vec과 Glove를 사용해 벡터화하고, 생성된 벡터들의 코사인 유사도를 계산함으로써 트랜잭션 데이터에 대한 특성 공학 과정과 모델링 과정의 자동화를 구현한다. <그림 1>은 기존의 예측 모델 생성 과정과 본 연구에서 제시하는 방법론을 도식화한 것이다.



<그림 1> 기존과 새로운 예측 과정의 비교

이를 통해 기존의 머신러닝 프로세스에서 가장 많은 시간과 노력이 소요되는 특성 공학과 모델링 과정에 소요되는 시간을 효율적으로 줄일 수 있을 것이라 판단된다. 또한 사람이 특성 공학 과정에 개입해 생성된 모형의 성능에 대한 성과 측정 기준이 되는 준거 모델의 확보가 가능할 것으로 기대된다.

II. 방법론

본 연구에서 제시하는 방법은 <그림 2>와 같은 프로세스를 가진다. 첫 번째 단계에서는 트랜

잭션 데이터에서 아이템을 추출한 후, 집합에 클래스 라벨을 추가하여 복원 추출을 통해 Corpus를 생성한다. 두 번째 단계에서는 생성된 Corpus에 워드 임베딩(Word Embedding) 기법을 적용하여 모든 아이템과 클래스 라벨에 대해 각각 임베딩 벡터를 생성한다. 이 때, 두 모델에서 생성된 벡터 중 상관관계가 높은 값들을 제거하기 위해 SVD를 사용하여 차원을 축소한다. 세 번째 단계에서는 중심연결법(Centroid)을 사용하여 클래스 라벨 벡터와 아이템 벡터들의 코사인 유사도를 계산하고 클래스 라벨을 예측하는 확률을 구한다.



<그림 2> 클래스 라벨 예측 과정

III. 실험결과

본 연구에서 제안한 방법의 유용성을 검토하기 위해 특성이 다른 두 데이터를 본 연구의 제안 방법과 Featuretools를 활용한 방법에 각각 적용하였다. 그 결과, 각 사용자 별 트랜잭션이 충분히 발생한 경우에는 본 연구에서 제안한 방법이 더 높은 성능을 보였다.

IV. 참고문헌

김영수, 이승우 2018. “문서 분류를 위한 신경망 모델에 적합한 텍스트 전처리와 워드 임베딩의 조합,” 정보과학회논문지, pp.690-700.

김준우 2015. “트랜잭션 데이터 분석을 위한 연관 분석 기반 추천 방법,” 한국지능정보시스템학회 학술대회논문집, pp.10-15. 9.

길선웅 2020, “코사인 유사도 측정을 통한 행위 기반 인증 연구,” 한국정보처리학회 학술대회논문집 Vol. 27 No. 1 (2020) pp.165-168.

문용혁, 신익희, 이용주, 민옥기 2019. “자동 기계학습(AutoML) 기술 동향,” 전자통신동향분석, pp.32-42.

안길승, 허선 2016. “트랜잭션 데이터 분석을 위한 확률 그래프 모형,” 대한산업공학회지, pp.249-256. 12.

우덕채, 문현실, 권순범, 조윤희 2019. “트랜잭션 기반 머신러닝에서 특성 추출 자동화를 위한 딥러닝 응용,” 한국IT서비스학회지, pp.143-159.

Sarkar, D.J. 2018. “Understanding Feature Engineering (Part 1)-Continuous Numeric Data,” Available at <https://towardsdatascience.com/understanding-feature-engineering-part1-continuous-numeric-data-da4e47099a7b>

Thomas, R. 2018. An Introduction to Deep Learning for Tabular Data, Available at <https://www.fast.ai/2018/04/29/categorical-embeddings>

Mitchell, T.M. 1997. “Machine Learning,” McGraw-Hill, New York.

Jordan, M.I. and T.M. Mitchell 2015. “Machine learning : Trends, perspectives, and prospects,” Science, Vol.349, No.6245, pp.255-260.

Müller, A.C. and S. Guido 2016. “Introduction to machine learning with Python : a guide for data scientists,” O’Reilly Media, Inc, California

Jae Kyeong Kim, Yoon Ho Cho 2003. “Using Web Usage Mining and SVD to Improve E-commerce Recommendation Quality,” PRIMA pp.86-97

Oren Barkan, Noam Koenigstein 2016. “Item2vec: neural item embedding for collaborative filtering,” 2016 IEEE Machine Learning for Signal Processing (MLSP)

E1.2 복원오류를 활용한 시공간 트랜스포머 모델의 미세먼지 예측 성능 향상

김영광

(주)웨슬리퀘스트

glory@wesleyquest.com

Abstract - 지하철 역사 내 미세먼지 저감을 위해 서울시는 스마트 공기질 관리 시스템 구축 등 다양한 노력을 기울이고 있다. 이를 위해서는 공기질 데이터의 수집 및 미세먼지 농도 예측 모델이 중요한 구성요소 중 하나이다. 지하철 역사 미세먼지 농도 예측관련 연구는 통계 및 순환신경망 기반의 모델 활용에 국한되었으나 최근 시공간 트랜스포머 모델을 활용하여 기존 모델들보다 우수한 성능을 확인한 연구가 발표되었다. 본 연구에서는 시공간 트랜스포머 모델의 미세먼지 예측 성능을 향상시키고자 복원오류를 활용한 모델을 제안한다. 본 연구 결과는 스마트 공기질 관리 시스템과 연계하여 지하철 역사내 미세먼지 저감 활동의 효율성 향상에 기여할 수 있을 것으로 기대된다.

Key Terms - 미세먼지 농도 예측, 시계열 데이터 분석, 복원오류, 시공간 트랜스포머

1. 서론

미세먼지에 장기간 노출되는 경우 호흡기나 심혈관 질환등의 발생 위험이 증가하는 것으로 알려져 있다. 환경부의 제3차 지하역사 공기질 개선 대책(2018~2022)에 의하면 지하철 역사의 경우 21개 다중이용시설 중 두번째로 미세먼지 오염도가 높은 것으로 나타난다. 서울시는 약 7,900여억원의 사업비(2019년부터 2022년)를 투자하여 지하역사 공기질 개선을 위해 노력하고 있다. 이중 공기질 데이터를 수집하고 미세먼지 농도를 예측하여 공기질을 관리하는 스마트 공기질 관리 시스템의 효율적 운영을 위해서는 미세먼지 농도 예측 모델이 중요한 구성 요소이다. 미세먼지 농도 예측 성능이 개선 될수록 시스템 운영의 효율성이 증가된다.

미세먼지 데이터는 시계열 데이터로 다양한 시계열 분석기법들이 미세먼지 농도 예측에 활용되고 있다. 데이터 마이닝 기법들 이전에는 지수평활법이나 ARIMA(Box, Jenkins, Reinsel, & Ljung, 2015)와 같은 통계모델들이 활용되었다. 하지만, ARIMA는 데이터의 안정성(Stationary)과 같은 이론적 요구사항의 고려가 필요하며, 비선형 관계를

가지는 데이터에 대해 예측 성능 저하의 한계가 있는 것으로 알려져 있다.

인공지능 기술의 발전에 따라 데이터간의 비선형 관계를 모델링할 수 있는 인공신경망과 순차적 데이터를 모델링할 수 있도록 설계된 순환신경망이 시계열 데이터 분석에도 적용되고 있다. 또한 전통적인 순환신경망이 가지는 기울기 소실 문제로 인한 장기 의존 관계 학습의 어려움을 해결하기 위하여 LSTM(Hochreiter & Schmidhuber, 1997)과 GRU(Cho et al., 2014)가 제안되어 다양한 응용분야에서 모델의 성능을 높였다. 이러한 응용 모델 중에는 인코더, 문맥벡터(Context vector)와 디코더로 구성된 시퀀스 투 시퀀스(Seq2Seq) 모델(Cho et al., 2014; Sutskever, Vinyals, & Le, 2014)이 우수한 성능을 보였고, Seq2Seq 모델의 입력 시퀀스의 길이 증가에 따른 성능 감소문제를 해결하기 위하여 어텐션(Attention) 기반의 모델(Bahdanau, Cho, & Bengio, 2014)이 제안되었다.

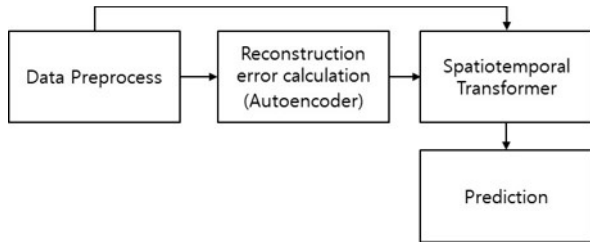
2017년에 제안된 트랜스포머 모델(Vaswani et al., 2017)은 시계열 예측 분야에서도 적용되어 뛰어난 성능을 보였다. 하지만 트랜스포머 모델에 개별적인 의미를 가진 변수들로 구성된 다변량 시계열 데이터를 적용하기 위해서는 변수간에 존재하는 공간적 관계에 대한 고려가 필요하다. 원조 트랜스포머 모델은 매 시점에 입력되는 다변수들을 단일한 개념의 토큰으로 취급하기 때문에 시간적 어텐션은 학습하지만 변수간에 존재하는 공간적 관계가 무시된다. 트랜스포머 모델을 시계열 데이터 분야에 적용하기 위해서는 시간적, 공간적 어텐션에 대한 고려가 필요하며 이에 대한 연구가 활발히 진행되고 있다.

지하철 역사의 미세먼지 농도 예측 연구는 기존의 통계와 순환신경망 기반의 모델 연구에 국한되어 있었으나, 최근 김영광, 김복주와 안성만(2022)은 시공간 트랜스포머 모델을 적용하여 기존 모델들보다 더 성능이 우수함을 보였다. 본 논문에서는 지하철 역사의 미세먼지 농도 예측 성능의 추가향상을 위하여 시공간 트랜스포머에 복원오류 (Reconstruction error)를 활용한 모델을 제안한다. 복원오류를 활용한 선행연구로는 Huang et al.(2014)이 데이터의 복원오류가 특정 기준보다 큰 데이터를 선정후 부스팅 모델을 활용하여 추가

적인 훈련을 시킴으로써 모델의 성능을 향상시킨 연구가 있다. Han, Zhang, Ringeval, and Schuller(2017)와 Yin, Lv, Sang, and Guo(2016)는 각각 회귀모델과 분류모델에 복원오류를 적용한 연구를 진행하였다.

II. 제안모델 프레임워크

본 연구의 제안모델 프레임워크는 <그림 1>과 같다.



<그림 1> 제안 모델 프레임워크

우선 입력 데이터에 대해 고정길이 슬라이딩 윈도우 방식을 통하여 지도학습 데이터 세트를 구성하고, 정규화 처리를 한다. 이를 오토인코더 모델에 투입하여 복원오류를 구한다. 이 복원오류는 다른 변수들과 함께 예측모델에 입력으로 투입되어 최종적으로 미세먼지 농도를 예측한다.

III. 실험결과

본 연구에서는 서울의 3개 지하철역의 공기 질 데이터, 지하철 운영자료, 역사 외부 미세먼지 농도, 기상데이터를 활용하여 실험을 진행하였다. LSTM, Seq2Seq, 트랜스포머, 시공간 트랜스포머에 복원오류를 적용한 결과, 모든 모델에서 성능이 향상되는 것으로 확인되었으며 이중에서도 시공간 트랜스포머의 성능이 가장 우수한 것으로 나타났다.

IV. 참고문헌

김영광, 김복주, 안성만. (2022). 미세먼지 예측 성능 개선을 위한 시공간 트랜스포머 모델의 적용. 지능정보연구, 28(1), 329-352.

Bahdanau, D., Cho, K., & Bengio, Y. (2014). Neural machine translation by jointly learning to align and translate. arXiv Preprint arXiv: 1409.0473.

Box, G. E., Jenkins, G. M., Reinsel, G. C., & Ljung, G. M. (2015). Time series analysis: Forecasting and control. John Wiley & Sons.

Cho, K., Van Merriënboer, B., Gulcehre, C., Bahdanau, D., Bougares, F., Schwenk, H., & Bengio, Y. (2014). Learning phrase representations using RNN encoder-decoder for statistical machine translation. arXiv Preprint arXiv:1406.1078.

Han, J., Zhang, Z., Ringeval, F., & Schuller, B. (2017). Reconstruction-error-based learning for continuous emotion recognition in speech. Paper presented at the 2017 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2367-2371.

Hochreiter, S., & Schmidhuber, J. (1997). Long short-term memory. Neural Computation, 9(8), 1735-1780.

Huang, W., Zhang, N., Hu, W., Hong, H., Song, G., & Xie, K. (2014). Dynamic boosting in deep learning using reconstruction error. 2014 International Joint Conference on Neural Networks (IJCNN), 473-480.

Sutskever, I., Vinyals, O., & Le, Q. V. (2014). Sequence to sequence learning with neural networks. Advances in Neural Information Processing Systems, 27

Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., . . . Polosukhin, I. (2017). Attention is all you need. Advances in Neural Information Processing Systems, 30

Yin, J., Lv, J., Sang, Y., & Guo, J. (2018). Classification model of restricted boltzmann machine based on reconstruction error. Neural Computing and Applications, 29(11), 1171-1186.

E1.3 이미지 데이터 증식 Crumple 알고리즘 연구

신인철

(주)선도소프트 지능정보사업부
icshin@sundosoft.co.kr

조경림

(주)선도소프트 지능정보사업부
klcho@sundosoft.co.kr

이민영

(주)선도소프트 지능정보사업부
mylee@sundosoft.co.kr

최인호

(주)선도소프트 지능정보사업부
ihchoi@sundosoft.co.kr

Abstract - 해당 논문에서는 구겨지거나 찌그러지는 등의 형태가 변할 수 있는 이미지를 대상으로 이미지를 증강하는 방법에 대해 연구하였다. 이미지 증식 기법은 기존에 많은 방법이 알려져 있지만, 단순한 이미지의 색상, 각도, 크기에 대한 변화를 주는 것이 일반적이다. 혹은 GAN을 통해 이미지의 스타일을 변환하는 방식이 존재하지만, 이와 같은 방식은 이미지의 형태를 변환하지는 못한다.

형태가 변하기 쉬운 대상을 증식하여, 수집되지 않은 이미지를 만들어 내는 것을 목표로 하여 보유하지 않은 데이터를 형태를 변환하여 증식하는 방식을 통해 새로운 이미지를 생성하는 방법을 통해 수집하지 않은 새로운 데이터를 생성하였고, 실제 구겨진 형태와 유사한 것을 확인할 수 있었다.

해당 논문에서는 딥러닝 학습용 이미지 데이터 증식의 가능성과 효과를 확인하였다. 이미지를 종이를 구기는 것과 비슷한 원리로 이하 Crumple이라 칭한다.

Key Terms - Feature Engineering(특징 공학), Data Augmentation(데이터 증식), Deep Learning(딥러닝), Image Processing(이미지 처리)

I. 서론

데이터를 확보하는 과정에서 항상 의미 있는 데이터를 수집하기는 어렵다. 해당 논문에서는 기존에 가지고 있는 데이터로 의미 있는 데이터를 생성해 내는 연구에 대한 결과이다.

학습 데이터라 하면 학습시킬 모델의 목적에 따른 데이터의 가공과 근본적으로 양질의 많은 데이터를 필요로 한다. 적은 양의 데이터를 이용해 딥러닝 모델을 학습하는 것은 과소 적합(Under Fitting)의 원인이 되며, 원활한 학습이 되지 않

는다. 또한 동일한 이미지로만 학습이 이루어진다면, 과대 적합(Over Fitting)의 원인이 되며, 그로 인해 학습 데이터 외의 실제 대상이 되는 것에 대한 정확도가 낮아지는 현상이 발생한다. 이러한 상황에서 사용할 수 있는 기법의 대표적인 예로 데이터 증식 기법(Data Augmentation)이 있다.

해당 논문에서는 재활용품 분류 및 선별 데이터 구축을 위해 연구를 진행하였다. 딥러닝 객체 탐지 모델을 통해 폐기물을 탐지하고, 분류함으로써 재활용센터에서의 폐기물 분류를 자동화하기 위해 사용할 학습 데이터의 부족을 극복하고자 이와 같은 증식 기법 같은 연구를 진행하였다.

기존의 이미지 증식은 다양한 환경과 형태를 고려하지 않고 전체적인 이미지에 대해 회전, 뒤집기, 비율 변형, 밝기, 색조 조절, 노이즈 조절에 대한 방법이 있었다. 하지만 실제 환경, 형태를 고려하지 않은 방법으로 학습 데이터로써 개선 가능성이 희박하다. 알루미늄, 비닐봉지와 같은 쉽게 구겨지고, 휘어지는 대상의 경우 해당 증식 방식이 효과적으로 판단된다.

Crumple은 이미지에 격자(Meshgrid)를 이용해 작동하는 알고리즘이다.



<그림 1> 해당 알고리즘으로 증식한 과자 봉지



<그림 2> 해당 알고리즘으로 중식한 캔

II. Acknowledgement

본 논문은 2022 재활용품 분류 및 선별 데이터 구축 사업의 이미지 데이터 구축 프로세스 사전 연구에 기반하여 수행한 것임.

III. 참고문헌

한국지능정보사회진흥원(2022), 2022년 인공지능 학습용 데이터 구축사업

E1.4 AI-Connect Protocol: A New Federated Deep Learning Method for User-Centric AI Service

최승호
경희대학교 빅데이터 연구센터
jcn99250@naver.com

정백
경희대학교 빅데이터응용학과
ylbaek@khu.ac.kr

황보유정
경희대학교 빅데이터 연구센터
hwangbo@khu.ac.kr

박경양
하렉스인포텍
park@ubpay.com

이경전
경희대학교 경영대학 &
빅데이터응용학과
klee@khu.ac.kr

Abstract - 사용자 중심 인공지능 서비스 구현을 위해 연합학습 (Federated Learning)을 적용하는 과정에서 Data 를 결합하지 않고도 학습 가중치만을 공유해야 되는 문제점이 있다. 위 문제를 경감하기 위해서 학습 가중치만 공유하는 개념에 기반하여

Iterative Parallel Average(IPA)를 제안한다. 새롭게 제안하는 IPA 방식은 학습 Data를 분할하여 순차적으로 Local Model을 만들고 학습 가중치를 반복 누적 평균하여 만든 Global Model이다. 이를 검증하기 위해 각 Local Model의 평균, Data를 결합한 Global Model, 기존의 연합학습에서 사용되고 있는 이른바 Monolithic Average (MA) 방법, 그리고 IPA 방법을 Text classification 와 Text generation 태스크 실험을 통해 비교했다. IPA 방식의 성능은 Local Model의 평균 성능보다 각 태스크에서 4.1%, 8.7%, MA 방법의 성능보다 5.1%, 13.7% 향상되었고, Data를 결합한 Global Model의 성능보다는 낮았다. 결론적으로 Data를 결합하지 않는 조건에서, 새롭게 제안한 IPA 방식의 성능이 향상됨을 확인했다.

Key Terms - AI-Connect Protocol, Federated Learning, Iterative Parallel Average, Monolithic Average, User-Centric AI

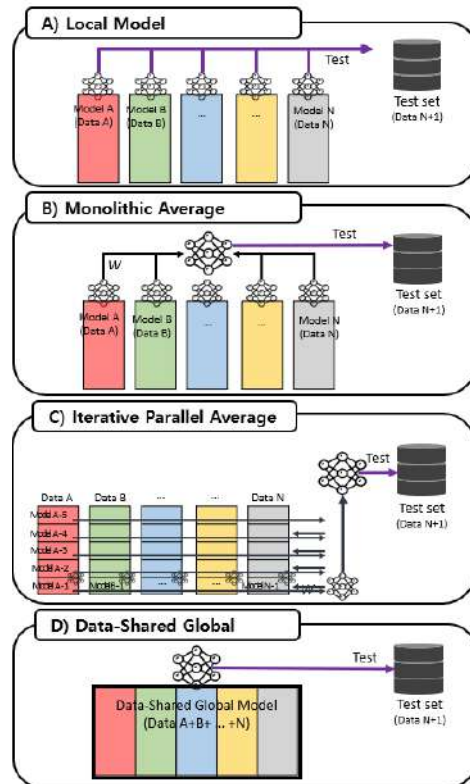
사사표기

본 논문(저서)은 교육부 및 한국연구재단 4단계 두뇌한국21 사업(4단계 BK21 사업)으로부터 지원 받은 연구이자, 2020년 대한민국 교육부와 한국연구재단의 지원을 받아 수행된 연구임 (NRF-2020S1A5B8103855)

1. 서론

사용자 중심 인공지능 [1]은 사용자 정보를 최소한으로 사용하면서도, 프라이버시를 보호하는 동시에, 기업이 보유하고 있는 사용자 정보를 사

업자간 상호 공유 혹은 통합하지 않고, 안전하게 협력할 수 있도록 한다. 이러한 사용자 중심 인공지능 서비스 구현을 위해서 연합학습을 적용한다. 연합학습을 적용하는 과정에서 Data 를 결합하지 않고도 학습 가중치만을 공유해야 되는 문제점이 있다. 이를 개선하기 위해서 Data를 결합하지 않고 학습 가중치 만을 공유하는 AI-Connect Protocol을 제안한다. Text classification과 Text Generation 두가지 태스크를 통해 제안 방법을 검증한다.



<그림 1> AI-Connect Protocol 4가지 방법

II. 제안방법

제안하는 AI-Connect Protocol은 <그림 1>과 같이 4가지 방법으로 구성된다. 첫번째 Local Model은 각각의 Data로 학습된 Local Model이며, 두번째 Monolithic Average(MA) 방법은 기존 연합 학습에서 가장 많이 사용되는 FedAvg [2]로 각각의 Data로 학습된 Local Model의 학습 가중치를 평균한 Global Model을 지칭한다. 세번째 Iterative Parallel Average (IPA) 방법은 새롭게 제안한 방법으로, 각각의 Data를 분할하여 순차적으로 학습된 Local Model을 만들고 학습 가중치를 반복 누적 평균하여 만든 Global Model이다. 마지막으로 Data-shared Global 방법은 모든 Data를 결합하여 만든 Global Model이다.

III. 실험 방법

Text Classification [3]과 Text Generation [4]에 AI-Connect Protocol 4가지 방법을 실험하였다. 평가지표는 Accuracy = (1 - (Ground truth - Model predict)*100)을 사용하여 평가를 진행했다. Local Model 수에 따른 Global Model의 성능을 함께 확인하기 위해 Local Model을 2,3,4,5,6, 그리고 7개로 만들었다. Local Model 성능은 모델의 개수를 나눈 평균 값을 이용했다.

IV. 실험 결과

<표1>은 Text Generation의 태스크에서 AI-Connect Protocol을 적용한 실험 결과이며, <표2>는 Text Classification의 태스크에서 확인한 결과이다. 두 태스크에서 Local Model을 여러 개로 만들어 확인한 실험 결과 모두 동일하게 Data-shared Global이 가장 높은 성능을 보였다. 그리고 본 연구에서 제시한 IPA 방법이 높은 성능을 보였으며, Local Model의 평균 성능보다 각 태스크에서 4.1%, 8.7%, MA 방법의 성능보다 5.1%, 13.7% 향상되었다. 결론적으로 Data를 결합하지 않는 조건에서, 새롭게 제안한 IPA 방식이 좋은 성능을 보이는 것으로 확인됐다.

MA 방식은 Local Model에서 만들어진 학습 가중치를 단일로 평균하는 과정은 각 Local Model 모델의 가중치 표현이 기존의 모델의 가중치 특성 표현이 뭉개져서 모델의 성능이 낮게 나올 수 있다. 그러나 IPA 방법은 가중치를 반복적으로 누적 학습함으로써 Local Model의 학습 가중치를 MA 방식보다 Global 모델에 누적 반영하여 모델의 가중치의 특성을 강건하게 표현함에 따라서 모델의 성능이 향상될 수 있다.

또한, Data-shared Global 방법의 성능이 가장 높은 것으로 확인되었지만, Data-shared Global 방법은 한 순간 혹은 고정적인 순간에 높은 성능이 향상될 수 있는 방법이지만 IPA 방법은 시간성을 가진 상태 혹은 동적으로 환경이 변화하

는 상태에서 지속적인 학습을 할 수 있는 장점을 가지고 있다.

또한 현실적으로 모든 Data를 결합하여 Global Model을 만드는 것은 비즈니스에서 사실상 불가능하다. 따라서 사용자 중심 인공지능 서비스로써 AI-Connect Protocol에서는 Data를 결합하지 않는 IPA 방식이 적합하다고 볼 수 있다.

<표 1> Text Generation의 태스크에서 AI-Connect Protocol 성능 경향성 분석

A) Local Model Performance Average, B) Monolithic Average, C) Iterative Parallel Average, and D) Data-shared Global

3	0.2997	0.2927	0.3130	0.3150
4	0.2921	0.2795	0.3129	0.3156
5	0.2865	0.2813	0.3142	0.3145
6	0.2693	0.2588	0.3116	0.3146
7	0.257	0.2542	0.3021	0.3154

<표 2> Text Classification의 태스크에서 AI-Connect Protocol 성능 경향성 분석

A) Local Model Performance Average, B) Monolithic Average, C) Iterative Parallel Average, and D) Data-shared Global

3	0.2997	0.2927	0.3130	0.3150
4	0.2921	0.2975	0.3129	0.3156
5	0.2865	0.2813	0.3142	0.3145
6	0.2693	0.2588	0.3116	0.3146
7	0.257	0.2542	0.3021	0.3154

V. 결론

사용자 중심 AI 서비스 구현을 위해 연합학습을 적용하는 과정에서 Data를 결합하지 않고도 학습 가중치만을 공유해야 되는 문제점을 경감하기 위해 새로운 AI-Connect Protocol 방법을 제안했다. AI-Connect Protocol에서 제안한 Local 방법, Monolithic Average 방법, Iterative Parallel Average 방법, 그리고 Data-shared Global 방법을 Text generation 그리고 Text classification에 실험해 검증했다. 이를 통해 제안한 IPA 방법이 로컬 방법, Monolithic Average 방법 보다 성능이 향상했다.

VI. 참고문헌

Lee, K., Hwangbo, Y., Jeong, B., Park, K., and Park, J., "User-Centric AI: Definition and Approach," 2020 Fall Conference, The Korea Society of Management information System.

McMahan, B., Moore, E., Ramage, D., Hampson, S. and Arcas, B. (2017), "Communication-Efficient Learning of Deep Networks from Decentralized Data", Proceedings of the 20th International Conference on Artificial Intelligence and Statistics.

https://keras.io/examples/nlp/text_classification_with_transformer/

https://keras.io/examples/nlp/text_generation_finet/

E1.5 ConvLSTM과 ATTENTION AutoEncoder를 통한 다변량 시계열 트래픽 이상탐지

이정현
연세대학교 산업공학과
ljh_0103@yonsei.ac.kr

정구섭
연세대학교 산업공학과
supkoon@yonsei.ac.kr

김우주
연세대학교 산업공학과
wkim@yonsei.ac.kr

Abstract - 최근 네트워크 트래픽 데이터를 활용한 DDoS(Distributed Denial-of-Service) 이상탐지에 대한 연구가 활발히 진행 중이다. 이는 계속해서 고도화되는 악의적 트래픽으로 인해 우리 사회에 경제적으로 큰 손실을 일으키기 때문이다. 이에 본 연구는 다변량으로 이루어진 트래픽 Netflow 데이터를 바탕으로 DDoS 공격을 탐지하는 이상탐지 모델링을 주제로 하여, 정상과 구별되는 이상을 탐지하고, 보다 빠른 이상시점의 탐지와 연속성에 대한 문제를 보완하여 현업에서 더욱 사용하기 적합한 모델을 구축하여 보완력 강화에 기여하고자 하였다. DDoS 공격은 호스트의 악의적인 공격 방식과 공격에 활용되는 Bot-Net의 개수에 따라 매우 다양한 이상 패턴을 갖기 때문에 그 특성을 정형화하기 어렵다는 것을 특징으로 한다. Anomaly 시점의 데이터를 직접 활용하는 supervised 방법은 학습한 이상 패턴 외의 새로운 유형에 대응이 어렵다는 근본적인 한계를 가지므로, 정상 데이터만을 활용한 AutoEncoder 기반의 semi-supervised 방법을 통해 해당 문제를 해결하였다. 또한 AutoEncoder에 Multihead-Attention layer를 함께 적용하여 정상과 이상시점의 간극을 극대화시킬 수 있도록 모델 구조를 변형하였다. 한편, 일반적인 Sequence 기반의 이상탐지 모델들이 최근 주를 이루는데 이는 현업에서 적용시 이상시점의 빠른 대처를 어렵게 만들 수 있다. 이를 보완하고자 본 연구는 시계열을 이미지화하여 ConvLSTM을 통한 시점 기반 예측 모델로 보다 빠른 이상시점 탐지를 가능하게 구조화하였다. 위에서 언급한 Multi-head attention을 활용한 AutoEncoder와 ConvLSTM을 함께 활용하여 정확하고 빠른 이상탐지 모델을 통해 모델의 성능을 고도화 하였으며 이는 딥러닝을 활용한 이상탐지 연구 분야에 새로운 방향성을 제시하고 있다고 판단된다.

Key Terms - DDoS, Anomaly Detection, AutoEncoder, ConvLSTM, Multi-Head Attention

이 논문은 국토교통부의 스마트시티 혁신인재육성 사업 및 한국산업기술평가원으로 지원되었습니다.

III. 참고문헌

Zhang, Chuxu, et al. "A deep neural network for unsupervised anomaly detection and diagnosis in multivariate time series data." *Proceedings of the AAAI conference on artificial intelligence*. Vol. 33. No. 01. 2019.

Kim, Seongchan, et al. "Deeprain: ConvLstm network for precipitation prediction using multichannel radar data." *arXiv preprint arXiv:1711.02316* (2017).

AN, Jinwon; CHO, Sungzoon. Variational autoencoder based anomaly detection using reconstruction probability. *Special Lecture on IE*, 2015, 2.1: 1-18.

CHOI, Hyunseung, et al. Unsupervised learning approach for network intrusion detection system using autoencoders. *The Journal of Supercomputing*, 2019, 75.9: 5597-5621.

NAVAZ, A. S.; SANGEETHA, V.; PRABHADEVI, C. Entropy based anomaly detection system to prevent DDoS attacks in cloud. *arXiv preprint arXiv:1308.6745*, 2013.

YUAN, Xiaoyong; LI, Chuanhuang; LI, Xiaolin. DeepDefense: identifying DDoS attack via deep learning. In: *2017 IEEE International Conference on Smart Computing (SMARTCOMP)*. IEEE, 2017. p. 1-8.

[DAY 1]

A2 [Tutorial] Tutorial (Amazon, Gartner)

A2.1 Accelerate Digital Experience Transformation

최 윤
가트너

During times of disruption and uncertain times, accelerating digital transformation is critical for organizations that want to prepare now for what's next. Facing CEO demands to grow and digitalize efficiently, IT leaders must find force multipliers to drive growth, adopt technology to scale digitalization, and create scalable IT foundations for cost efficiency. Gartner's strategic technology trends show the key technologies to scale, adapt and grow.

**Digital Acceleration
and Top Strategic
Technology Trends
in 2022**

Youn Choi, Senior Executive Partner
Gartner Executive Programs
22 June 2022

© 2022 Gartner, Inc. and/or its affiliates. All rights reserved. Gartner is a registered trademark of Gartner, Inc. or its affiliates. This presentation, including all supporting materials, is proprietary to Gartner, Inc. and/or its affiliates and is for the sole internal use of the intended recipients. Because this presentation may contain information that is confidential, proprietary or otherwise legally protected, it may not be further copied, distributed or publicly displayed without the express written permission of Gartner, Inc. or its affiliates.

Gartner

A2.2 Amazon A9 & A10 Algorithms that Make Amazon Sellers Laugh and Cry

서주영
(FAEM GLOBAL)

gollala
글로벌 패션 도매 마켓

**동대문 시스템을 글로벌 시장과 연결하여
미래 패션산업의 표준이 되게 합니다**
Link K-fashion system to global market & Make the standard of the future fashion industry

2021

- 2021.12 연간 거래 금액 4,600억 달성
- 2021.11 Pre-A Bridge 30억 투자유치
- 2021.09 (주)와이즈 패션-MD뱅크 사업 인수
- 2021.08 한국 브랜드 7,000개 입점 해외고객 방문자 15만명 달성 국내 거래액 월 800억 달성
- 2021.04 Pre-A 15억 투자 유치 동대문 메타버스 최초 시작
- 2021.02 4억 엔젤투자 유치

2020

- 2020.10 (주)골라라 설립

Two smartphone screenshots showing the Gollala mobile app interface, including product listings and promotional banners.

About

- 연간 거래 금액 **4600억+**
- 누적 투자 금액 **50억+**
- 가입 도매 매장 **1만개+**
- 가입 소매 매장 **1.3만개+**

Four smartphone screenshots illustrating app features:

- 골라라**: 주문 사업 정산까지 소매사장님을 위한 원스톱 사입 서비스
- 골라라 송금정산**: 심플한 송금, 정산, 세금계산서 소매 사장님과 사업상촌을 위한 원스톱 장끼 관리 서비스
- 골라라 영끌**: 기존 주문서 양식 그대로 대량 주문도 3분만에 끝 사업상촌을 위한 자동 주문 서비스
- 골라라 파트너스**: 전세계 바이어와 연결되는 도매사장님 필수 상품 판매 서비스

A2.3 ICAN: icon-based coding education software for all ages

강병석
에스원

Abstract

As the Software (SW) centered society has emerged, SW-based problem-solving capabilities emphasized in all areas of society. It is a trend that universities are obliged to do SW basic education for non-major students and they are carrying out programming education. This study derives grammatical elements based on conciseness, generality, and efficiency among the design principles of programming theories and based on it, compares and analyses visual programming language and diagramming language. In this paper, we introduce a new coding education software ICAN for all ages. It supports icon coding and debugging mode, students can check wrong part or value with callstack while programming. In addition, ICAN provides multi-user tournament-style evaluation mode.

Keyword

ICAN, coding, programming, icon coding, new coding software

Acknowledgement

This work was supported in part by the R&D Center, S1, South Korea.

References

- UK education for software teaching, 2015.
- Gorman, H. Bourn, L. E. (1983). Learning to think by learning LOGO: Bosch, N., & D'Mello, S. (2017). The affective experience of novice computer programmers. *International journal of artificial intelligence in education*, 27(1), 181-206.
- Yadav, A., Gretter, S., Good, J., & McLean, T. (2017). Computational thinking in teacher education. In *Emerging research, practice, and policy on computational thinking* (pp. 205-220). Springer, Cham.
- Xiao, M., & Yu, X. (2017, December). A Model of Cultivating Computational Thinking Based on Visual Programming. In *2017 International Conference of Educational Innovation through Technology (EITT)* (pp. 75-80). IEEE.
- Crews, T., Ziegler, U. (1998). The flowchart interpreter for introductory programming courses. In *Frontiers in Education Conference, FIE'98*. 28(1), 307-312.
- Barricelli, B. R., & Valtolina, S. (2017). A visual language and interactive system for end-user development of internet of things ecosystems. *Journal of Visual Languages & Computing*, 40, 1-19.
- Piteira, M., & Costa, C. (2013). Learning computer programming: study of difficulties in learning programming. In *Proceedings of the 2013 International Conference on Information Systems and Design of Communication, Lisboa*. ACM
- Barker, L. J., McDowell, C., Kalahar, K. (2009) Exploring factors that influence computer science introductory course students to persist in the major. In *ACM SIGCSE Bulletin*, 41(1), 153-157.
- Bennedsen, J., Caspersen, M. E., Kölling, M. (Eds.) (2008). *Reflections on the teaching of programming: Methods and implementations* (Vol. 4821). Springer.
- Kazimoglu, C., Kiernan, M., Bacon, L., Mackinnon, L. (2010). Developing a game model for computational thinking and learning traditional programming through game-play. In: *Proceedings of the World Conference on E-learning in Corporate, Government, Healthcare and Higher Education 2010*. AACE. 1378-1386.
- Tsukamoto, H., Takemura, Y., Oomori, Y., Ikeda, I., Nagumo, H., Monden, A., Matsumoto, K. I. (2016). Textual vs. visual programming languages in programming education for primary schoolchildren. In *Frontiers in Education Conference (FIE)*, 1-7.
- Noone, M., Mooney, A. (2017). First Programming Language: Visual or Textual?. *arXiv preprint arXiv:1710.11557*.

Kim, S. D., Yi, J., Kim, H. M., & Ra, J. B. (1999). A deblocking filter with two separate modes in block-based video coding. *IEEE transactions on circuits and systems for video technology*, 9(1), 156-160.

Chiang, T., Chien, M., Kwok, W., & Sun, H. (2001). U.S. Patent No. 6,192,081. Washington, DC: U.S. Patent and Trademark Office.

Nikiforos, S., Kontomaris, C., & Chorianopoulos, K. (2013). MIT scratch: A powerful tool for improving teaching of programming. *Conference on Informatics in Education*, 1-5.

Robert, W. S. (2018). *Concepts of programming languages*. Pearson.

Kwon, D., Yoon, I., Lee, W. (2011). Design of programming learning process using hybrid-programming environment for computing education. *KSII Transaction on Internet and Information Systems*, 5(10), 1799-1813.

Eng, L. Z. (2016). *QT5 C++ GUI programming cookbook*. Packt Publishing Ltd.

[DAY 1]

B2 [Special Session] 서울디지털재단

B2.1 스마트시티에서 IoT인프라의 정책 활용 : 서울시 공원녹지 조성효과와 신규입지 선정

박지혜

서울디지털재단 디지털전략팀

jhpark@sdf.seoul.kr

Abstract - 스마트시티는 도시화로 인한 각종 문제를 정보기술의 활용으로 해결해 나갈 수 있는 지속 가능한 도시이다. 관련하여 스마트시티를 구성하는 요소로서 사물인터넷 인프라는 도시 운영정보를 물리적 최점점에서 관측·수집함으로써 내부 자원 최적화를 위한 원천데이터의 보고가 되고 있다. 특히 최근에는 기후변화와 관련하여 그린인프라의 중요성이 높아지는 가운데 서울시에서는 2019년부터 현재까지 약 1,100개의 지점에 도시 데이터 복합센서(S-DoT)를 설치하고 환경정보를 수집하고 있으며, 도시현상 확인과 스마트도시 정책 수립에 이를 활용하고 있다. 본 연구는 S-DoT 환경 측정 데이터를 활용하여 정량적으로 서울시 도시공원 조성의 효과를 확인하는 것을 목적으로 한다. 구체적으로는 공원, 인근지, 비공원간 열섬현상, 미세먼지, 악취, 대기오염 4개 분야의 환경수치 차이를 반복측정 분산분석을 통해 검증하며, 아울러 녹지 우선조성 필요지역을 도출하기 위한 방법론을 제시한다. 공원녹지의 환경효과를 다룬 선행연구에서 위성사진과 열적외선 등 전자기파를 활용한 열섬현상 감소효과의 확인은 다수 이루어졌으나, 상대적으로 계량연구 결과가 부족한 악취, 대기, 미세먼지를 포함하여 환경효과를 확인한다는 점에서 본 연구는 학술적인 의미가 있다. 또한 한정된 대기측정소 자료를 활용한 연구는 다수이나, 본 연구는 스마트시티의 인프라로써 설치된 IoT에서 수집한 공간적으로 밀도 있는 환경측정 자료가 사용된 활용사례라는 점에서 실무적 의미를 갖는다.

Key Terms - 공원녹지, 그린인프라, 스마트시티, 열섬현상, S-DoT

B2.2 중대재해처벌법 시행에 따른 건설분야 디지털 기술 활용에 대한 고찰

고설타
서울디지털재단
kost@sdf.seoul.kr

Abstract - 본고에서는 중대재해처벌법 시행에 따라 상대적으로 준비가 열악한 중소규모 건축공사를 위한 정부 및 지자체 차원의 제도적 장치 필요성을 강조하고 '스마트 건설기술'로 명명된 건설분야 디지털 기술 활용 사례를 자원관리, 안전관리, 프로젝트관리, 현장관리 분야로 구분하여 설명하고 향후 중소규모 건축공사장의 안전 확보 방안에 대해 논의하고자 한다.

Key Terms - 중대재해처벌법, 스마트 건설기술, IoT, 블록체인, BIM.

B2.3 시공간 유동인구 분석 기반 공공와이파이 핫플레이스 입지 분석

지태훈
서울디지털재단
jith@sdf.seoul.kr

Abstract - 디지털 전환이 가속화 되면서 시민의 디지털 접근성 제고 및 정보 격차 해소를 위해 공공와이파이 확대 설치에 대한 수요가 증가하고 있다. 본 연구에서는 공공와이파이 활용 활성화를 위해 유동인구 데이터 분석 기반의 핫플레이스 입지 분석을 진행하였다. 기존에는 특정 기간의 전체 유동인구 값을 활용하여 핫플레이스를 선정하였는데, 이는 코로나-19, 계절 등의 유동인구 변화 환경 요소를 반영하지 못하는 한계가 존재한다. 따라서 본 연구에서는 유동인구의 시계열 변화에 따른 유동인구 패턴을 추가로 분석하여 핫플레이스 유형을 새롭게 분류하였으며, 분석 결과는 서울시 25개 자치구 담당자의 신규 공공와이파이 지점 선정에 활용되었다.

Key Terms - 공공와이파이, 입지분석, GIS, Hotspot분석

B2.4 GeoAI 기반 도시 변화탐지 서비스 도입과 활용방안

백수진
서울디지털재단
sjback@sdf.seoul.kr

Abstract - 도시화로 인한 각종 도시문제가 심화되는 가운데 건물을 무단 변경한 불법건축물 관리 문제가 심화되고 있다. 각 지자체는 관리 사각지대를 해소하기 위하여 항공영상을 활용한 변화건물 정밀판독을 실시하고 있으나, 사람의 육안에 의존하여 시간과 비용 소요가 크다. 본 연구의 목적은 현행 인력의존형 도시변화 탐지 업무에 GeoAI 기술을 적용하여 자동탐지 체계를 구축하는 것이다. 이를 위하여 고해상도 항공영상 및 드론영상을 활용한 학습데이터를 구축하였으며, 건물의 외관상 변화를 탐지해낼 수 있는 CNN 기반 알고리즘을 개발하였다. 특히 인식가능한 객체의 범위를 녹지, 도로, 태양광패널 등으로 확대하여 서비스 활용의 분야를 확장하였다. 연구 결과는 서울시 판독현황도 제작에 시범적용하여 탐지 정확도와 실용성을 검증한다.

Key Terms - GeoAI, 항공영상, 객체탐지, CNN

B4.5 고령층 친화 디지털 접근성 표준개발

강민정
서울디지털재단
kmj95@sdf.seoul.kr

Abstract - 지능정보사회로의 전환에 따라 세대 간 디지털 활용 격차가 심화되면서 디지털계층화가 사회적계층화로 고착되는 현상이 나타나고 있다. 코로나19 이후 일상전반에서 디지털 기술·서비스의 활용이 필수요건으로 여겨지고 있으며, 65세 이상 고령층은 신체적 노화로부터 발생하는 장애 요인으로 인해 디지털 활용에 어려움을 경험하고 있다. 본 연구의 목적은 고령층 사용자의 디지털 기기·서비스 접근성을 보장하고 사용 편의를 증대시키기 위한 표준(안)을 마련하는 것이다. 기존 정보접근성의 개념은 장애인, 고령자 등 정보취약 계층을 포괄하여 모든 사람이 정보에 접근이 가능하도록 해야 한다는 의미를 담고 있으나, 실제로는 장애인의 정보접근권 보장을 위한 개념으로 널리 인식되고 있다. 이에 지금까지 접근성의 대상으로 논의가 부족했던 고령층의 특징에 주목한 디지털 접근성 개선방안 연구가 필요한 시점이며, 물리적·기술적 기준에서 화면의 기본구성(정보구조), 서비스 흐름(과업 수행 절차)까지 연구 범위를 확대할 필요가 있다. 고령층 사용자의 신체·인지·심리적 특성을 고려하여, 디지털 서비스 디자인 관점과 함께 객관적 측정 및 실험을 통한 감성·인지공학 관점을 접목한 복합적 접근방식이 중요함을 강조한다.

Key Terms - 디지털포용, 정보접근권, 고령층

[DAY 1]

C2 [ICEC-Paper Session] E-Commerce Strategy

C2.1 The Effects of Social Influence on Consumer Behaviors in Social Commerce from Innovation Attributives

Li Zhao¹, Yun Xu¹, Xu Xu¹

¹ School of Economic Information Engineering, Southwestern University of Finance and Economics, Chengdu, 611130, China

Abstract

As a new development model of traditional e-commerce, social commerce is a new force in the digital economy, driving consumption growth and promoting social employment, especially flexible jobs. Social commerce is fast becoming one of the key instruments in promoting economic development in COVID-19. However, as a two-sided market, social commerce is easily affected by external networks, that is, the scale could be affected by the number of users and merchants in social commerce. Therefore, to explore behavior intention of social commerce, this manuscript takes innovation diffusion theory as the main framework and combines economic theory to innovatively construct different social influence mechanisms (subjective norms and critical mass) and build social commerce innovation attributes (user and platform) that measure Requires Trust for User and Compatibility, Usefulness and others for Platform. This paper collected 1007 valid samples through questionnaires. The results show that subjective norms and critical mass have a significant positive effect on social commerce behavior intention, and the two innovative attributes also affect the social influence mechanism. In conclusion, this paper expands the application of social influence in social commerce and develops the influence of the innovative attributes of social commerce on behavior through empirical research.

Keywords: Social commerce; DoI; Subjective norms; Critical mass; Innovation attributives

Introduction

Since the development of social commerce, it has gradually become a new force in the digital economy, playing an important role in driving consumption growth and promoting social employment, especially flexible jobs (Shen et al., 2019). Social commerce offers an innovative channel for enterprises to build brand loyalty and promote sales through customer engagement on social networking sites such as Facebook (Wang et al., 2019). From the perspective of consumers, social commerce can achieve the individual needs of consumers than traditional e-commerce, with complete information access and lower product prices.

Social commerce is the fusion of e-commerce and social media, allowing users to communicate before and after shopping, further enhancing users' perception of products, thereby influencing purchasing decisions. Communication between users is prone to social influence and trust mechanisms. Many studies have explored the effects on user behavior in social commerce of trust mechanisms (Alkhalifah, 2022; Qin and De-Juan-Vigaray, 2021; Lin et al., 2019; Sharma et al., 2019) and social influence mechanisms (Momani, 2021; Zhang and Wang, 2019; Hu et al., 2019; Kim and Kim, 2018). But the speed of innovation diffusion is related to the information flow of social influence in the environment, and social influence takes different forms, such as subjective norms (SN), group norms, social identity, social network configuration and critical mass (CM) (Chen et al., 2013; Hsu and Lu, 2004), these mechanisms may affect the acceptance of social commerce (Axsen and Kurani, 2012). However, few researchers have been able to draw on any systematic research into the different social influence mechanisms on the behavior intention of social commerce. Therefore, this paper follows the classification of social influence from the perspectives of Social Psychology and Economics, exploring the impact of social influence mechanisms on social commerce behavior from SN and CM. CM is an objective and collective social force that promotes the development of innovation through collective power, arguing that all members (strong and weak ties) in a given social network have equal influence (Lou et al., 2000; Kraatz, 1998). While SN is subjective and personal, focusing more on the perception of individuals who are visible and influential to others, when potential adopters are uncertain about new innovative technology, they are more likely to imitate the

behavior of people who are important to them (Park and Smith, 2007; Venkatesh and Davis, 2000). SN and CM are two distinct social influence mechanisms, and while many studies have shown the key role of social influence in the use and acceptance of technology, few have pointed to different social influence mechanisms in motivating individuals to accept the influence of new technologies. Therefore, important theoretical questions that need to be addressed are (a) the extent to which SN and CM differ; (b) whether their effects on beliefs and behaviors in accepting new social commerce are consistent or competitive.

The main innovation characteristics of social commerce are User and Platform (sales platform) compared to traditional e-commerce. Social commerce users are not only consumers but product communicators. The continuous communication between users can form large and small relationship chains that have an impact on the social influence mechanism through trust because of the lack of face-to-face communication between users. (Zhao et al., 2019). The social commerce platform has been extended to social media platforms (Weibo, WeChat, Douyin). Merchants in social commerce could improve customer experience and attract more customers by connecting, nurturing and serving users through social media platforms, thereby influencing the social influence mechanism (Hu et al., 2019). However, previous research on social commerce has not paid attention to the impact of social commerce innovative attributes (platform and user) on social influence.

The purpose of this paper is to explore the influence of the innovation attributives of social commerce on behavioral intentions through the mediating of different social influence mechanisms. And using the Innovation Diffusion Theory (DoI) as a system framework, we explored the main measures of innovative characteristics, and discovered the impacts of these innovative characteristics on different social impact mechanisms; this paper focuses on the relationship between digital technology innovation and social influence, offering new ideas to promote the development of social commerce.

The rest of the manuscript is organized as follows. We provide the theoretical development and present the research model and the hypotheses, followed by a description of the research materials and methodology. The paper then presents the research results, followed by a discussion of key findings and contributions, as well as the implications for both research and practice. Finally, we discuss the limitations of this study and the possible direction of future research.

Theory and hypotheses

Behavior Intention to Use Social Commerce

In recent years, the rapid development of social commerce has attracted the attention of many academic researchers and entrepreneurs. At present, the literature has studied the influence of different factors in social commerce on intention to use, in terms of platform technology services (Curty and Zhang, 2013; Huang and Benyoucef, 2013), the communication services provided by social software and websites allow users to communicate and maintain online relationships, which is an important factor affecting users' behavioral intentions (Wu and Wang, 2005). Some researchers extend the Technology Acceptance Model (TAM) to study the impact of platform technical services (Wang and Herrando, 2019; Zhu and Kraemer, 2002). relationship trust (Chen and Shen, 2015) and social influence have a significant impact on consumers' purchase intention. In terms of social relationships and trust, relationship quality mediates between social support, website quality, and outcomes of commercial and persistent intent (Chen and Shen, 2015). Some researchers have also found that trust has a positive correlation with users' willingness to use social commerce (Hajli et al., 2017; Mamonov and Benbunan-Fich, 2017). In terms of social influence, related theories suggest that social influence is crucial in shaping user behavior. For example, in the Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), behavioral intentions are influenced by SN and attitudes. DoI also shows that user adoption decisions are more influenced by social systems, beyond individual decision-making styles and information technology characteristics (Rogers, 1995). In the existing research literature in the field of social commerce, the research on social influence is mainly limited to SN. Therefore, this paper extends social influence to economic theory and introduces CM to construct a two-dimensional social influence mechanism.

hypotheses and research model

Diffusion of Innovations

Rogers (1995) put forward the Theory of Innovation Diffusion (DoI). He believed that innovation is an idea, practice, or thing regarded as novel by individuals or other adopters; innovation diffusion refers to a fundamental social process in which subjectively felt information about a new idea is disseminated. Through social construction, the significance of a particular innovation gradually emerges. This theory is currently widely used in the field of information technology, such as the field of e-commerce (Chong et al., 2010), mainly to study the acceptance of innovation by individuals (Wang et al., 2020), and it is also suitable for explaining innovation in enterprises. The process of internal diffusion (Carreiro and Oliveira, 2019). The dissemination of technology is mainly affected by the characteristics of innovation, which include relative advantage, compatibility, complexity, trialability, and observability. Relative advantage refers to whether current innovations provide more benefits compared to previous methods; complexity is similar to perceived ease of use in TAM (Chong et al., 2010); compatibility refers to the degree of consistency with values of innovation and user experience; trialability is whether users have the opportunity to try innovation; observability is the degree to which the innovation results are visible to others (Rogers, 1995).

Social influence

Social influence refers to a behavior that affects or changes individuals' original thoughts, feelings, attitudes, or behaviors after interacting with other groups of individuals (Amblee and Bui, 2011). There are theories that social factors drive people's perspective, intention to use, and actual behavior, such as TRA (Fishbein and Ajzen, 1975), Theory of Planned Behavior (TPB) (Ajzen, 1991), TAM (Davis, 1989), and the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003).

With the continuous deepening of research, different concepts and substructures of social influencing factors have begun to appear, such as SN and group norms, social identity, social network configuration, and CM, but most researchers confuse them (Dahabiyeh et al., 2020). However, the underlying motivations and mechanisms are different from these structures (Cho, 2011). Social psychology and economics divide social influence into SN and CM (Chen et al., 2013; Hsu and Lu, 2004). The herd theory in social psychology believes that group members tend to obey the group norms, and these norms, in turn, affect the perceptions and behaviors of members (Lascu and Zinkhan, 1999). Social learning theory (Bandura and McClelland, 1977) shows that people learn from each other by communicating with their trusted friends. In economics, the influence of network externality usually forms a CM, affecting technology adoption. At present, some researchers have studied the impact of perceived CM and SN on different technologies, such as the game field (Dahabiyeh et al., 2020), 3G technology (Cho, 2011), online networks (Qin et al., 2011), etc. Therefore, this paper builds on the predecessors and extends it to social commerce.

SN is derived from the theories of TRA and TPB, and the concept is that "the attitude of the person who is important to him will affect whether the individual makes the decision" (Fishbein and Ajzen, 1975). Venkatesh and Davis (2000) argued that if people who think they are important to them expect them to do so, even if they do not necessarily agree to certain behaviors, they may perform the behavior. In other words, SN refers to "socially perceived pressure to perform or not perform a certain behavior" (Ajzen, 1991). SN is related to self-maintenance and compliance (Kwahk and Kim, 2017). Some studies have shown that SN is the decisive factor in adopting new technologies (Hsu and Lu, 2004; Davis, 1989). It is closely related to the individual's decision-making process (Venkatesh and Morris, 2000).

H1: SN positively influences the behavior intention of social commerce.

CM is closely related to the concept of network externality in economics, which mainly refers to the increase in the value of technology to users as the number of users increases. In network theory, when more users are involved in the network, and each user may communicate with more other users, the value of online social networks to users will increase. A single user will not use an interactive medium such as instant messaging unless many other recipients are already using the medium (Markus, 1994). As a form of social influence, when enough initial adopters create enough motivation, CM is reached, promoting rapid and widespread adoption by others (Oliver et al., 1985). Social networks are formed through

connections, information sharing, and mutual exchanges. Compared with offline shopping, online shopping relies more on the information created by peer customers, that is, electronic word of mouth (Song et al., 2019). And the density of social connections in social networks helps promote CM (Marwell et al., 1988). When users use an online social network to have more friends (social relations), they will think it is more practical and, therefore, more motivated to use it. Qin et al. (2011) found that CM positively affects online social media intentions.

H2: CM positively influences the behavior intention of social commerce.

Innovation characteristics

Having discussed why social influence is well critical in behavior intention, we next consider why such mechanisms might differ in strength for certain innovations. Social commerce has specific innovations characteristics compared to e-commerce which has social contexts for customers and potential implications on how information spreads through society. We focus on two such characteristics that are common to social commerce and formulate hypotheses that they could alter the association between social influence mechanisms and behavior intention.

The first innovation characteristic is the "user attributives", and Requires Trust is selected as the core indicator of user attributives. The core of social commerce is people and social networking. Social networking has infinitely enlarged the relationship chain through the Internet. Word of mouth and sharing are everywhere on the Internet, so trust plays an important role. A challenge of this is the need for users to trust the offering from another unknown user through confidence in the digital platform of social commerce (Geissinger et al., 2020). Many studies found that lack of trust is one of the main reasons hindering the development of the sharing economy. We consider trust in the platform impacts social influence mechanisms. For example, if a friend recommends using a certain type of product (WOM), but trust in the platform does not exist, the importance of the person's recommendation becomes stronger in the intention process.

H3: Requires Trust positively influences the SN in social commerce.

H4: Requires Trust positively influences the CM in social commerce.

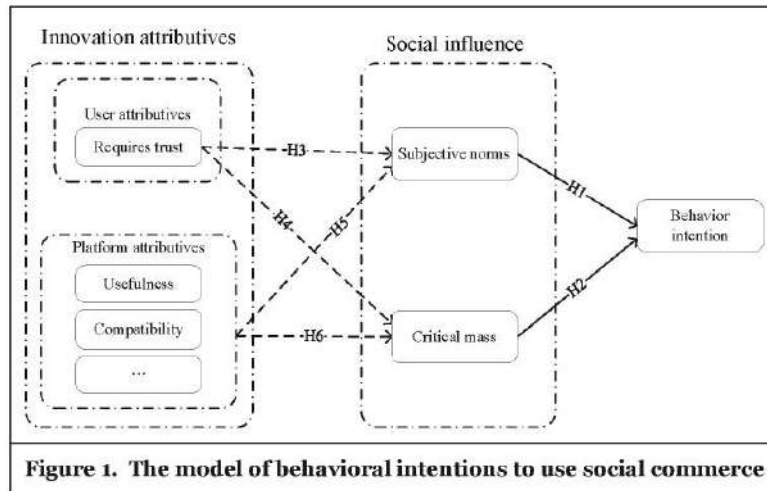
The second characteristic is the "platform attributives", which mainly considers the usefulness, compatibility, and advantages of the platform. Consumer behaviors may vary depending on the prevalence of the new state of social commerce scenarios, including adding commercial features into social media and adding social media features to traditional e-commerce (Huang and Benyoucef, 2013). Through platform innovative attributes, merchants can better connect, nurture and serve users. The efficiency of business can be greatly improved after digital operation, the service can be more comprehensive, and defects of the original traditional business can be remedied timely so that people can enjoy more differentiated experiences and feel the benefits of social commerce platforms. Through word-of-mouth sharing and dissemination, it will affect the social influence mechanism.

H5: Platform attributives positively influence the SN in social commerce.

H6: Platform attributives positively influence the CM in social commerce.

Research Model

The social commerce use intention behavior model of this article is shown in Figure 1.



Materials and Methodology

Measurement items

This paper uses questionnaire surveys to collect data. A five-point Likert scale has been used, ranging from 1 strongly disagree to 5 strongly agree. The measurement items are shown in Table 2. PLA is adapted from Venkatesh et al., (2003), Bianchi and Figueiredo (2017); RT is adapted from Carter and Bélanger (2005), Chong et al., (2010); SN is adapted from Venkatesh et al., (2003); CM is adapted from Qin et al., (2011), Chong et al. (2010); BI is adapted from Davis (1989) and Shen (2012).

Survey design and administration

An explanatory statement is designed at the beginning of the questionnaire in this manuscript. After reading and understanding the explanatory statement, users must sign a consent form. The second part mainly records the demographic characteristics of the participants (such as gender, age, income), and the third part is the measurement items of constructs.

The data collection time for this paper is from August 2020 to February 2021. The data collection is completed in two ways. The participant resides are 18 years old and above in China.

The first way was mainly snowballed through relatives, friends and classmates, and 383 questionnaires were collected. Excluding 26 questionnaires whose questionnaire filling time was less than 200 seconds and the answers were the same option, 357 valid questionnaires remained. The second way is to collect data through the sample service of Sojump. Its advantages are (1), Sojump is the most popular online questionnaire survey tool in China (www.wjx.cn/sample/service.aspx). Many studies have used Sojump for data collection (Lien and Cao, 2014). (2) The Sojump has a large sample size and high effectiveness for collecting data. There are more than 2.6 million Chinese users who will have points that can be redeemed for gifts offered by Sojump and partners if they provide effective questionnaires. (3) The service sample of Sojump is comprehensive. Respondents have a wide range of ages, identities, occupations, and regions. In this study, 650 valid questionnaires were collected through the Sojump sample service.

In summary, the total number of valid questionnaires for this survey is 1,007, used in this article for further research and analysis.

Demographics of respondents

Table 1 outlines the demographic details of the respondents. As can be seen from Table 1, Women account for 54.1%, having a relatively large proportion of the data. The ages between 18 - 24 and 25 - 34 years old are more represented in the data than other age groups, however, the age distribution is wide with respondents in all the categories. More than 582(58%) respondents obtained Undergraduate degrees. In terms of employment status, 622(62%) are full-time, 47% with an annual household income of more than 100,000 yuan before tax. Table 1 also describes the details of how to know the social commerce of respondents, the most are friend introduction (686) and social networks (787). In the data, 92% have shopping experience by social commerce, and 470(46%) stated that they used social commerce for more than 3 years. The most frequent shopping by social commerce is 1-5 times per month, accounting for 53.4%.

Variable		Total number	Proportion (%)
gender	man	462	45.9
	woman	545	54.1
age	18-24	311	30.9
	25-34	434	43.1
	35-44	168	16.7
	45-54	74	7.3
	≥55	20	2.0
Annual house income (thousand)	<20¥	132	13.1
	20¥-50¥	209	20.8
	60¥-90¥	198	19.7
	100¥-130¥	161	16.0
	140¥-170¥	112	11.1
	180¥-200¥	91	9.0
	>200¥	104	10.3
shopping by social commerce (years)	≤1	192	19.0
	[1,2)	184	18.3
	[2,3)	171	17.0
	≥3	470	45.7
Frequency of use social commerce (times/month)	[1,5]	538	53.4
	[6,10]	221	21.9
	[11,15]	100	9.9
	[16,20]	23	2.3
	>20	44	4.4

Table 1 Demographics of respondents

Data analysis

All of the model-testing was conducted via component-based PLS-SEM in SmartPLS 3.0. PLS-SEM has received more and more attention in various research fields, such as operations management (Peng and Lai, 2012), strategic management (Nell and Ambos, 2013), and innovation management (De Brentani et al., 2010). PLS-SEM is suitable for analyzing complex conceptual models, including mediation effects and

second-order structures (Peng and Lai, 2012; Wetzels et al., 2009). The appropriate sample size is small (Gefen et al., 2000). Regarding the distribution of research sample data, it is not required to follow a multivariate normal distribution. It can integrate two different indicator types, formative and reflective indicators (Hair et al., 2019). In summary, this study chooses the PLS-SEM method as the analysis tool.

Results

Measurement model analysis

Studies have suggested that if the measurement model does not meet the reliability and validity, the structural model is also meaningless (Hair et al., 2019). The reliability and validity are shown in Table 2.

Construct	Item	Outer Loadings	Cronbach's Alpha	CR	AVE
Platform attributives (PLA)	PLA1: S-commerce would be compatible with my lifestyle	0.843	0.826	0.884	0.657
	PLA2: I could see the benefits of using S-commerce immediately	0.789			
	PLA3: Using S-commerce would improve my overall shopping experience compared to traditional e-commerce (such as Taobao and Jingdong)	0.823			
	PLA4: Using S-commerce would make it easier to shop compared to traditional e-commerce	0.785			
Requires Trust (RT)	RT1: S-commerce provides its services/produces with the professionalism	0.828	0.902	0.927	0.718
	RT2: I would believe in the information that S-commerce provides	0.848			
	RT3: S-commerce could be counted on as a trustworthy way to shop online	0.862			
	RT4: S-commerce is a reliable way to do online shopping	0.870			
	RT5: I believe S-commerce is relied on to keep its promises	0.830			
Critical mass (CM)	CM1: Of the people, I am in contact with regularly, many use S-commerce	0.858	0.844	0.895	0.681
	CM2: Many people I know in my around use S-commerce	0.844			
	CM3: The people I am in contact with using S-commerce will continue to use it in the future	0.792			
	CM4: It is the current trend to use S-commerce	0.805			
Subjective Norms (SN)	SN1: People who are important to me think that I should use S-commerce	0.906	0.871	0.921	0.795
	SN2: People who influence my behavior think that I should use S-commerce	0.879			
	SN3: People whose opinions that I value prefer that I use S-commerce	0.888			
Behavior	B1: I intend to use S-commerce in the future	0.841	0.871	0.912	0.722

Intention (BI)	BI2: I am likely to purchase products I found on S-commerce	0.802			
	BI3: I will frequently use S-commerce	0.866			
	BI4: I will recommend family members and friends to use S-commerce	0.888			
Note: All item loadings are significant at 0.01; CR = Composite Reliability; AVE = Average Variance Extracted					
Table 2. Results on construct reliability and validity					

In terms of convergent validity, Hair et al. (2019) proposed that three indicators must be examined: the reliability of each measurement item of constructs, Composite Reliability (CR>0.8), and the Average Variance Extracted (AVE>0.5). In Table 2, the Outer Loadings and Cronbach's Alpha are all more than 0.7, indicating that the measurement items have good reliability. CR is 0.88 to 0.93 and AVE are more than 0.6, demonstrating that each construct shows relatively good convergent validity.

according to Fornell and Larcker (1981), Fornell-Larcker Criterion has limitations to verify the discriminative validity. Therefore, both Fornell-Larcker Criterion (Table 3) and Heterotrait-monotrait (HTMT) indicators have been used to verify the discriminative validity; For Fornell-Larcker Criterion, the AVE value is greater than the correlation coefficient of each construct, and the confidence interval of HTMT is not included 1, indicating that the data has good discriminative validity.

	CM	BI	SN	PLA	RT
CM	0.825				
BI	0.745	0.850			
SN	0.556	0.643	0.891		
PLA	0.672	0.780	0.615	0.811	
RT	0.637	0.776	0.659	0.735	0.848
Table 3. Fornell-Larcker Criterion for discriminative validity					

Structural model analysis

According to the study of Hair et al. (2019), when the result of the measurement model meets the standard, a structural model evaluation is required. The main criteria considered in the structural model mainly include the coefficient of determination (R²), redundancy measure (Q²), variance inflation factor (VIF), and the statistical significance of the path coefficient.

Hypothesis	Path	Inner VIF	Path Coefficients	T Statistics	results
H1	SN→BI	1.447	0.331***	11.600	supported
H2	CM→BI	1.447	0.551***	20.846	supported
H3	RT→SN	2.177	0.449***	11.978	supported
H4	RT→CM	2.177	0.311***	8.439	supported
H5	PLA→SN	2.177	0.285***	7.047	supported
H6	PLA→CM	2.177	0.443***	12.308	supported
Note: ***p<0.001; **p<0.01; *p<0.05.					
Table 4. Summary of hypothesis testing.					

Structural model coefficients are obtained by estimating a series of regression equations. Before evaluating the structural model, VIF must be checked to ensure that it does not affect the regression

results, and the VIF should be close to 3 or lower (Hair et al., 2019). as shown in Table 4, all the VIF is less than 3, which proves that there is no collinearity.

Hair et al. (2019) recommended that when the R^2 value is 0.33 to 0.67, the model is considered to have relatively significant explanatory power. And this model is 0.631 in Figure 2. Hence, the structural model constructed in this paper has good explanatory power.

Q^2 can reflect the prediction accuracy of the PLS path model, and the value of Q^2 should be greater than zero, indicating that the structural model has the accuracy of prediction. Q^2 values higher than 0, 0.25, and 0.50 respectively suggest that the prediction accuracy of the PLS path model is small, medium, and large (Hair et al., 2018). The Q^2 value is obtained through the blindfolding program of SmartPLS. The initial values are calculated according to the default value of the program. The Q^2 value of SN is 0.371, CM is 0.331, and BI is 0.452, all of which are greater than 0.25, which proves that the structural model has better prediction accuracy for social commerce behavior intention (Hair et al., 2019).

After satisfying the reliability and validity constraints, this paper uses the Bootstrapping Procedure of SmartPLS to estimate the structural model's path coefficient and T value. The initial value of Subsamples is set to 5000 to evaluate all Hypotheses (Hair et al., 2019). The running results of the structural model are shown in Table 4 and Figure 2.

The specific analysis results are as follows: As shown in Table 4, all hypotheses are striking and significant at the 0.001 level. Among them, the path coefficient of CM to BI is the largest ($\beta=0.561$, $T=20.846$), and SN ($\beta=0.331$, $T=11.600$) also has a positive impact on BI, which proves that different social influence mechanisms will positively affect the behavior intention of social commerce, and hypotheses 1, 2 were verified. Furthermore, RT to SN ($\beta=0.449$, $T=11.978$) and RT to CM ($\beta=0.311$, $T=8.439$) both have a positive effect, hypotheses 3, 4 were validated; finally, PLA to SN ($\beta=0.285$, $T = 7.047$) and PLA to CM ($\beta=0.443$, $T=22.308$) also have a positive effect, so hypotheses 5 and 6 were verified, proving that different innovative characteristics of social commerce will have an impact on the social influence mechanism.

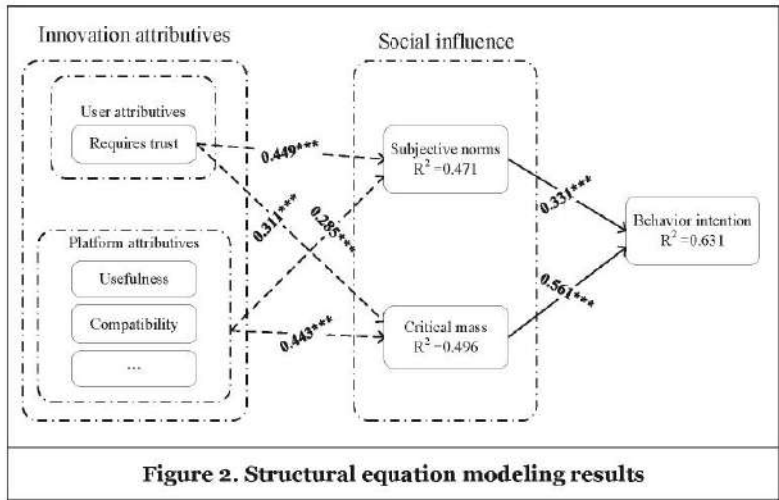


Figure 2. Structural equation modeling results

Table 5 analyzes the indirect effects of the model. It can be seen from Table 5 that the 4 indirect effect pathways are all significant and significant at the 0.001 level, and the PLA→CM→BI ($\beta=0.249$) is the largest. It shows that innovative characteristics will indirectly affect the behavior intention of social commerce through the social influence mechanism.

Path	Indirect effects	T Statistics	results
PLA→NS→BI	0.094*	5.460	supported
RT→NS→BI	0.149***	8.088	supported
PLA→CM→BI	0.249	10.036	supported
RT→CM→BI	0.175***	7.561	supported
Note: ***p<0.001; **p<0.01; *p<0.05.			
Table 5 The indirect effects of factors on path coefficients.			

Discussion

Based on previous literature, this paper uses different social influence mechanisms as mediating variables and provides new insights for promoting the use and dissemination of social commerce from the perspective of innovative characteristics. Through previous literature, the common characteristics of social commerce innovation attributes are extracted, and their influence on social commerce behavior intentions is explored. According to the DoI, it is confirmed that both social influence mechanisms (SN and CM) are positively correlated with social commerce usage intention. Through the social influence mechanism, the perceived risk of potential users will be reduced, thereby promoting the further development of social commerce.

Through empirical analysis, it is found that the social influence mechanism - SN and CM - both have a positive impact on the behavior intention of social commerce, especially CM. The results are similar in social networking sites (Chen et al., 2013; Qin et al., 2011) and online games (Hsu and Lu, 2004). When more and more people participate in social commerce or reach a certain critical point, there will be a particular emotion among consumers, and this information will affect people who have not yet used social commerce, creating a good consumption environment for potential consumers, resulting in the herd effect and herd behavior, thereby generating the use intention. At this time, the CM impacts the purchase decision, and this impact is active, direct, and impulsive. In addition, people, in reality, care about the opinions of people who are important to them, and some groups accept a specific behavior to gain the approval and support of others (such as relatives, friends, government, and other social relations). Therefore, when people who can influence themselves agree with models such as social commerce or use such models, it will cause pressure on the parties and prompt them to use intentions. At this time, SN have an impact on purchasing decisions. This influence is passive and stressful.

In addition, the innovative characteristics of social commerce—platform and user—both have an impact on the social influence mechanism. The usefulness, advantages and compatibility of social commerce platforms will bring customers a better-differentiated experience, which is consistent with the research conclusions of Isaac Kofi (2019) and Arvidsson (2014). Isaac Kofi (2019) found that relative advantages, compatibility has a significant impact on users continuing to use WeChat mobile payment services. In social commerce, users care about the benefits they can get through social commerce, such as saving time compared to traditional e-commerce, and if social commerce is compatible with users' lifestyles, it will be easier to generate usage intentions. The Requires Trust of users innovative characteristics will further promote the spread of social commerce through the social influence mechanism. Consumers mainly participate in social commerce through social communities, containing significant interpersonal relationships. If consumers trust the sharer, the trust will be passed on to the product or service. It will further increase consumers' willingness to buy when the communication between consumers increases significantly; both parties will perceive similar psychological states, resulting in emotions such as joy, which will further deepen trust, and then obtain accurate information about the product and perceive the privacy of the information and the product utilitarian value.

Finally, the research also has important practical implications. First of all, relevant enterprises should be aware of social influence mechanism, especially the important role of CM in promoting the development of social commerce. Relevant enterprises can use network advantages and key groups to design website functions, thereby stimulating more connections and interactions among communities to better market

their products and services. Second, enhance users' perception of innovation attributives by actively promoting various forms of social commerce use promotion activities. Highlight the advantages of social commerce over traditional e-commerce, such as product quality, platform guarantee mechanism, time-saving, so that users can obtain promotional information and access customized product information to optimize their output and value. Furthermore, trust and risk often go hand-in-hand, and when trust in technology increases, the perceived risk decreases. Relevant enterprises should attach importance to penetration marketing, embody the corporate culture on products and services, demonstrate the ability to serve customers, and increase their perception of their value and trust.

Conclusion

Social commerce promotes economic growth, especially in COVID-19, which further drives consumption and employment. As a two-sided market, social commerce is affected by both merchants and users. The more users on the platform, the more merchants it attracts. Therefore, it is particularly important to explore the mechanism that affects the use of social commerce from different perspectives.

Starting from the innovative characteristics of social commerce, this paper uses different social influence mechanisms as mediating variables to explore the influence on the use of social commerce. The results show that different social influence mechanisms are important determinants of behavior intention, and the CM has the most significant factor, indicating that the external network is very important for the pulling users. In addition, the importance of SN cannot be ignored, which reflects the social behavior of users, and their behavioral norms are influenced by individuals with influential characteristics. This paper also discovers that the innovation characteristics (platform and user) have a partial mediating effect on the use intention of social commerce, and will affect the social influence mechanism. According to the DoI, this paper mainly extracts the user innovation characteristics as Requires Trust, and the platform innovation characteristics as the usefulness, compatibility, advantage. It shows that the innovative characteristics will positively affect the behavior intention of social commerce, and it is necessary to further expand the innovative advantages of social commerce.

In a word, by researching the factors that affect social commerce behavior intention, this paper provides directions for related companies in attracting users, which can further promote the development of social commerce. However, there are still shortcomings: (1) Although the sample size of this study is large, only Chinese residents are covered, and the coverage rate of the elderly over 65 years old is relatively low. (2) The innovative features of social commerce use qualitative extraction methods, and quantitative methods are not enough.

Future research can be explored from the following aspects (1) to expand the model's applicability from different levels, adding other influencing factors, such as the continuous upgrading of the Internet, the development of social tools, and the personality of different people. (2) Although it is assumed that the sample can be representative of the population, larger sample size can reduce the possibility of estimation error, so it can be tried to use a larger dataset in the future to validate the model.

References

- Ajzen, I. (1991). "The theory of planned behavior", *Organizational Behavior and Human Decision Processes*, Vol. 50 No. 2, pp. 179-211.
- Alkhalifah, A. (2022). Exploring Trust Formation and Antecedents in Social Commerce. *Frontiers in Psychology*, 12.
- Amblee, N., & Bui, T. X. (2011). Harnessing the Influence of Social Proof in Online Shopping: The Effect of Electronic Word of Mouth on Sales of Digital Micro products. *International Journal of Electronic Commerce*, 16(2), 91-114.
- Arvidsson, N. (2014). Consumer attitudes on mobile payment services – results from a proof of concept test. *International Journal of Bank Marketing*, 32(2), 150-170.
- Axsen, J., & Kurani, K. S. (2012). Social influence, consumer behavior, and low-carbon energy transitions. *Annual Review of Environment and Resources*, 37, 311-340.
- Bandura, A., & McClelland, D. C. (1977). *Social learning theory*. First published.
- Bianchi, C. G., & Figueiredo, J. C. B. d. (2017). Characteristics of Brazilian scientific research on diffusion of innovations in business administration. *RAI Revista de Administração e Inovação*, 14(4), 311-320.

- Carreiro, H., & Oliveira, T. (2019). Impact of transformational leadership on the diffusion of innovation in firms: Application to mobile cloud computing. *Computers in Industry*, 107, 104-113.
- Carter, L., & Bélanger, F. (2005). The utilization of e-government services: citizen trust, innovation and acceptance factors*. *Information Systems Journal*, 15(1), 5-25.
- Chen, A., Lu, Y., Wang, B., Zhao, L., & Li, M. (2013). What drives content creation behavior on SNSs? A commitment perspective. *Journal of Business Research*, 66(12), 2529-2535.
- Chen, J., & Shen, X.-L. (2015). Consumers' decisions in social commerce context: An empirical investigation. *Decision Support Systems*, 79, 55-64.
- Cho, H. (2011). "Theoretical intersections among social influences, beliefs, and intentions in the context of 3G mobile services in Singapore: decomposing perceived critical mass and subjective norms", *Journal of Communication*, Vol. 61 No. 2, pp. 283-306.
- Chong, A. Y., Darmawan, N., Ooi, K., & Lin, B. (2010). Adoption of 3G services among Malaysian consumers: an empirical analysis. *International Journal of Mobile Communications*, 8(2), 129-149.
- Curry, R. G., & Zhang, P. (2013). Website features that gave rise to social commerce: a historical analysis. *Electronic commerce research and applications*, 12(4), 260-279.
- Dahabiyeh, L., Najjar Mohammad, S., & Agrawal, D. (2020). The effect of risk levels on technology adoption decision: the case of online games. *Information Technology & People*, 33(5), 1445-1464.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *Management Information Systems Quarterly*, 13(3), 319-340.
- De Brentani, U., Kleinschmidt, E. J., & Salomo, S. (2010). Success in Global New Product Development: Impact of Strategy and the Behavioral Environment of the Firm. *Journal of Product Innovation Management*, 27(2), 143-160.
- Fishbein, M. and Ajzen, I. (1975), *Belief, Attitude, Intention, and Behavior: An Introduction to Theory and Research*, Addison-Wesley, Reading.
- Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, 18(1), 39-50.
- Gefen, D., Straub, D., & Boudreau, M. (2000). Structural Equation Modeling and Regression: Guidelines for Research Practice. *Communications of the Association for Information Systems*, 4, pp-pp.
- Geissinger, A., Laurell, C., & Sandström, C. (2020). Digital Disruption beyond Uber and Airbnb—Tracking the long tail of the sharing economy. *Technological Forecasting and Social Change*, 155, 119323.
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of
- Hajli, N., Sims, J., Zadeh, A. H., & Richard, M.-O. (2017). A social commerce investigation of the role of trust in a social networking site on purchase intentions. *Journal of Business Research*, 71, 133-141.
- Hsu, C.-L., & Lu, H.-P. (2004). Why do people play online games? An extended TAM with social influences and flow experience. *Information & Management*, 41(7), 853-868.
- Hu, X., Chen, X., & Davison, R. M. (2019). Social Support, Source Credibility, Social Influence, and Impulsive Purchase Behavior in Social Commerce. *International Journal of Electronic Commerce*, 23(3), 297-327.
- Huang, Z., & Benyoucef, M. (2013). From e-commerce to social commerce: A close look at design features. *Electronic Commerce Research and Applications*, 12(4), 246-259.
- Isaac Kofi, M. (2019). Predictors of the Continued Adoption of WECHAT Mobile Payment. *International Journal of E-Business Research (IJEER)*, 15(4), 1-23.
- Kim, N., & Kim, W. (2018). Do your social media lead you to make social deal purchases? Consumer-generated social referrals for sales via social commerce. *International Journal of Information Management*, 39, 38-48.
- Kraatz, M. S. (1998). Learning by Association? Interorganizational Networks and Adaptation to Environmental Change. *Academy of Management Journal*, 41(6), 621-643.
- Kwahk, K., & Kim, B. (2017). Effects of social media on consumers' purchase decisions: evidence from Taobao. *Service Business*, 11(4), 803-829.
- Lascu, D.-N., & Zinkhan, G. (1999). Consumer Conformity: Review and Applications for Marketing Theory and Practice. *Journal of Marketing Theory and Practice*, 7(3), 1-12.
- Lien, C. H., & Cao, Y. (2014). Examining WeChat users' motivations, trust, attitudes, and positive word-of-mouth: Evidence from China. *Computers in Human Behavior*, 41, 104-111.
- Lin, X., Wang, X., & Hajli, N. (2019). Building E-Commerce Satisfaction and Boosting Sales: The Role of Social Commerce Trust and Its Antecedents. *International Journal of Electronic Commerce*, 23(3), 328-363.

- Lou, H., Luo, W. and Strong, D. (2000), "Perceived critical mass effect on groupware acceptance", *European Journal of Information Systems*, Vol. 9 No. 2, pp. 91-103.
- Mamonov, S., & Benbunan-Fich, R. (2017). Exploring factors affecting social e-commerce service adoption: The case of Facebook Gifts. *International Journal of Information Management*, 37(6), 590-600.
- Markus, M. L. (1994). Electronic Mail as the Medium of Managerial Choice. *Organization Science*, 5(4), 502-527.
- Marwell, G., Oliver, P. E., & Prahl, R. (1988). Social Networks and Collective Action: A Theory of the Critical Mass. III. *American Journal of Sociology*, 94(3), 502-534.
- Momani, A. M. (2021). A Modified Technology Acceptance Theory to Assess Social Commerce Technology Adoption. *Information Resources Management Journal (IRMJ)*, 34(2), 43-62.
- Nell, P. C., & Ambos, B. (2013). Parenting advantage in the MNC: An embeddedness perspective on the value added by headquarters. *Strategic Management Journal*, 34(9), 1086-1103.
- Oliver, P., Marwell, G., & Teixeira, R. (1985). A Theory of the Critical Mass. I. Interdependence, Group Heterogeneity, and the Production of Collective Action. *American Journal of Sociology*, 91(3), 522-556.
- Park, H. S., & Smith, S. W. (2007). Distinctiveness and Influence of Subjective Norms, Personal Descriptive and Injunctive Norms, and Societal Descriptive and Injunctive Norms on Behavioral Intent: A Case of Two Behaviors Critical to Organ Donation. *Human Communication Research*, 33(2), 194-218.
- Peng, D. X., & Lai, F. (2012). Using partial least squares in operations management research: A practical guideline and summary of past research. *Journal of Operations Management*, 30(6), 467-480.
- Qin, L., & De-Juan-Vigaray, M. D. (2021). Social commerce: Is interpersonal trust formation similar between U.S.A. and Spain? *Journal of Retailing and Consumer Services*, 62, 102642.
- Qin, L., Kim, Y., Hsu, J., & Tan, X. (2011). The Effects of Social Influence on User Acceptance of Online Social Networks. *International Journal of Human-Computer Interaction*, 27(9), 885-899.
- Rogers, E.M. (1995). *Diffusion of Innovations*. Free Press, New York.
- Sharma, S., Menard, P., & Mutchler, L. A. (2019). Who to Trust? Applying Trust to Social Commerce. *Journal of Computer Information Systems*, 59(1), 32-42.
- Shen, J. (2012). Social Comparison, Social Presence, and Enjoyment in the Acceptance of Social Shopping Websites. *Journal of Electronic Commerce Research*, 13(3), 198.
- Shen, X.-L., Li, Y.-J., Sun, Y., Chen, Z., & Wang, F. (2019). Understanding the role of technology attractiveness in promoting social commerce engagement: Moderating effect of personal interest. *Information & Management*, 56(2), 294-305.
- Song, T., Huang, J., Tan, Y., & Yu, Y. (2019). Using User- and Marketer-Generated Content for Box Office Revenue Prediction: Differences Between Microblogging and Third-Party Platforms. *Information Systems Research*, 30(1), 191-203.
- Venkatesh, V. and Davis, F.D. (2000), "A theoretical extension of the technology acceptance model: four longitudinal field studies", *Management Science*, Vol. 46 No. 2, pp. 186-204.
- Venkatesh, V., & Morris, M. G. (2000). Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *MIS quarterly*, 115-139.
- Venkatesh, V., Morris, M.G., Davis, G.B. and Davis, F.D. (2003), "User acceptance of information technology: toward a unified view", *MIS Quarterly*, pp. 425-478.
- Wang, X., Lin, X., & Spencer, M. K. (2019). Exploring the effects of extrinsic motivation on consumer behaviors in social commerce: Revealing consumers' perceptions of social commerce benefits. *International Journal of Information Management*, 45, 163-175.
- Wang, X., Yuen, K. F., Wong, Y. D., & Teo, C.-C. (2020). E-consumer adoption of innovative last-mile logistics services: A comparison of behavioral models. *Total Quality Management & Business Excellence*, 31(11-12), 1381-1407.
- Wang, Y., & Herrando, C. (2019). Does privacy assurance on social commerce sites matter to millennials?. *International Journal of Information Management*, 44, 164-177.
- Wetzels, M., Odekerken-Schröder, G., & van Oppen, C. (2009). Using PLS Path Modeling for Assessing Hierarchical Construct Models: Guidelines and Empirical Illustration. *MIS Quarterly*, 33(1), 177-195.
- Wu, J.-H., & Wang, S.-C. (2005). What drives mobile commerce? An empirical evaluation of the revised technology acceptance model. *Information & Management*, 42(5), 719-729.

- Zhang, Z., & Wang, H. (2019). How online social ties and product-related factors influence purchasing intention in mobile social commerce context? (2019). *International Journal of Mobile Communications*, 17(2), 191-212.
- Zhao, J.-D., Huang, J.-S., & Su, S. (2019). The effects of trust on consumers' continuous purchase intentions in C2C social commerce: A trust transfer perspective. *Journal of Retailing and Consumer Services*, 50, 42-49.
- Zhu, K., & Kraemer, K. L. (2002). E-commerce metrics for net-enhanced organizations: Assessing the value of e-commerce to firm performance in the manufacturing sector. *Information systems research*, 13(3), 275-295.

C2.2 Feeling Close: The Role of Psychological Distance in Augmented Reality-Enabled E-commerce Experiences

Liu, J.^a, Du, Z.^b, Wang, T.^c, and Sun, G.^d

^a Business School of Sport, Beijing Sport University
E-mail: 18701000308@163.com

^b Business School of Sport, Beijing Sport University
E-mail: duzhao@bsu.edu.cn

^c Business School of Sport, Beijing Sport University
E-mail: wtj0817@163.com

^d Business School of Sport, Beijing Sport University
E-mail: sgd23666@163.com

Abstract

Augmented reality (AR) emerges as an effective tool to deliver immersive e-shopping experiences. Though many studies have explored the functioning mechanism of AR, few studies investigate how AR changes consumers' perception of psychological distance by superimposing virtual contents onto their surroundings or body parts. To address this gap, we expect to conduct a mixed-methods to reveal the vital role of psychological distance in AR-enabled e-commerce. In the first phase, we will adopt a semi-structured interview to explore consumers' distance perception of the products, analyze the reasons, and develop the hypotheses. In the second phase, we will carry out a laboratory experiment to test our research model. Our studies contribute to discerning the impact of psychological distance on consumers in AR-based online shopping experience, thus enriching the application context of psychological distance. Managerially, it helps retailers to understand consumers' psychological change and leverage it to market products.

Keywords: Augmented reality, psychological distance, online shopping, mixed-method design

C2.3 The Impact of E-Commerce Capability on Export Performance

Ait Bouazza, Ilham

*Information & Telecommunication Technology Program (ITTP), Korea
Advanced Institute of Science and Technology (KAIST)*

E-mail: ilham@kaist.ac.kr

Abstract

Despite the popularity of e-commerce in recent years among exporters as means to reach new markets, research on the determinants of its success comes up short. Grounded on the resource-based view of the firm (RBV), this research aims to examine the relationship between e-commerce capability, managerial ability, and firms' performance.

Historical financial information of the largest publicly traded US firms was collected using the COMPUSTAT Database from 2000 to 2020. The e-commerce capability construct was acquired from text-mining EDGAR's 10-K filings, while the managerial ability variable was obtained through proxies.

Using the software STATA, we applied the Difference-in-Differences (DID) approach by running the Two-Way Fixed Effects (TWFE) linear regression to compare the changes in outcomes over time between the targeted firms.

This research will provide key managerial implications to inform business decisions as trade in the digital age promises new opportunities and raises new challenges for firms of all sizes.

Keywords: Resource-based view, e-commerce capability, managerial ability, foreign exposure, text-mining, treatment effects.

C2.4 The impact of artificial intelligence on customer relationship management performance in ecommerce enterprises

Li, L.^a, Lin J. B.^b and Luo, W. Y.^c

^a College of Economics and Management, Northwest Agriculture and Forestry University, Yangling, lilei0123@nwfau.edu.cn

^b College of Economics and Management, South China Agricultural University, E-mail: linjb@scau.edu.cn

^c College of Economics and Management, South China Agricultural University, E-mail: luowenyi1101@163.com

Abstract

Despite the importance of artificial intelligence (AI) technologies in improving customer relationships, AI usage in enabling customer relationship management (CRM) capabilities and in turn improving CRM performance has not yet been investigated. Drawing on dynamic capability theory, this study investigates the impact of AI usage on customer relationship management performance and tests the mediating effect of customer relationship management capabilities. We test our core proposition and theory-driven research model using data collected from a sample of 193 e-commerce enterprises in China. The empirical results indicate that artificial intelligence usage positively impacts customer relationship management performance and customer relationship management capabilities play a positive mediating role in the relationship between them. Thus, this paper contributes to IS research with an eloquent theoretical explanation and strong empirical evidence on why e-commerce enterprises deploy AI initiatives to improve their CRM capabilities and performance.

Keywords: AI usage, CRM capabilities, CRM performance, E-commerce enterprise

Introduction

A stable customer relationship is a vital strategic resource for enterprises in the customer-dominated market (Guerola Navarro et al. 2021). Improving customer relationship management (CRM), can give e-commerce enterprises win more opportunities. Artificial intelligence (AI) is widely used in CRM to provide competitive advantages by analyzing a big volume of customer data and providing personalized recommendations (Saura et al. 2021). Notwithstanding AI has great potential business value, previous studies have presented inconsistent conclusions (positive or negative) regarding the impact of AI usage on CRM performance. This inconsistency can be explained through understanding the mechanisms (e.g. mediation processes) that translate AI usage into CRM performance. CRM capabilities are the ability to discern and satisfy consumer needs, and thus maintain long-term customer relationships and may play a mediating role in the impact of AI usage on CRM performance (Guerola Navarro et al. 2021). However, empirical evidence of CRM capabilities as a mediator is scarce.

To address the above research gaps, we explain the impacts of AI usage on CRM performance in e-commerce enterprises and the mediating role of CRM capabilities between them. The study makes three key contributions. First, this study expands the previous Information Systems (IS) research on the value of AI usage, testing the effects of AI usage on CRM performance, and providing empirical evidence that enterprises can leverage AI to facilitate CRM. Second, this study provides a novel lens for revealing the mechanism through which AI usage positively influences CRM performance in e-commerce enterprises, and identifies the mediation role of CRM capabilities. Third, this study

supplements the applicability of dynamic capability theory in a digital context and finds that AI usage (i.e. low-order organizational capabilities) can promote CRM capabilities (i.e. high-order organizational capability).

Theoretical background

Dynamic capability theory

Dynamic capabilities refer to the ability of enterprises to integrate, build or reset internal and external competitiveness to adapt to the rapidly changing external environment, and can be divided into low- and high-order capabilities (Mikalef et al. 2020). Organizations form high-order organizational capabilities by integrating low-order organizational capabilities to gain competitive advantages (Li et al. 2022). In this research, e-commerce enterprises use AI technology (i.e. low-order organizational capabilities) to form CRM capabilities (i.e. high-order organizational capability), thus improving enterprise performance.

Research model and hypotheses

The research model is shown in Figure 1:

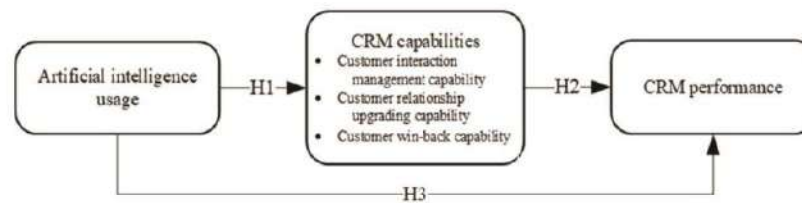


Figure 1. Research Model

AI usage and CRM capabilities

Through the system algorithm, AI can standardize the frequently repeated questions and automatically accumulate satisfactory answers and phrases for customers to solve customers' doubts in real-time and improve profitable customer satisfaction. Furthermore, AI can help enterprises to analyze historical transaction records and demographic information of customers, identify patterns leading to customer churn, and predict the churn tendency of existing customers, thus taking corresponding measures to retain them. Therefore, we hypothesize the following:

H1: AI usage has a positive impact on CRM capabilities in e-commerce enterprises.

CRM capabilities and CRM performance

Customer interaction management capability can help e-commerce enterprises identify critical customers, form a stable partnership and credit relationship with them, and improve customer stickiness. E-commerce enterprises with a high customer relationship upgrading capability can sell various and high-quality related products and services to customers through the cross and additional selling, increasing the purchase frequency and improving satisfaction. Customer win-back capability can monitor the current situation and reasons for customer loss and quickly find the operational links that need to be improved to re-establish trust with lost customers, thereby improving CRM performance. Hence, we hypothesize the following:

H2: CRM capabilities have a positive impact on CRM performance in e-commerce enterprises.

AI usage and CRM performance

When purchasing products, AI provides customers with accurate product information and consulting services while timely processing customer doubts, optimizing the customer experience, and promoting cross- and up-selling between e-commerce enterprises and customers. In the post-sale segment, AI could also standardize the frequently repeated questions and automatically accumulate satisfactory answers and phrases for customers to solve customers' troubles in real-time and improve customer satisfaction. Accordingly, we hypothesize the following:

H3: AI usage has a positive impact on CRM performance in e-commerce enterprises.

Data collection

This study used an online survey to conduct a questionnaire survey on e-commerce enterprises, which were from the database of the Department of Agriculture and Rural Affairs of China and mainly sold agricultural products. Excluding 18 questionnaires, including answer times less than 1 minute or more than 30 minutes and without artificial intelligence, 193 valid questionnaires were collected. Among the samples surveyed, 98.4% are enterprises established more than three years ago, 83.3% are small and medium-sized enterprises, and 86.0% have been using AI for more than one year. Most (76.7%) of the sampled enterprises are located in the eastern, northern, and southern regions of China.

Empirical analysis and results

Measurement model evaluation

We estimated multicollinearity, weights, loadings, and their level of significance. The values of variance inflation factors (VIFs) range from 1.085 to 1.351, which are less than the cutoff score of 10, suggesting that multicollinearity is not a problem. All indicator weights are significant (from 0.145*** to 0.566***) and all indicator loadings range from 0.482** to 0.860***. Thus, our constructs have good measurement properties.

Structural model evaluation

The results show that AI usage positively affects CRM capabilities ($\beta=0.566$, $p<0.001$), CRM capabilities positively affect CRM performance ($\beta=0.658$, $p<0.001$), AI usage positively affects CRM performance ($\beta=0.148$, $p<0.01$), and CRM capabilities have a partial mediating role between AI usage and CRM performance. In addition, we find that firms' region ($\beta=-0.010$, ns), firm size ($\beta=-0.019$, ns), and AI experience ($\beta=0.068$, ns) have no significant effect on CRM performance.

Theoretical contributions

First, although the impact of AI usage on CRM is a vital research topic, there is no consistent conclusion in previous studies. This finding enriches IS studies on the value of AI, providing a novel lens for enterprises using AI to improve CRM performance.

Second, some scholars believe that using AI to achieve CRM performance is not always simple, and there may be undiscovered mechanisms between them. Our study explores the mediating role of CRM capabilities and provides a possible mechanism for a better understanding of how the presence of AI usage within e-commerce enterprises can improve CRM.

Third, although previous research has provided evidence of the link between AI and performance, there is still a limited understanding of AI usage and CRM capabilities. This study contributes to our understanding of how AI uses to develop CRM capabilities, thus enriching the management research on AI usage and CRM capabilities.

References

- Chatterjee, S., Chaudhuri, R., Vrontis, D., Thrassou, A. and Ghosh, S. K. 2021. "Adoption of artificial intelligence-integrated CRM systems in agile organizations in India," *Technological Forecasting and Social Change*, 168120783.
- Foltean, F. S., Trif, S. M. and Tuleu, D. L. 2019. "Customer relationship management capabilities and social media technology use: Consequences on firm performance," *Journal of Business Research*, (104), pp. 563-575.

C2.5 Can Social Commerce Platforms Retain Users? The Perspectives of Technological Environments and Perceived Values of Generation Z

Yu, Z^a, and Ye, Z^b and Ma, K-F. A.^c

Beijing Normal University-Hong Kong Baptist University
United International College, Zhuhai, China

^aE-mail: n830024310@mail.uic.edu.cn

^bE-mail: n830024329@mail.uic.edu.cn

^cE-mail: angelama@uic.edu.cn

Extended Abstract

Research has shown that social commerce influences consumer purchase intentions, but little attention has been paid to the perspectives of Generation Z and its growing purchasing power. This study aimed to provide insights into the mechanisms influencing Generation Z's intentions to continue using social commerce platforms, focusing on China's RED as a representative platform. Through the lens of the stimulus-organism-response model, we investigated the effects of RED's technological environments on consumers' intrinsic values, extrinsic values and online purchase intentions. The results showed that the mediating effects of intrinsic and extrinsic values were significant. This suggests that social commerce features positively influence consumers' intrinsic and extrinsic values, which enhances their continuance intentions. The results of this study provide similar social commerce platforms with ideas on how to improve the design of their platforms to increase consumer continuance intentions in the post-COVID-19 era.

Keywords: Social commerce platform, technological environments, generation Z

Introduction

Recently, economic conditions in China have been negatively influenced by the consequences of the COVID-19 pandemic, as well as by tighter regulations imposed by the Chinese government to suppress the low-price subsidy war (Liu et al. 2021). Consequently, growth in the social commerce market has become stagnant, and there has been no significant expansion in consumer participation, particularly in the case of major users, Generation Z (hereafter referred to as "Gen Z") (Achille et al. 2020). It appears that marketing approaches that rely on social media may have reached a ceiling. As age is an important factor in the new digital culture (Lee and Schumann 2009) resulting in differences among different categories of consumers, and in their expectations as consumers. Gen Z, born between 1995 and 2005 and raised in a diversified and digitally connected environment, is a group of consumers with strong and rapidly growing buying power and great openness to new trends. These consumers are possibly the main target of brands across different product categories ranging from basic necessities to luxury goods (Adeola et al. 2019). These young consumers have gravitated to virtual platforms, which empower them to take up experiences and boost their perceived value, or enable them to sprint and expand their personal possibilities. Thus, social commerce platforms have been most popular among Gen Z consumers compared with other generations (Liu et al. 2021). In the post-pandemic era, however, the uncertainty of the economic slowdown and Gen Z's overdependence on the Internet are likely to cause them stress and anxiety. Consequently, the factors affecting the shopping behaviours of this major consumer group are a key issue that social commerce companies should explore and understand to

further develop their business opportunities. Our study had three objectives. First, through a literature review, we sought to determine the influence of the platform’s environment on consumers’ continuance intentions from the perspective of their perceived value. Second, we considered the essential environmental characteristics that may promote stimuli in social commerce platforms and influence consumers’ perceptions of the values of these stimuli. To achieve this goal, we developed a framework comprising the essential elements of technological environments, which have an effect on the extrinsic and intrinsic values that contribute to consumers’ intentions to continue online shopping. Third, through empirical research, we aimed to identify both the antecedents and results of consumer perceived value using RED as an example.

Hypothesis and Research Model

Liu et al. (2021) divided the technological environments of social commerce into four important areas based on consumers’ perceived interactivity, stickiness, personalisation, and sociability. In this study, perceived value refers to the relationship between the benefits of products or services and their costs. Based on Holbrook’s (Holbrook 2006) value theory, perceived value can be divided into intrinsic and extrinsic values. It provides firms with a competitive advantage and is a crucial factor in their future development. Therefore, consumers’ perceived value plays an important role in continuance of online purchase intentions by strengthening purchase satisfaction and consumer loyalty (Hsin Chang and Wang 2011). The research model is illustrated below (see Figure 1):

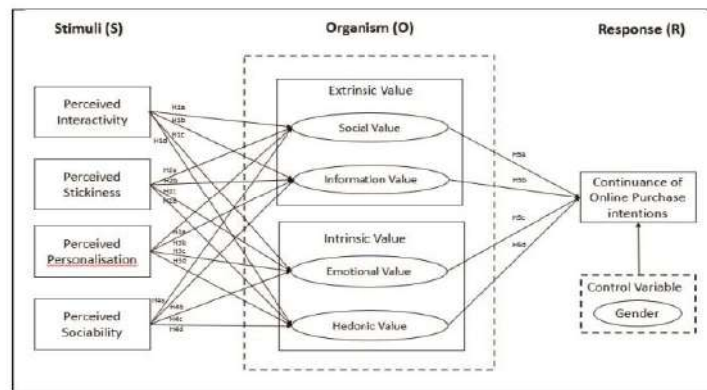


Figure 1. Theoretical Model with Hypotheses

Methodology

The questionnaire comprised 34 items covering all of the variables in the study, in addition to collecting the demographic information. We administered the official survey through the selected professional survey company over a 3-month period. Only members of Gen Z who had used RED before were targeted as survey respondents. A total of 366 valid responses were finally received.

Data Analysis and Results

We applied SPSS 22.0 and AMOS 21.0 to conduct multiple data analyses, including descriptive data analysis, confirmatory factor analysis (CFA), path analysis, and mediation analysis. CFA was initially used to assess the reliability and validity of the research model, followed by Scanning Electron Microscopy (SEM) and mediation analysis to test the proposed hypotheses. Table 1 presented 20 groups of path relationships, of which 16 were significant with the path coefficient value and the *t* value greater than 0, and *p* values smaller than .01. The remaining 4 relationships were not significant: perceived interactivity and emotional value, perceived personalisation and social value, perceived personalisation and emotional value, hedonic value and continuance intentions.

Table 1. Hypothesis Testing Results

X	→	Y	t value	p	Path coefficients	Results
PST	→	EV	2.478	0.01	0.120*	Supported
PSO	→	EV	9.112	0	0.462***	Supported
PI	→	EV	1.791	0.07	0.087	<i>Not supported</i>
PP	→	EV	0.328	0.74	0.017	<i>Not supported</i>
PST	→	HV	7.854	0	0.327***	Supported
PSO	→	HV	6.782	0	0.295***	Supported
PI	→	HV	4.899	0	0.206***	Supported
PP	→	HV	2.961	0	0.130**	Supported
PST	→	SV	2.892	0	0.141**	Supported
PSO	→	SV	9.606	0	0.490***	Supported
PI	→	SV	2.892	0	0.142**	Supported
PP	→	SV	-3.231	0	-0.166	<i>Not supported</i>
EV	→	OPI	6.299	0	0.291***	<i>Supported</i>
HV	→	OPI	-0.47	0.64	-0.023	<i>Not supported</i>
SV	→	OPI	7.937	0	0.360***	<i>Supported</i>
IV	→	OPI	3.843	0	0.184***	<i>Supported</i>
PST	→	IV	5.437	0	0.241***	<i>Supported</i>
PSO	→	IV	6.049	0	0.281***	<i>Supported</i>
PI	→	IV	2.892	0	0.130**	<i>Supported</i>
PP	→	IV	4.974	0	0.233***	<i>Supported</i>

Note. * $p < .05$. ** $p < .01$. *** $p < .001$. Perceived interactivity (PI); perceived stickiness (PST); perceived personalisation (PP); perceived sociability (PSO); social value (SV); informational value (IV); emotional value (EV); hedonic value (HV); and continuance of online purchase intention (OPI).

Discussion and Contributions

As presented in Table 1, our analysis indicated that the technological environmental factors of social commerce platforms, comprising perceived interactivity, perceived stickiness, and perceived sociability, had a significant influence on consumers' perceived value, including their social, informational, and emotional values, which in turn affected Gen Z consumers' willingness to make purchases on RED. Contrary to our hypotheses, perceived interactivity had a negative relationship with emotional value (Figure 1, H1c refers); perceived personalisation had a negative relationship with social value (H3a) as well as emotional value (H3c); and hedonic value had a non-significant impact on the continuance of online purchase intentions (H5d). These four insignificant results imply that young users of RED, in particular the Gen Z consumer group, may be evolving into more rational buyers than other user groups. In the context of the current economic downturn driven by COVID-19, and in the approaching post-pandemic era, it appears that Gen Z users of social commerce platforms are driven to buy not for entertainment or pleasure, but to fulfil their needs. Our findings suggest that the pursuit of social, informational, and emotional values is the primary motivation of RED users rather hedonic value, such as fun or enjoyment. Based on the results of our study, RED should not be considered simply as a communication tool or a social network service, but as an artificial structural equivalence of social connections that carries users' social capital. When people join RED and immerse themselves in it, it

can transfer users' social capital online, and digitalise their daily lives over the boundaries of space and time. By connecting the virtual social commerce platform and the real commercial world, our research explains partially why consumers join a social network platform such as RED and why they repeatedly use it. This study provides theoretical and practical implications for similar social platforms to improve their platform design in order to increase consumer continuance intentions in the post-COVID-19 era.

Acknowledgement

This project was supported by the Beijing Normal University-Hong Kong Baptist University United International College (Grant No. A1067).

References

- Achille, A., C. Balloch, L. Bu, c. Chen, G. Chen, L. Chen, W. Enger, J. Ho, X. Huang, D. Hui, D. Kuijpers, N. Leung, L. Li, J. Mak, J. Ngai, F. Poh, D. Pountney, A. Sawaya, S. Saxon, J. Seong, S. Sha, K. Tu, J. Woetzel, C. Xia, L. Xu, H. Ye, J. Yu, S. Zerbi, C. Zhang, J. Zhou, and D. Zipser. 2020. "Understanding Chinese Consumers: Growth Engine of the World," *McKinsey & Company* November. <https://as-pacific.com/assets/presentations/mckinsey-2021.pdf> (accessed Jan 5, 2022)
- Adeola, O., R. E. Hinson, and O. Evans. 2019. Social Media in Marketing Communications: A Synthesis of Successful Strategies for the Digital Generation. In *Digital Transformation in Business and Society*, 61-81. Cham: Springer International Publishing. Doi:10.1007/978-3-030-08277-2_4.
- Holbrook, M. B. 2006, "Consumption Experience, Customer Value, and Subjective Personal Introspection: An Illustrative Photographic Essay," *Journal of Business Research* (59:6), pp. 714-725. doi:10.1016/j.jbusres.2006.01.008.
- Hsin Chang, H., and H. Wang. 2011, "The Moderating Effect of Customer Perceived Value on Online Shopping Behaviour," *Online Information Review* (35:3), pp. 333-359. doi:10.1108/14684521111151414.
- Lee, E., and D. W. Schumann. 2009, "Proposing and Testing the Contextual Gender Influence Theory: An Examination of Gender Influence Types on Trust of Computer Agents," *Journal of Consumer Psychology* (19:3), pp. 440-450. doi:10.1016/j.jbusres.2019.10.048.
- Liu, P., M. Li, D. Dai, and L. Guo. 2021, "The Effects of Social Commerce Environmental Characteristics on Customers' Purchase Intentions: The Chain Mediating Effect of Customer-to-Customer Interaction and Customer-Perceived Value," *Electronic Commerce Research and Applications* (48:July), pp. 101073. doi:10.1016/j.elerap.2021.101073.

C2.6 Consumer Engagement and Reuse Intention Through Content Type in Mobile Commerce

Wang, M.^a and Choi, J. W.^b

^a Department of Business Administration, Soonchunhyang University
E-mail: jackwang1121@sch.ac.kr

^b Department of Business Administration, Soonchunhyang University
E-mail: jaewonchoi@sch.ac.kr

Abstract

This study is to identify the difference between customer engagement and reuse intention according to the three types of content characteristics. Analysis of variance was applied to compare three groups on average to analyze the differences between those groups. After testing the manipulation of experiment, structural equation modeling for various antecedents was performed. Interaction had a positive effect on Engagement, as we have proved within the paper. Content information had a positive impact on Engagement. The effect of attention on Engagement was confirmed as positive. Scarcity of time had a positive effect on engagement and Scarcity of quantity had a positive effect on engagement, Ubiquity has a positive effect on engagement. System quality positively affects engagement. Ease of use has a positive effect on engagement. Consumer engagement had a positive effect on reuse intention. Finally, there are differences among the three kinds of mobile commerce as conclusion within the findings.

Keywords: Content Characteristics; Mobile Commerce; Scarcity; Engagement; Interactivity

Introduction

The introduction Users use social networking sites (SNSs) to create personal profiles, define their identities, connect with other users and brands, and view, share, upload, and comment on images, messages, videos, and other news feed content (Vinu and Rejees, 2021). SNSs are growing more prevalent in people's daily lives worldwide. Kepi's analysis shows that there are more than 4.62 billion social media users around the world in January 2022, equating to 58.4 percent of the total global population. Furthermore, the Social Media Examiner's industry report reveals that over 96% of companies use SNSs for their own brands and product marketing because of the increased brand exposure, website traffic attraction, loyal fan cultivation, and market intelligence acquisition capabilities. Through these SNSs, marketers can provide additional touchpoints to consumers. The prevalence of social media, with millions of enterprises seeking brand communication, necessitates the understanding of how social media exposure influences brand-related outcomes (Kin and Han, 2020).

With the global outbreak of the new coronavirus, we face huge societal transformations in labor, healthcare, education, culture, and the art (Yuan, 2021). The migration to online platforms was a successful entrepreneurial strategy during the COVID-19 pandemic. As the national lockdowns and governmental restrictions changed consumer behaviors, a change in terms of entrepreneurial behavior was also required. The entrepreneurial activities that provided health-related materials used against SARS-COV-2, online services, e-commerce, teleworking, distance learning and education, and home delivery services were the winners (Lungu et al., 2021). Manufacturers believe that goods and services within the unfact economic based online platform will compete for competitive advantages (Hajili,

2015). This will have an impact on consumption, as people prefer to "shop alone" without feeling burdened, and therefore choose to do so (Liang and Turban, 2011).

Within the existing open market and mobile shopping centered on online shopping companies, such as group buying, the mobile commerce market with multi-channel shopping strategies such as department stores, hypermarkets, TV shopping, and mobile shopping is highly competitive (Gao et al., 2013). Mobile shopping has grown in popularity as the number of smartphone users has increased and has become a significant distribution channel for businesses (Chen et al., 2021).

Consumer culture has been impacted by the growth of the mobile commerce market and the active untack economy (Zhang et al., 2021). Cell phone e-commerce, which evolved from the medium of single-person live streaming, such as YouTube and Instagram, is one of the expanding distribution channels where people and artists can use their abilities (Hu et al., 2017). Live videos are predicted to grow 15 times or 17% in 2022 compared with FY2017, supporting the development of the streaming market (Kang et al., 2021).

Prior studies on mobile commerce characteristics have proposed generic characteristics, such as instantaneity, ubiquity, localization, personalization, and identification (Zhang et al., 2012). For example, some studies explore the influence of the attributes of mobile devices on their ease of use (Okazaki and Mendez, 2013), perceived usefulness (Choi et al., 2014), social influence, trust (Sharif et al., 2014), perceived behavioral control, and subject norms (Mishra 2014). Other studies explore the intention to adopt, from the viewpoint of flow and impulse buying, perceived value (Pantano and Priporas, 2016), motivations and the unified theory of acceptance and use of technology (Lo et al., 2016). Portability allows consumers to shop "anywhere, anytime" and enables consumers to get quick responses to their needs, while visual appeal enables consumers to read the mobile commerce content easily. In most studies of mobile commerce contexts, these characteristics are the main research. However, content has always attracted consumer attention. The purpose of this study is to identify the difference between customer engagement and reuse intention according to the three types of content characteristics. Thus, we classify content-based mobile commerce into three types: brand content type commerce, review content type commerce, and home shopping content type commerce. Through the preliminary research, this study selected the main variables used in mobile commerce. The content characteristics were classified as interactivity, content information, and interaction. Scarcity as time limit, quantity limit. Mobile characteristics as ubiquity, system quality, ease of use. An empirical study of consumer engagement and reuse intention was conducted. Finally, we investigate whether there are differences in consumer engagement and reuse intentions across the three different content types of mobile commerce.

This paper is organized as follows. Section 2 provides a review of existing studies about Mobile commerce. Section 3 details the research hypotheses and model. Section 4 details the research methodology that experimental design and stimuli and data collection, and the section 5 is the results. Finally, section 6 is the discussion that details the conclusion and implication.

Theoretical Background

Mobile commerce

Mobile commerce refers to e-commerce in a mobile environment (Chen 2017). Mobile commerce, unlike commerce on a personal computer (PC), provides strong convenience characteristics as it does not require the process of starting or launching to run applications, and therefore has few spatial constraints and is highly real-time (San-Martín et al., 2016).

Researchers have provided various attributes of m-commerce. To distinguish the features of mobile commerce from those of online commerce, convenience, personalization, flexibility, and transferability have been proposed (Holmes et al., 2013). Another study identified seven mobile commerce attributes: ubiquity, convenience, accessibility, security, location, instant access, and personalization (Marinkovic and Kalini, 2017). When comparing online and mobile shopping, four distinct attributes of mobile shopping have been presented: convenience, accessibility, location-based, and personalization

(Marinao-Artigas and Barajas-Portas, 2020). Instant connectivity, content information, accessibility, playfulness, usefulness, and evaluation are the six factors (Mahapatra 2017).

Content types and characteristics of mobile commerce

Video content has always attracted consumer attention. The portable and mobile nature has demonstrated distinct characteristics from TV shopping in terms of information and interest over a short period of time. With the development of multichannel networks, it is difficult to ascertain whether the goal is to shop or watch videos. The goal of mobile commerce is to enhance sales through shopping by replaying various video contents, but with the element of entertainment, interesting content is expanding to multiple channels indefinitely (Li et al., 2013).

Depending on the type of content in mobile commerce, the attributes and multiple elements of the content can be used to categorize it. Content or fun-based products and brand descriptions or storylines are categorized into three types: brand content type commerce, review content type commerce, and home shopping content type commerce.

Branded-content-type commerce promotes products for sale by creating a brand in a story through video exposure. If a story is added to the video, it is more unique and freer than a general advertisement, and it will be shared quickly across numerous SNSs (Chen, 2012). As the service or product require advertisement, the story is edited into a video according to the content.

Review content-type commerce is a method of advertising the sale of services or products directly or indirectly through interesting stories on various social media platforms, aimed at ordinary people or celebrities who have popularity or influence (Swani and Milne, 2017). They are mainly used to convey their experiences to consumers before and after scenes of product use, such as product usage method application functions.

Home shopping content-type commerce is a live-streaming method of selling the appearance, function, and use of products to be shopping sites (Lee et al., 2022). TV shopping differs from home-shopping content-type commerce in that consumers actively participate in watching videos, and if promotions such as products or discount events are difficult to differentiate, the time spent watching varies depending on the response of the program host.

Research Model

This study was designed as an experiment with different types of content to determine content characteristics, scarcity, and mobile characteristics, that affect engagement and reuse intentions. According to content type, branded content-type commerce, review content-type commerce, and home shopping content-type commerce were created, and responses to those types of commerce were analyzed. To test the hypotheses of this study, a structural equation analysis was conducted by PLS. Analysis of variance (ANOVA) conducted to identify manipulation of three experimental groups. The research model is as follows Figure 1.

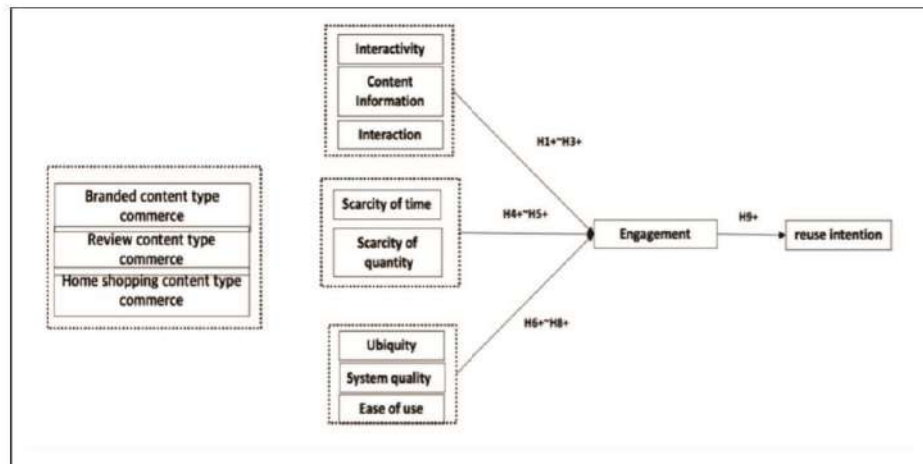


Figure 1. Research Model

Relationship between content characteristics and consumer engagement

Interactivity is defined as a two-way exchange of meanings between consumers and sellers, or the degree to which consumers and sellers can communicate and exchange meanings during the meaning exchange process (Alexander and Kent, 2020). Consumer interaction with messaging refers to the ability of consumers to produce and modify messages, and interactive media such as mobile machines and the Internet are more interactive than traditional media (Gong, 2013).

The majority of existing studies on the impact of interactivity focus on the effect of the online environment on information retrieval, and studies can be distinguished by factors such as the applicant's attitude toward advertising effectiveness, the effect of the mobile environment on the consumer's intention to accept and purchase goods, or the effect on perceived interactivity (Bhargave et al., 2016). The importance of content-based consumer-perceived interactivity in mobile commerce is highlighted in this study. Therefore, we propose the following hypothesis.

H1: Interactivity has a positive (+) impact on consumer engagement.

Content information is obtained through observation or measurement, and information quality is the evaluation of the quality of the outcome when information or content is delivered to a person (Franke et al., 2009). Content information was defined as accurate and mutually relevant in a study on the impact of O2O services on consumers' perceived value utilizing location-based information provided by smartphones (Hau et al., 2017). In a study regarding consumer responses to distribution companies' provision of location-based mobile shopping services, it was asserted that information is vital (Li et al., 2018). Therefore, the following hypothesis is proposed.

H2: Content information has a positive (+) effect on consumer engagement.

The term "attentionless" refers to how powerful is the ability to attract people's attention (Dobrinsky and Frymier, 2004). Ways to elicit interactions, include item color, Jun-jac form, deformation, humor, change, and contrast (Darvin and Norton, 2014). Consumers recognize morphology based on their mindset, attention, interest, and attention level. Therefore, deformation of the form that is inversely proportional to the peripheral size or unexpected can be used to draw new attention and interest to consumers in the design of products or services. Consumers can find a variety of content as they browse social media. Therefore, establishing content attention is more crucial than guiding consumer attitudes or behaviors (Hsu and Lin, 2015). Companies will develop unique designs that immediately catch the eye to capture customer preferences, and customers will be drawn to these designs to choose their products or services (Tucanrat et al., 2021). We thus propose the following.

H3: Interaction has a positive (+) effect on consumer engagement.

Relationship between scarcity and consumer engagement

Scarcity emphasizes that consumers' ability to use and purchase a service or product is limited, as is the quantity of the service or product or the time available. Therefore, the psychological oppression of consumers who are not easily available can be used to influence their intention to use and purchase (Lynn, 1992). Time limitation refers to the extent to which goods are available for purchase for a limited period or sale. Quantity restriction refers to the extent to which the number of items available for purchase or sales is restricted (Khan et al., 2019). Therefore, the following are proposed.

H4. Scarcity of time has a positive (+) effect on consumer engagement.

H5. Scarcity of quantity has a positive (+) effect on consumer engagement.

Relationship between mobile characteristics and consumer engagement

Convenience refers to the ability to access important information and content regardless of time and location via a smart device that you carry (Bhuiyan et al., 2018). Mobile application characteristics (paranoia) are employed as influential variables in research on the impact of the intention to use m-commerce (Kalinic and Marinkovic, 2016). For consumers who use mobile and online services as an important factor of differentiation, convenience can increase their usefulness and satisfaction with a service, impacting their acceptance of new technologies or purchase intention at shopping centers (Chen et al., 2021). Therefore, we propose:

H6 Ubiquity has a positive (+) impact on consumer engagement.

System quality is the extent to which users consider a system to be used effectively (Yuen and Thai, 2015) It is easy to use, enabling the user to achieve a certain goal; adaptive reliability in terms of whether it works effectively at the right moment, flexibility to alter content to the consumer's needs, and response time (Chu and Kim, 2011). The system quality of smartphones had a substantial impact on users in a research of smartphone acceptance intentions (Parasuraman and Grewal, 2000). Since the learning environment is a virtual space based on an online network, system quality can have a significant impact on how well learners learn (Wang and Liao, 2008). In e-commerce empirical studies, several researchers have confirmed that information quality, system quality, and service quality have a direct and significant effect on intention to use (Leong et al., 2017). It can be observed that the system quality of online shopping positively influenced intention to use, and the relationship between quality factors and intention to use was stronger than the relationship between quality factors and user satisfaction. Therefore, we propose:

H7. System quality has a positive (+) effect on consumer engagement.

Ease of use is the degree to which individuals believe a system is easy to use (Davis, 1989). If ease of use is defined as the concept of effort, then an evaluation of the process of user's system can be expected; thus, ease of use is defined as process expectation (Lee et al., 2019). The utility of mobile app services has a substantial impact on customer satisfaction, and ease of use is considered an important determinant of system use and affects attitudes toward that factor system (Chu et al., 2020) Therefore, the following is proposed.

H8: Ease of use has a positive (+) effect on consumer engagement.

Relationship between consumer engagement and reuse intentions

Immersion refers to the emotional state experienced when a person is completely immersed in an object or activity. The effects on consumers' behavioral intentions were analyzed, and the findings revealed that immersion affects consumers' purchase intentions (Alalwan, 2020).

Re-use intention implies the extent to which consumers want to use and buy the good or service again and the likelihood of continuing to use the service in the future (Kalinić et al., 2019). The data reveal

that customer satisfaction has a considerable impact on reuse intention for mobile commerce. Therefore, we propose the hypothesis:

H9: Consumer engagement has a positive (+) effect on reuse intention.

Research Methodology

Experimental design and stimuli

The six most appropriate products (Table 1) were selected to conduct this investigation. To evaluate the hypotheses of this study, an experimental questionnaire was given to consumers who had used mobile commerce as the study population. The experiments were allocated by random sampling online or through each mobile chat tool, and they were configured to six by three dimensions, as presented in Table 1. Six stimuli in three dimensions were presented to 20 university students independently to determine the feasibility of each experiment and each dimension was identified for differentiation before the content was modified.

The stimuli listed in Table 1 were employed for this study. The first is for two types of branded content-type commerce stimuli: utility goods and pleasure goods. The utility item is a video advertising grandmother's shampoo, and the pleasure item is a video advertising a toy bicycle. The second is a practical and pleasure product for review-based commerce. The practical product is a video selling hammer drill, and the pleasure product is a video selling toy crystal clay. The third is a useful and pleasure product for home-shopping content-type commerce. The practical goods are videos selling electric screwdrivers, while the pleasure goods are videos selling Skittles toys.

Table 1. Experimental Stimuli

Type of Content	Utilitarian (U)	Hedonic (H)
Branded content type (BC)		
Review content type (RC)		
Home shopping content type (HSC)		

Table 1. Six Experimental Groups: Contents with Product types

Product Types	Content Types	Product	Characteristics
Utilitarian (U)	BC	Shampoo	-The grandmother returned home from her farm work. She washed her hair because it was hot. Show the characteristics of shampoo by washing hair.
	RC	Motor Drill	- Through actual comparison and use, Introduce to consumers how to use the Motor Drill, its efficiency in various situations, and the performance of the Motor Drill itself, etc.

	HSC	Electric Screwdrivers	- Sales of Electric Screwdrivers on the online platform through home shopping mode The two hosts introduced the performance and price of the Electric Screwdrivers and told the audience about their feelings during the sales process.
Hedonic (H)	BC	Toys Sports bikes	- Vlad and Nikita ride sports bikes with the kids and pretend to play with toys. The children's magic transformation bike.
	RC	Toys slime	- The video introduces his childhood toy, introducing the play and price of this toy, as well as his own feelings about this toy.
	HSC	Toys Sewing machines	- The video is about selling Toys Sewing machines on an online platform through home shopping mode. In this video sales process, the host shows the audience how to make clothes and bags with toys.

Data Collection

This study employs an online questionnaire for data collection. Our participants were people who have experience in adopting mobile shopping in south Korea. Thus, participants were recruited by Naver Live Shopping (<https://shoppinglive.naver.com/home>)'s user online community. When participants entered the survey page through a suggested web-link, they were automatically assigned to one of the six types of content-specific experimental pages. Respondents were asked to answer whether they had any experience with m-commerce. Those participants with the experience continued the survey and those without the experience were automatically redirected to the end of the survey. After closing experimental pages, we excluded several outliers that took less than a few minutes to complete, as well as those that were incomplete. Excluding outliers, a total of 384 responses were used for this research.

The demographic characteristics of the respondents were the same as those in Table 2. Of the 384 collected respondents, 163 (42.4%) were male and 221 (57.6%) were female. In terms of age group, 19 (4.9%) were in their late teens, 209 (54.4%) in their 20s, 112 (29.2%) in their 30s, 36 (9.4%) in their 40s, and eight (2.1%) in their 50s. In terms of the average number of respondents who used cell phones for business each week, 23 (6.0%) used it for less than 1 hour, 47 (12.2%) for 1–5 hours, 79 (20.6%) for more than 5–10 hours, 131 (34.1%) for more than 10–15 hours, 83 (21.6%) for more than 15–20 hours, and 21 people (5.5%) for more than 20 hours.

Table 2. Demographic characteristics

Demographics		N	%
Gender	Male	163	42.4
	Female	221	57.6
	Total	384	100
Age	10's	19	4.9
	20's	209	54.4
	30's	112	29.2
	40's	36	9.4
	50's	8	2.1
	60's	19	4.9

	Total	384	100
Average time spent in mobile commerce per week	Less than 1h	23	6.0
	1-5 h	47	12.2
	5-10h	79	20.6
	10-15h	131	34.1
	15-20h	83	21.6
	More than 20h	21	5.5
	Total	384	100

Convergent and discriminant validity

In this empirical study, hypothesis testing is based on 384 empirical data points. Exploratory factor analysis was conducted to measure the feasibility of all variables in the research model. Factor analysis was performed by removing questions from the questionnaire that were mismeasured with twenty professionals for content validity, and the results confirmed that all factors had a factor loading of 0.7 or above. The results of the plausibility measures for all variables were the same as those in Table 3. All variables had Cronbach's alpha values greater than 0.7, indicating that they were statistically reliable.

To determine the convergence feasibility of all variables in this study, the mean variable expansion (AVE) greater than 0.5 was calculated, resulting in a conceptual confidence level greater than 0.7. The square root of AVE was greater than the carrying capacity of each lower variable, confirming the discriminative feasibility of the model. In this study, the model's AVE values ranged from 0.720 to 0.957, all of which were proven to be greater than 0.5. The conceptual confidence values ranged from 0.882 to 0.993, all of which were confirmed to be higher than 0.7, indicating the feasibility of the study's conceptual convergence. As depicted in Table 4, the discriminative feasibility of this model is confirmed. Therefore, the model's feasibility and reliability were confirmed in this study, and hypotheses were tested.

Table 3. Convergence Feasibility Analysis

Variables		Factor Loading	Reliability	AVE	Construct Reliability
Interactivity (IN)	IN1	0.803	0.971	0.848	0.882
Interactivity (IN)	IN2	0.809	0.971	0.848	0.882
Interactivity (IN)	IN3	0.810	0.971	0.848	0.882
Interactivity (IN)	IN4	0.816	0.971	0.848	0.882
Content Information (CI)	CI1	0.830	0.824	0.815	0.890
Content Information (CI)	CI2	0.818	0.824	0.815	0.890
Content Information (CI)	CI3	0.839	0.824	0.815	0.890
Content Information (CI)	CI4	0.743	0.824	0.815	0.890

Short Title of up to 8 words

Interaction (INT)	INT1	0.834	0.848	0.837	0.899
Interaction (INT)	INT2	0.889	0.848	0.837	0.899
Interaction (INT)	INT3	0.823	0.848	0.837	0.899
Scarcity of Time (SCT)	SCT1	0.925	0.722	0.922	0.972
Scarcity of Time (SCT)	SCT2	0.891	0.722	0.922	0.972
Scarcity of Time (SCT)	SCT3	0.797	0.722	0.922	0.972
Scarcity of Quantity (SCQ)	SCQ1	0.865	0.857	0.957	0.985
Scarcity of Quantity (SCQ)	SCQ2	0.877	0.857	0.957	0.985
Scarcity of Quantity (SCQ)	SCQ3	0.923	0.857	0.957	0.985
Ubiquity (UB)	UB1	0.861	0.720	0.720	0.911
Ubiquity (UB)	UB2	0.899	0.720	0.720	0.911
Ubiquity (UB)	UB3	0.912	0.720	0.720	0.911
Ubiquity (UB)	UB4	0.917	0.720	0.720	0.911
System Quality (SQ)	SQ1	0.958	0.874	0.974	0.993
System Quality (SQ)	SQ2	0.971	0.874	0.974	0.993
System Quality (SQ)	SQ3	0.981	0.874	0.974	0.993
System Quality (SQ)	SQ4	0.981	0.874	0.974	0.993
Ease of Use (EU)	EU1	0.738	0.906	0.895	0.943
Ease of Use (EU)	EU2	0.812	0.906	0.895	0.943
Ease of Use (EU)	EU3	0.823	0.906	0.895	0.943

Ease of Use (EU)	EU4	0.831	0.906	0.895	0.943
Engagement (EN)	EN1	0.813	0.890	0.904	0.909
Engagement (EN)	EN2	0.807	0.890	0.904	0.909
Engagement (EN)	EN3	0.819	0.890	0.904	0.909
Engagement (EN)	EN4	0.815	0.890	0.904	0.909
Reuse Intention (RI)	RI1	0.765	0.905	0.796	0.896
Reuse Intention (RI)	RI2	0.786	0.905	0.796	0.896
Reuse Intention (RI)	RI3	0.783	0.905	0.796	0.896

Table 4. Convergence and Discriminant Validity

	INT	EU	CI	EN	IN	RI	SCQ	SQ	SCT	UB
INT	0.915									
EU	0.749	0.946								
CI	0.735	0.788	0.910							
EN	0.021	0.033	0.020	0.951						
IN	0.027	0.023	0.024	0.803	0.921					
RI	0.022	0.025	0.025	0.847	0.836	0.892				
SCQ	0.065	0.131	0.151	0.022	0.020	0.010	0.978			
SQ	0.056	0.031	0.037	0.272	0.290	0.279	0.008	0.987		
SCT	0.006	0.126	0.146	0.017	0.001	0.001	0.703	0.021	0.961	
UB	0.198	0.225	0.228	0.107	0.081	0.104	0.027	0.064	0.030	0.849

* [Note] Leading diagonal shows the squared root of AVE of each construct

Results and Discussions

Video content is an aid in attracting consumer attention (Chung et al., 2015). Mobile commerce content can be classified depending on various factors, including the content's attributes and the distribution channel (Chen, 2017). This study classifies brand content-type commerce, review content-type commerce, and home shopping content-type commerce, according to content type. Therefore, the content type of mobile e-commerce determines the differences between the three types of e-commerce.

The average difference between the three groups of brand content type commerce, review content type commerce, and home shopping content type commerce was tested in this study to confirm whether there are differences in consumer input and reuse intention based on three types of content-based commerce, and the comparison results in Table 5 were obtained. Unlike the other factors, the mobile characteristics had no statistically significant values, while the consumer input and reuse intention variables did. Therefore, manipulation test of experimental groups was confirmed.

ANOVA post-hoc tests were conducted to determine the differences between the groups, and the results were the same as those in Table 6. The results were as follows: (1) In terms of consumer input, there

were variances in the means of all three groups. Review content-type commerce outperforms home-shopping content-type commerce, while brand content-type commerce outperforms both. (2) Validation of the repurposing intentions resulted in dividing the groups into three. Review content-type commerce outperforms home-shopping content-type commerce, while brand content-type commerce outperforms both.

Table 5. ANOVA Analysis

	Group	N	mean	F	Sig.
Interactivity (IN)	RC	129	5.3217	500.618	0.000
	BC	129	1.9147		
	HSC	126	6.1687		
Content Information (CI)	RC	129	4.9554	610.596	0.000
	BC	129	1.9186		
	HSC	126	4.8313		
Interaction (INT)	RC	129	1.7416	605.964	0.000
	BC	129	6.6796		
	HSC	126	1.7440		
Scarcity of Time (SCT)	RC	129	4.3416	70.596	0.000
	BC	129	1.6899		
	HSC	126	4.7772		
Scarcity of Quantity (SCQ)	RC	129	1.6061	91.301	0.000
	BC	129	1.5969		
	HSC	126	4.6227		
Ubiquity (UB)	RC	129	4.6919	0.408	0.665
	BC	129	4.8605		
	HSC	126	4.7500		
System Quality (SQ)	RC	129	6.1919	0.050	0.951
	BC	129	6.0997		
	HSC	126	6.2098		
Ease of Use (EU)	RC	129	4.8295	0.051	0.950
	BC	129	4.8120		
	HSC	126	4.8758		
Engagement (EN)	RC	129	1.9748	589.899	0.000
	BC	129	5.8837		
	HSC	126	1.4603		
Reuse Intention (RI)	RC	129	1.9793	856.338	0.000
	BC	129	6.0000		
	HSC	126	1.3413		

* [Note] RC: Review Content Type; BC: Branded Content Type; HSC: Home Shopping Content Type

Table 6. Ad-hot Test

Engagement

Groups by Content Type	N	1	2	3
HSC	126	1.4603		
RC	129		1.9748	
BC	129			5.8837
(2) Reuse Intention				
	N	1	2	3
HSC	126	1.3413		
RC	129		1.9793	
BC	129			6.0000

* [Note] RC: Review Content Type; BC: Branded Content Type; HSC: Home Shopping Content Type

In this study we used the Partial Least Squares (PLS) to test the proposed model. The reason for choosing PLS is that PLS allows the observed variable to not satisfy the multivariate normal distribution; the other is that the sample size is low, and the convergence speed is fast. The results of hypothesis testing, using the given settings are identical to these in Figure 2. First, we determined the coefficient of determination R^2 of the explanatory power of the study model. The coefficient for engagement is 0.437 and for Reuse intention is 0.424. Therefore, the explanatory power of the model in this study is greater than 0.1 in the social sciences, which has a slightly higher explanatory power and yields no problems with hypothesis testing.

The relationship between content characteristics and engagement had a path coefficient of 0.199 for interactivity ($p < 0.001$) from the path of this study to the model. Therefore, H1 is supported. The path coefficient of content information was 0.340 ($p < 0.001$). Consequently, H2 is supported. The path coefficient for the interaction was 0.266 ($p < 0.01$). Therefore, H3 is supported. Our research hypotheses was confirmed that the content characteristics i.e., interactivity, content information, and interaction have a positive impact on consumer engagement.

The relationship between scarcity and consumer engagement was also explored. The path coefficient of the relationship between scarcity of time and consumer engagement was 0.411 ($p < 0.001$). Therefore, H4 is supported. The path coefficient of the relationship between scarcity of quantity and engagement was 0.401 ($p < 0.001$). Therefore, H5 is supported. Our research hypotheses was confirmed that the scarcity of time and the scarcity of quantity have a positive impact on consumer engagement.

The relationship between mobile characteristics and engagement showed a path coefficient of 0.199 ($p < 0.001$) for ubiquity. Therefore, H6 is supported. The path coefficient indicating the system quality was 0.228 ($p < 0.01$). Therefore, H7 is supported in this study. The path coefficient for ease of use was 0.319 ($p < 0.01$). Therefore, H8 is supported. Our research hypotheses was confirmed that the mobile characteristics i.e., ubiquity, system quality and ease of use have a positive impact on consumer engagement.

The path coefficient of consumer engagement and reuse intention was 0.847 ($p < 0.001$). Therefore, H9 is supported. Consumer engagement has a positive effect on reuse intention.

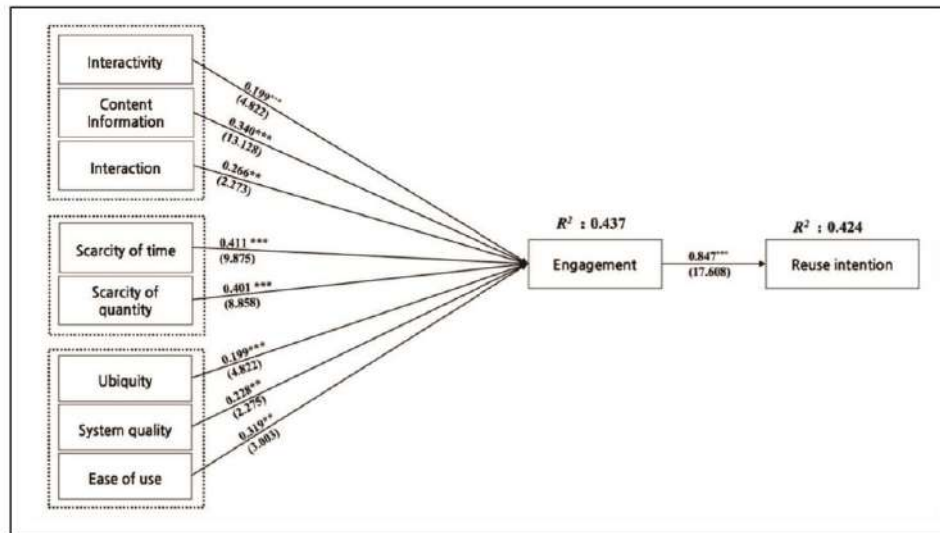


Figure 2. Path Analysis

The results show that all of the proposed hypotheses in this study have been accepted. In the experimental design in this study, the difference in the three content types is well classified. Among them, in the case of interactivity or interaction related to mobile information, the experiment could not be conducted in the same form as the real mobile shopping site. To materialize these antecedents, it is necessary to develop an additional experimental environment, and the results may also cause some changes.

In addition, in the case of Scarcity in this study, the participant responded as a perceived concept. Therefore, providing specific forms about scarcity also needs to be added in extra experimental designs. Although this was not the scope of this study, real form of scarcity of mobile shopping pages is necessary to be improved to complete experimental design.

Conclusions

Concluding remark

The mobile commerce industry has seen numerous changes as a result of the continuous integration and growth of related fields and related platforms, among other things. In contrast to the solely commercial transactions formerly available on the Internet, whenever a mobile and media platform is launched, the first service mentioned is mobile commerce, and social media and smart media are no exception. The researchers discovered that this expansion of mobile commerce with various listing backgrounds eventually led to the phenomenon of smart media convergence to the apex, and they evaluated it using several criteria to distinguish between several types of smart media and summarize their marketing cases in the field.

Based on content type, this study classified mobile commerce into three types: brand content type commerce, review content type commerce, and home shopping content type commerce. The factors concerning content characteristics, scarcity, mobile characteristics, and engagement in m-commerce were discussed, and the relationship between immersion and reuse intention was demonstrated. The criteria were derived from a prior study, and their respective correlations to engagement were empirically analyzed and validated; alternatively, the distinctions between the three types of commerce were examined according to content type. The results of the study's analysis are as follows: First, content characteristics influence consumer engagement positively, and interaction has a positive impact on engagement as well. The digital native generation, who naturally embraces the online environment,

builds social relationships and interacts through a variety of services based on mobile networks and SNSs, and lives a life of self-ordering the content and services they wish to consume. Second, scarcity affects consumer engagement. The time constraint has a positive impact on the engagement. Quantity restrictions have a positive impact on engagement. Third, mobile device characteristics affect engagement. Preferred presence, system quality, and ease of use have a positive impact on engagement. Finally, in terms of consumer engagement and reuse intention, mobile commerce and review content type commerce outperform TV shopping content type commerce, while brand content-type commerce is the most effective. At this level, the short-term effects of branded content are limited. However, for consumers' perceptual and underlying attitudes and behaviors, the effects of brand content can readily continue without changing attitudes if sustained efforts are made from a long-term perspective. Therefore, although review content is effective in eliciting short-term, immediate action, brand content is more effective at sustaining long-term impacts through a long-term brand-consumer relationship.

Implications

The following are the study's academic insights. First, the impact of content characteristics variables (such as interactivity, content information, and attention) on consumer engagement in mobile commerce has been confirmed. Second, it is academically valuable that scarcity in mobile commerce does not affect consumer purchase behavior, but it does influence consumer engagement. Third, determining the impact of mobile characteristics on immersion, such as bias ubiquity, system quality, and ease of use, is academically valuable. Finally, in mobile e-commerce, the differences between the three types of e-commerce may be examined based on the content type, which has a high level of academic spiciness.

In this study, each characteristic variable was found to have a positive impact on consumer engagement; therefore, according to the study's results, companies can be more effective in attracting consumers. Second, brand content-type commerce, review content-type commerce, and home-shopping content-type commerce each have their own strengths, and companies can employ diverse mobile commerce to maximize profits depending on their needs. Finally, this study's practical implication includes that, in terms of consumer engagement and reuse intention, review content-type commerce is more effective than TV shopping content-type commerce in mobile commerce, while brand content-type commerce is the most effective. At this level, the short-term effects of branded content are minimal. However, if sustained efforts are made from a long-term perspective, the effects of brand content can readily continue without changing attitudes for consumers' perceptual and underlying attitudes and behaviors. Therefore, although review content is effective in eliciting short-term, immediate action, brand content is effective at sustaining long-term effects through a sustained brand-consumer relationship. Those in charge of businesses should expect better results when developing marketing strategies that take full advantage of the results identified in this study.

The limitations of this study are that it only used one platform; however, future studies could select multiple platforms to compare the differences. Second, no comparison of different types of products was made in this study, and future studies should analyze the differences between different products.

References

- Alalwan, A. A. 2020. "Mobile Food Ordering Apps: An Empirical Study of the Factors Affecting Customer E-satisfaction and Continued Intention to Reuse," *Int J Inf Manage.* (50), pp.28–44.
- Alexander, B.; Kent, A. 2020. "Change in Technology-Enabled Omnichannel Customer Experiences in-Store," *J. Retailing Consum. Serv.* 102338.
- Bhargave, R.; Mantonakis, A.; White, K. 2016. "The Cue-of-the-Cloud Effect: When Reminders of Online Information Availability Increase Purchase Intentions and Choice," *J. Market. Res.* (53), pp.699–711.
- Bhuiyan, S.N.; Sharma, S.K.; Butt, I.; Ahmed, Z.U. 2018. "Antecedents and Pro- Environmental Consumer Behavior (PECB): The Moderating Role of Religiosity," *J Consum Mark.* (35:3), pp.287–299.

- Chen, A.h.; Lu, Y.B.; Wang, B. 2017. "Customers' Purchase Decision-Making Process in Social Commerce: A Social Learning Perspective," *I Int J Inf Manage.* (37:6), pp.627-638.
- Chen, Y.-R. 2017. "Perceived Values of Branded Mobile Media, Consumer Engagement, Business-Consumer Relationship Quality and Purchase Intention: A Study of WeChat in China," *Public Relat. Rev.* (43:5), pp.945-954.
- Chen, Y.R.; Regina, Zhao, X.Y. 2021. "Digital Dialogue in Online Brand Communities: Examining the Social Network Outcomes of Brands' Dialogue with Facebook Users," *Telemat. Inform.* (57), 101507.
- Chen, Y.R.; Regina, Zhao, X.Y. 2021. "Digital Dialogue in Online Brand Communities: Examining the Social Network Outcomes of Brands' Dialogue with Facebook Users," *Telemat. Inform.* (57), 101507.
- Chen, Y.Y. 2012. "Why do Consumers go Internet Shopping Again? Understanding the Antecedents of Repurchase Intention," *J. Organ. Comput. Electron. Commer.* (22:1), pp.38-63.
- Cheung, C.M.; Zheng, X.; Lee, M.K. 2015. "How the Conscious and Automatic Information Processing Modes Influence Consumers' Continuance Decision in an E-commerce Website," *APJIS.* (7:2).
- Choi, S., Cheong, K., Somera, B., Hao, Q. 2014. "Determinants of Utilitarian Value in Smartphone-Based Mobile Commerce," *PACIS*
- Chu, S.C.; Chen, H.T.; Gan, C. 2020. "Consumers' Engagement with Corporate Social Responsibility (CSR) Communication in Social Media: Evidence from China and the United States," *J. Business Res.* (110), pp.260-271.
- Chu, S.-C.; Kim, Y. 2011. "Determinants of Consumer Engagement in Electronic Word-of-Mouth (eWOM) in Social Networking Sites," *Int. J. Advert.* (30:1), pp.47-75.
- Darvin, R.; Norton, B. 2014. "Transnational Identity and Migrant Language learners: The Promise of Digital Storytelling," *Education Matters: JETL.* (2:1), pp.55-66.
- Davis F.D. 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Q.* (13:3), pp.319-340.
- Dobransky, N.; Frymier, A. 2004. "Developing Teacher-Student Relationships Through Out of Class Communication," *Journal Mass Commun Q.* (52), pp.211-223.
- Franke, N.; Keinz, P.; Steger, C.J. 2009. "Testing the Value of Customization: When do Customers Really Prefer Products Tailored to Their Preferences?" *J. Market.* (73), pp.103-121.
- Gao, T. T.; Rohm, A. J.; Sultan, F.; Pagani, M. 2013. "Consumers Un-tethered: A Three-Market Empirical Study of Consumers' Mobile Marketing Acceptance," *J Bus Res.* (66), pp.2536-2544.
- Gong, Y.T. 2013. "Customer Value Co-creation Behavior: Scale Development and Validation," *J. Bus. Res.* (66), pp.1279-1284
- Hajli, N. 2015. "Social Commerce Constructs and Consumer's Intention to Buy," *Int J Inf Manage.* (35:2), pp.183-191.
- Hau, L.N.; Tram Anh, P.N.; Thuy, P.N. 2017. "The Effects of Interaction Behaviors of Service Frontliners on Customer Participation in the Value Co-creation: a Study of Health Care Service," *Serv Bus.* (11), pp.253-277.
- Holmes, A.; Byrne, A.; Rowley, J. 2013. "Mobile Shopping Behaviour: Insights into Attitudes, Shopping Process Involvement and location," *Int. J. Retail. Distrib. Manag.* (42), pp.25-39.
- Hsu, C.-L.; Lin, J.C.C. 2015. "What Drives Purchase Intention for Paid Mobile Apps? – An Expectation Confirmation Model with Perceived Value," *Electron. Commer. Res. Appl.* (14), pp.46-57.

- Hu, M.; Zhang, M.; Wang, Y. 2017. "Why do Audiences Choose to Keep Watching on Live Video Streaming Platforms? An Explanation of Dual Identification Framework," *Comput. Hum. Behav.* (75:10), pp.594–606.
- Kalinić, Z.; Marinković, V.; Djordjević, A.; Liebana-Cabanillas, F. 2019. "What Drives Customer Satisfaction and Word of Mouth in Mobile Commerce Services? A UTAUT2- Based Analytical Approach," *J. Enterp. Inf. Manag.* (33:1), pp.71–94.
- Kalinic, Z.; Marinkovic, V. 2016. "Determinants of Users' Intention to Adopt M- commerce: An Empirical Analysis. I INF SYST E-BUS MANAG. (14 :2), pp.367–387.
- Kang, K.; Lu, J.; Guo, L.; Li, W. 2021. "The Dynamic Effect of Interactivity on Customer Engagement Behavior Through Tie Strength: Evidence From Live Streaming Commerce Platforms," *Int J Inf Manage.* 56.
- Khan, H.; Daryanto, A.; Liu, C. 2019. "How Anticipated Regret Influences the Effect of Economic Animosity on Consumers' Reactions Towards a Foreign Product," *Int. Bus. Rev.* (28 :2), pp. 405–414.
- Kim, J.J.; Han, H. 2020. "Hotel of Future: Exploring the Attributes of a Smart Hotel Adopting a Mixed-Methods Approach," *J. Travel Tour. Mark.* (37:7), 804822.
- Lee, J.; Ryu, M.H.; Lee, D. 2019. "A Study on the Reciprocal Relationship Between User Perception and Retailer Perception on Platform-Based Mobile Payment Service," *J. Retailing Consum. Serv.* (48), pp.7–15.
- Lee, J.; Won, J.H.; Lee, D.H. 2022. "Customer Shopping Experience in a South Korea's Government-Run Home Shopping Channel for Small and Medium Enterprises Based on Critical Incident Technique and Unsupervised Machine Learning Analysis," *Telemat. Inform.* (68). 101777.
- Leong, C.; Tan, B.; Xiao, X.; Tan, F.T.C.; Sun, Y. 2017. "Nurturing a FinTech Ecosystem: The Case of a Youth Microloan Startup in China," *Int. J. Inf. Manag.* (37:2), pp.92–97.
- Li, M.; Huang, L.; Tan, C.-H.; Wei, K.K. 2013. "Helpfulness of Online Product Reviews as Seen by Consumers: Source and Content Features," *Int. J. Electron. Commer.* (17:4), 1.
- Li, Y.; Liu, H.; Lim, E.T.K.; Goh, J.M.; Yang, F.; Lee, M.K.O. 2018. "Customer's Reaction to Cross-Channel Integration in Omnichannel Retailing: The Mediating Roles of Retailer Uncertainty, Identity Attractiveness, and Switching Costs," *Decis. Support Syst.* (109), pp.50–60.
- Liang, T.P.; Turban, E. 2011. "Introduction to the Special Issue Social Commerce: A Research Framework for Social Commerce," *Int. J. Electron. Commer.* (16:2), pp.5-14.
- Lo, L. Y. S., Lin, S. W., Hsu, L. Y. 2016. "Motivation for Online Impulse Buying: A Two-Factor Theory Perspective," *International Journal of Information Management.* (36:5), pp.759–772.
- Lungu, A.E., Bogoslov, I.A., Stoica, E.A., Georgescu, M.R. 2021. "From Decision to Survival-Shifting the Paradigm in Entrepreneurship During the COVID-19 Pandemic," *Sustainability.* (13:14). 7674.
- Lynn, M. 1992. "The Psychology of Unavailability: Explaining Scarcity and Cost Effects on Value," *Basic Appl. Soc. Psychol.* (13:1), pp.3–7.
- Mahapatra, S. 2017. "Mobile Shopping Among Young Consumers: An Empirical Study in an Emerging Market," *Int. J. Retail. Distrib. Manag.* (45), pp.930–949.
- Marinao-Artigas, E.; Barajas-Portas, K. 2020. "Precedents of the Satisfaction of Mobile Shoppers. A cross-Country Analysis," *Electron. Commer. Res. Appl.* (39), 100919.
- Marinkovic, V.; Kalinic, Z. 2017. "Antecedents of Customer Satisfaction in Mobile Commerce," *Online Inf. Rev.* (41), pp.138–154.
- Mishra, S. 2014. "Adoption of M-Commerce in India: Applying Theory of Planned Behaviour Model," *Journal of Internet Banking and Commerce.* (19:1), pp.1–17.

- Okazaki, S., and Mendez, F. 2013. "Exploring Convenience in Mobile Commerce: Moderating Effects of Gender," *Computers in Human Behavior*. (29:3), pp.1234–1242.
- Pantano, E., Priporas, C. V. 2016. "The Effect of Mobile Retailing on Consumers' Purchasing Experiences: A Dynamic Perspective," *Computers in Human Behavior*. (61), pp.548–555.
- Parasuraman, A.; Grewal, D. 2000. "The Impact of Technology on the Quality-Value- Loyalty Chain: a Research Agenda," *J. Acad. Market. Sci.* (28:1), pp.168–174.
- San-Martín, S.; Prodanova, J.; Lopez Catalan, B. 2016. "What Makes Services Customers Say "Buy It with a Mobile Phone"?" *J. Serv. Mark.* (30:6), pp.601–614.
- Sharif, M. S., Shao, B., Xiao, F., Saif, M. K. 2014. "The Impact of Psychological Factors on Consumers Trust in Adoption of M-Commerce," *International Business Research*. (7:5), pp.148–155.
- Swani, K.; Milne, G.R. 2017. "Evaluating Facebook Brand Content Popularity for Service Versus Goods Offerings," *J. Bus. Res.* (79), pp.123-133.
- Tueanrat, Y.; Papagiannidis, S.; Alamanos, E. 2021. "A conceptual Framework of the Antecedents of Customer Journey Satisfaction in Omnichannel Retailing," *J. Retailing Consum. Serv.* (61), 102550.
- Vinu, S.; Rejcesh, M. R. 2021. "A Detailed Behavioral Analysis on Consumer and Customer Changing Behavior with Respect to Social Networking Sites," *J. Retail. Consum. Serv.* 58.
- Wang, Y.S.; Liao, Y.W. 2008. "Assessing eGovernment Systems Success: a Validation of the DeLone and McLean Model of Information Systems Ssuccess," *Govern. Inf.* (25:4), pp.717–733.
- Yuan, Y.P. 2021. "Can COVID-19 pandemic influence experience response in mobile learning?" *Telemat. Inform.*, (64), pp.133-165.
- Yuen, K.F.; Thai, V.V. 2015. "Service Quality and Customer Satisfaction in Liner Shipping," *Int. J. Qual. Serv. Sci.* (7:2/3), pp.170–183.
- Zhang, L., Zhu, J., Liu, Q. 2012. "A Meta-Analysis of Mobile Commerce Adoption and the Moderating Effect of Culture," *Computers in Human Behavior*. (28:5), pp.1902–1911.
- Zhang, M.L.; Liu, Y.F.; Wang, Y.Z. 2021. "How to Retain Customers: Understanding the Role of Trust in Live Streaming Commerce with a Socio-technical Perspective," *J. Retail. Consum. Serv.* 127.

[DAY 1]

D2 [Special Session] Welcome to
World Smart Sustainable Cities

D2.1 In-depth research on the application of blockchain in the virtual world

조승연
한양대학교 경영대학
shengj0712@gmail.com

Dengsheng Yu
Wenzhou University of
Technology
kits0820@naver.com

임규건
한양대학교 경영대학
gglim@hanyang.ac.kr

Abstract – With the increasing attention to the virtual world from all walks of life, blockchain technology with a decentralized and distributed structure has also received widespread attention. Many companies and scholars who develop virtual worlds believe that an economic system can be built in the virtual world through blockchain technology, which can not only provide the fairness of the virtual world economy but also increase transparency. However, according to the analysis of the characteristics of the blockchain, we believe that the blockchain technology can have more and wider applications in the virtual world.

The development process of blockchain can be roughly divided into two aspects. One aspect is technology. Technologies such as decentralized storage, authentication, private computing, and BaaS (blockchain-as-a-service) provide the foundation for decentralized applications in industries such as healthcare, manufacturing, and energy. Another aspect is finance. DeFi, xFi, NFT and other methods provide various service models for the financial market.

Since the virtual world is constructed from a 3D virtual reality space, it enables users to interact with digital objects in an immersive environment. Therefore, both areas of blockchain development can have positive applications in the virtual world.

First, with the increasing demand for blockchain-related development environments and development tools in the technology field, the demand for BaaS is also growing rapidly. BaaS is a cloud-based blockchain development platform. It can be expected

that a lot of resources and funds will be wasted when developing blockchains that meet the various needs of the virtual world, and BaaS can effectively reduce this problem. In addition, with the increase in transaction demand, the phenomenon of inter-chain transactions is also increasing. By developing exchange functions within BaaS, it is possible to build an environment that enables smooth transactions between chains. Virtual worlds can also generate identity verification capabilities via blockchain. In the case of Bitcoin and many virtual currencies, the authentication process is performed via asymmetric keys. User privacy is guaranteed when asymmetric keys are used. Hyperledger creates an MSP (Membership Service Provider) and uses a system to manage user personal information for each ledger. This method provides convenience in management, and can also be easily connected when linking with applications.

Secondly, in the financial field, when building an economic system, it can be developed and classified according to asset types. For assets with high liquidity such as cash stocks, the transparency and liquidity of assets can be checked through distributed storage and calculation methods such as virtual currency. Assets with low liquidity such as real estate and artwork can be traded by generating NFT to ensure asset safety and profitability. In addition, digital goods in the virtual world can also be securely traded through the blockchain. With the development of the digital age, the demand for digital commodity trading is also increasing. Trading digital

goods through the blockchain can prevent copyright infringement caused by network copy and paste, while also ensuring transaction security by tracking all transaction details. Blockchain also has the profitability of reducing intermediary costs due to transactions without a central intermediary.

Blockchain technology can be widely used in the virtual world, but its shortcomings cannot be ignored. Excessive price volatility of cryptocurrencies can cause financial losses to users and cause chaos in the financial sector. Also, there is a phenomenon where the source files are modified or replaced after the NFT is created, which can lead to later asset risks. When the source files of digital products are very large, it is also difficult to upload all of them to the chain for transactions. As a decentralized system, blockchain also has the problems of low real-time processing efficiency and unsmooth verification of transactions. In terms of technology, the compatibility problem between BaaS platforms cannot be ignored. So far, there is no unified standard for each BaaS platform. And because the virtual world has no country restrictions, when verifying identity, the verification standards between countries must also be unified.

Therefore, this research divides the blockchain technology into two fields, the technical field and the financial field, through literature and examples, and proposes a direction for the application of blockchain technology in the virtual world. In the future, there are plans to collect expert opinions to further study the significance and methods of updating blockchain technology in the virtual world.

Key Terms – Blockchain As A Service, DeFi, digital transaction, NFT, virtual world

D2.2 Analysis of NFT diversity trends using topic modeling and social network analysis

Hee-young Joe
Ewha Woman University
Cyber Security
mugudeli601@ewhain.net

Na-yeon Kim
Ewha Woman University
Cyber Security
bluelemon112@ewhain.net

Ho-yeon Park
Ewha Woman University
Computer Science &
Engineering
hoyeonpark@ewha.ac.kr

Abstract – *Non-Fungible Token is a type of crypto asset based on blockchain technology that is meant to be unique. It has become a widely accepted concept with elevated accessibility either as a buyer and a creator via the popularization of platforms that offer free minting. This paper attempts to organize papers that articulate NFT in diverse perspectives and ultimately suggest the next methods to analyze NFT's trends.*

Key Terms – *NFT, non-fungible token, blockchain*

I. Introduction

Non-fungible token (NFT) is a digital asset delivered via blockchain technology with its uniqueness proven based on smart contracts. It has paved ways for replicable digital assets to acquire tradeable rights (Nadini et al., 2021; Dowling, 2022). While contents can be minted on-chain or off-chain, it theoretically provides the irreplaceable ownership value once it is minted.

NFT is spotlighted as a novel method to create unique, non-repudiable, authorized contract that has been managed by hand or managed in a scanned format. Policy makers assume NFT as the next-generation format of existing assets that can revolutionize how documents are created and used. As numerous business people including Mark Zuckerberg of Meta anticipate a metaverse with substantial number of humans and materials transferred into its digital twin, NFT is also attracting attention as means of expressing digital existence.

Before NFT, contemporary digital assets were easily replicable. After the advent of NFT, through the blockchain technology that enable non-replicability and increased security, assets were given proprietary value. Unlike other formats of digital assets, not only can NFT provide value to intangible assets, it enables trade of ownership upon game assets, digital arts, and other properties

involved in various fields (Chalmers et al., 2022 ; Park et al., 2022). However, research topics within Korea mainly involve legal issues and administrative considerations rather than NFT diversity. This study analyzed the research trend of NFT to imply its diversity. We used topic modeling, which is a branch of artificial intelligence and Social Network Analysis widely used in Social Science research. The research data was collected from journals outside Korea, and we proceeded text mining with the keyword “NFT.” Through this study, we desired to grasp the research trend by consuming large volumes of data and practicing objective analysis.

The paper is organized as follows. Section II presents the related literature. Section III describes this paper methods. In Section IV, we will discuss the experiment results. Finally, the paper is concluded in Section V.

II. NFT

NFT is a token that endows a unique identifier to digital assets thereby generating “NFT ownership” and preventing duplication. As the implicated value of each token is different due to the duplication prevention technology based on blockchain technology, NFT enables the proof of originality and ownership unlike other digital assets (Gong et al., 2021; Zhang et al., 2021). This is also attributed to the fact that it is a Ethereum-based coin with a non-replicable tag assuring uniqueness. Digital asset ownership sparked conversation about the possibility of cryptocurrency replacing not only the value representation of artworks of a prominent artist but also every other assets in real life. NFT is already in use to prove ownership of various media such as the very first tweet message, doodles of children, adorable cat drawings, and memes.

III. Methodology

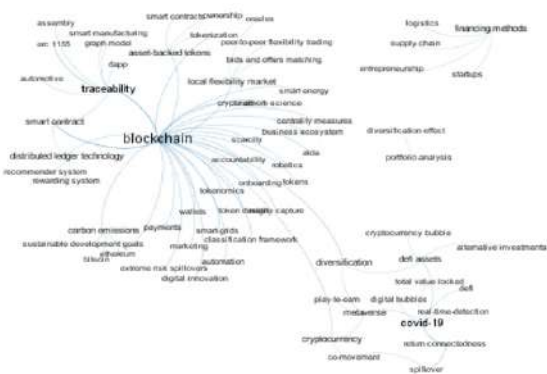
Text mining is a vocabulary that joins "Text and Mining. It is one of unstructured data analysis

tools that extracts meaningful information within a document. It is comprised of web crawling, data pre-processing, data extraction, data analysis, and data utilization in sequence. This study attempted to proceed text mining using LDA(Latent Dirichlet Allocation) which is a topic modelling method widely used for document analysis, and Social Network Analysis which is one of Social Studies research analysis tactics. LDA was used to analyze research trends by constructing relationship indicators utilizing singular value decomposition between a vocabulary and a concept. Social Network Analysis used a complex system and devised groups of socially connected objects. The analysis was undergone under the construct that individuals formulate networks upon interactions. The network theory was calculated based on graph theory.

IV. Experiment results

The data is comprised of articles from the "Science Direct" and "IEEE" between 2019 January and 2022 February, searched with keywords "non-fungible token," and "NFT." Unexpectedly, the keyword "NFT" was also a traditional abbreviation of a biochemistry term "neurofibrillary degeneration" and after removing relevant articles we acquired 32 research articles with which we proceeded our experiment.

Before conducting LDA experiment, data was pre-processed: punctuation marks and symbols were excluded, words were decapitalized and undergone stemming, and stopwords and other unnecessary vocabularies were removed as well. The term "covid-19" was intentionally included in decapitalized form because it is an important keyword that implies the time period. After that, we proceeded LDA experiment based on the calculation of topic importance in relation to NFT and similarity between topics.



<Figure 1> Social network analysis experiment result

The result of utilizing LDA methodology is shown in <FIGURE 1>. "blockchain", "covid-19" and "traceability" appeared as the essential words. Executing Social Network Analysis based on important word matrix made with LDA.

V. Conclusions

Unlike contemporary studies on NFT that focus on a single topic, we executed quantitative analysis encompassing all areas relevant with NFT in order to provide novel insight. As the result of our experiment, we discovered that the research trend on "NFT" began with "blockchain" and "COVID-19." In later studies, we assume that studying the research trend on "NFT" before and after the execution of administrative measures will provide interesting implications.

Reference

Nadini, Matthieu, et al. "Mapping the NFT revolution: market trends, trade networks, and visual features." Scientific reports 11.1 (2021): 1-11.

Dowling, Michael. "Fertile LAND: Pricing non-fungible tokens." Finance Research Letters 44 (2022): 102096.

Chalmers, Dominic, et al. "Beyond the bubble: Will NFTs and digital proof of ownership empower creative industry entrepreneurs?." Journal of Business Venturing Insights 17 (2022): e00309.

Park, Andrew, et al. "The evolution of nonfungible tokens: Complexity and novelty of nft use-cases." IT Professional 24.1 (2022): 9-14.

Gong, Anmin, et al. "A Review of Neurofeedback Training for Improving Sport Performance From the Perspective of User Experience." Frontiers in Neuroscience 15 (2021).

Zhang, Wenyi, Benjamin A. Friedman, and James A. Bain. "Simulation of a Thermally Efficient Heat-Assisted Magnetic Recording Ridge Waveguide NFT on an AIN Heat Sink." IEEE Transactions on Magnetics (2021).

D2.3 모바일 뱅킹 서비스에 대한 서비스품질과 중요도 파악 : BERTopic 및 감성분석을 통한 사용자 리뷰 분석

김민지, 차경진
한양대 경영대학

Abstract - COVID-19의 발생 이후로 대부분의 비즈니스 활동들이 억제되는 동시에 소비자 행동의 변화와 비즈니스의 디지털화가 가속되고 있다. 그 중 금융산업은 디지털 뱅킹의 사용이 더욱 활발해졌으며 디지털 경험에 대한 고객의 욕구가 높아졌다. 이에 핀테크 및 기타 디지털에 정통한 기업의 경쟁이 치열해졌으며, 은행은 이에 맞춰 핵심 플랫폼을 현대화해야 한다고 말한다(McKinsey and Co, 2021; McKinsey and Co, 2022).

플랫폼의 현대화와 함께 더 많은 사용자 확보를 위해서는 사용자들이 실제 불만을 파악하여 개선하는 과정이 필요하다. 이를 파악하는 방법 중 하나는 사용자의 리뷰 분석이다. 리뷰는 사용자들의 실제 사용 경험을 바탕으로 작성되었기 때문에 제품인 서비스에 대한 솔직한 생각과 의견을 알 수 있다. 또한 다양한 디지털 플랫폼을 통해 사용자가 공유한 리뷰는 사용자의 긍정적이고 부정적인 경험을 식별하는데 도움이 된다(Chatterjee, S., 2019). 모바일 뱅킹의 서비스 품질에 대한 연구는 많이 존재하지만, 모바일 뱅킹에서 서비스 품질을 측정하기 위해 리뷰를 다룬 연구는 많지 않았다. 따라서, 이에 관한 연구는 진행될 가치가 있다. 이에 본 연구에서는 사용자의 모바일 뱅킹 애플리케이션의 리뷰 데이터를 수집하여 모바일 뱅킹의 서비스 품질에 대한 연구를 진행한다. 수집된 데이터를 통하여 모바일 서비스 품질을 측정하고, 우선적으로 고려해야 하는 서비스 품질 차원을 알기 위해 서비스 품질 중요도를 분석한다.

본 연구를 통하여 온라인 기반 은행의 모바일 뱅킹 서비스와 오프라인 기반 은행의 모바일 뱅킹 서비스에서 사용자가 인식하는 서비스 품질에 대한 차이를 확인했다. 또한, 서비스 품질의 점수를 차원별로 측정했을 뿐만 아니라 모바일 뱅킹 서비스의 전체적인 품질 점수를 측정했다. 이에 더해, 서비스 품질 차원의 중요도를 비교하여 서비스 품질을 개선을 위해 우선적으로 고려해야 하는 서비스 품질 차원을 확인했다. 본 연구는 모바일 뱅킹 서비스의 품질과 중요도를 파악할 수 있는 방법을 제시하였으며, 이를 바탕으로 우선적으로 개선이

필요한 모바일 뱅킹 서비스 품질 차원을 선정하는 지표를 제시한다.

Key Terms - Mobile banking service, Service quality, Service quality importance, Sentiment analysis, Topic model

I. 참고문헌

Abuzayed, Abeer, and Hend Al-Khalifa. "BERT for Arabic Topic Modeling: An Experimental Study on BERTopic Technique." *Procedia Computer Science* 189 (2021): 191-194.

Al-Natour, Sameh, and Ozgur Turetken. "A comparative assessment of sentiment analysis and star ratings for consumer reviews." *International Journal of Information Management* 54 (2020): 102132.

Arcand, M., PromTep, S., Brun, I. and Rajaobelina, L. (2017), "Mobile banking service quality and customer relationships", *International Journal of Bank Marketing*, Vol. 35 No. 7, pp. 1068-1089.

Chatterjee, S. (2019), "Explaining customer ratings and recommendations by combining qualitative and quantitative user generated contents", *Decision Support Systems*, Vol. 119, pp. 14-22.

Dahal, Biraj, Sathish AP Kumar, and Zhenlong Li. "Topic modeling and sentiment analysis of global climate change tweets." *Social Network Analysis and Mining* 9.1 (2019): 1-20.

Ghasiya, Piyush, and Koji Okamura. "Investigating covid-19 news across four nations: A topic modeling and sentiment analysis approach." *Ieee Access* 9 (2021): 36645-36656.

Jeong, B. K., J. H. Yoon, and J. M. Lee. "Social media mining for product planning: A product opportunity mining a pproach based on topic modeling

and sentiment analysis." *International Journal of Information Management* 48 (2019): 280-290.

Jun, M. and Palacios, S. (2016), "Examining the key dimensions of mobile banking service quality: an exploratory study", *International Journal of Bank Marketing*, Vol. 34 No. 3, pp. 307-326.

Kim, S. Y, J. H. Sim, and Y. J. Chung. "The Effect of Changes in Airbnb Host's Marketing Strategy on Listing Performance in the COVID-19 Pandemic." *Journal of Intelligence and Information Systems* 27.3 (2021): 1-27.

Leem, B. H. and S. W. Eum, "Using text mining to measure mobile banking service quality." *Industrial Management & Data Systems* (2021).

McKinsey and Co, Banking on the 'soft stuff', Available at :
[https://www.mckinsey.com/business-functions/transformation/our-insights/banking-on-the-soft-stuff\(2021\)](https://www.mckinsey.com/business-functions/transformation/our-insights/banking-on-the-soft-stuff(2021)), Accessed 28th Mar 2022

McKinsey and Co, How to get a core banking transformation right: Eight mistakes to avoid, Available at :
[https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/tech-forward/how-to-get-a-core-banking-transformation-right-eight-mistakes-to-avoid\(2022\)](https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/tech-forward/how-to-get-a-core-banking-transformation-right-eight-mistakes-to-avoid(2022)), Accessed 9th April 2022

McKinsey and Co, McKinsey's Global Banking Annual Review, Available at :
[https://www.mckinsey.com/industries/financial-services/our-insights/global-banking-annual-review\(2021\)](https://www.mckinsey.com/industries/financial-services/our-insights/global-banking-annual-review(2021)), Accessed 28th Mar 2022

Shaikh, Aijaz A., Majed D. Alharthi, and Hawazen O. Alamoudi. "Examining key drivers of consumer experience with (non-financial) digital services—An exploratory study." *Journal of Retailing and Consumer Services* 55 (2020): 102073.

Shankar, A., Jebarajakirthy, C. and Ashaduzzaman, M. (2020), "How do electronic word of mouth practices contribute to mobile banking adoption?", *Journal of Retailing and Consumer Services*, Vol. 52, p. 101920.

Zhang, Le, Qiang Yan, and Leihan Zhang. "A text analytics framework for understanding the relationships among host self- description, trust perception and purchase behavior on Airbnb." *Decision Support Systems* 133 (2020): 113288.

D2.4 KB-BERT: 금융 특화 한국어 사전학습 언어모델과 그 응용

Donggyu Kim
KB국민은행 테크그룹
금융AI센터
donggyukimc@kbf.com

Dongwook Lee
KB국민은행 테크그룹
금융AI센터
dylan@kbf.com

Jangwon Park
KB국민은행 테크그룹
금융AI센터
jangwon.park@kbf.com

Sungwoo Oh
KB국민은행 테크그룹
금융AI센터
swoh@kbf.com,

Sungjun Kwon
KB국민은행 테크그룹
금융AI센터
sjkwon@kbf.com

Inyong Lee
KB국민은행 테크그룹
금융AI센터
ilyee@kbf.com

국문초록

대량의 말뭉치를 비지도 방식으로 학습하여 자연어 지식을 획득할 수 있는 사전학습 언어모델 (Pre-trained Language Model)은 최근 자연어 처리 모델 개발에 있어 매우 일반적인 요소이다. 하지만, 여타 기계학습 방식의 성격과 동일하게 사전학습 언어모델 또한 학습 단계에 사용된 자연어 말뭉치의 특성으로부터 영향을 받으며, 이후 사전학습 언어모델이 실제 활용되는 응용단계 태스크 (Downstream task)가 적용되는 도메인에 따라 최종 모델 성능에서 큰 차이를 보인다. 이와 같은 이유로, 법률, 의료 등 다양한 분야에서 사전학습 언어 모델을 최적화된 방식으로 활용하기 위해 각 도메인에 특화된 사전학습 언어모델을 학습시킬 수 있는 방법론에 관한 연구가 매우 중요한 방향으로 대두되고 있다. 본 연구에서는 금융(Finance) 도메인에서 다양한 자연어 처리 기반 서비스 개발에 활용될 수 있는 금융 특화 사전학습 언어모델의 학습 과정 및 그 응용 방식에 대해 논한다. 금융 도메인 지식을 보유한 언어모델의 사전학습을 위해 경제 뉴스, 금융 상품 설명서 등으로 구성된 금융 특화 말뭉치가 사용되었으며, 학습된 언어 모델의 금융 지식을 정량적으로 평가하기 위해 토픽 분류, 감성 분류, 질의 응답의 세 종류 자연어 처리 데이터셋에서의 모델 성능을 측정하였다. 금융 도메인 말뭉치를 기반으로 사전 학습된 KB-BERT는 KoELECTRA, KLUE-RoBERTa 등 State-of-the-art 한국어 사전학습 언어 모델과 비교하여 일반적인 언어 지식을 요구하는 범용 벤치마크 데이터셋에서 견줄 만한 성능을 보였으며, 문제 해결에 있어 금융 관련 지식을 요구하는 금융 특화 데이터셋에서는 비교대상 모델을 뛰어넘는 성능을 보였다.

주제어

자연어 처리, 금융

D2.5 텍스트마이닝을 활용한 지역화폐 이슈 분석

박순형
동아대학교 경영대학
shp7443@naver.com

홍순구
동아대학교 경영대학
shong@dau.ac.kr

Abstract - 지역화폐는 대안적 사회운동의 하나로 운영되어 공동체화폐의 개념에서 출발하였으며 코로나 19 이후 지역경제 활성화와 지역순환경제 구축을 목적으로 활용하고 있고 매년 발행 규모를 늘리며 사회적 관심도 증가하고 있다.

이에 본 연구는 지역경제 활성화를 위해 시행되고 있는 ‘지역화폐’에 관련된 신문기사를 분석하여 사회적으로 형성되고 있는 주요 이슈가 무엇인지를 파악하는 것이다. 이를 위하여 지역화폐가 활성화되기 시작한 2017년부터 2021년까지 보도된 ‘지역화폐’ 관련 신문기사 21,884건을 수집하고 전처리과정을 거쳐 빈도분석과 LDA분석을 실시하였고 총 15개의 토픽을 도출하였다.

연구결과, 지자체별로 발행하고 운영하는 지역화폐는 지역 내에서 사용하게 함으로써 소비의 역외유출을 차단하여 소상공인을 보호하여 지역경제를 활성화하고 지역화폐를 정책적 발행으로 활용함으로써 다양한 분야에서 복지 혜택을 부여 하였다. 또한 지역화폐의 안정적 운영과 부정유통 방지를 위하여 블록체인 기술을 도입하고 지역화폐와 공공배달앱서비스의 협업을 통하여 지역 내 자영업자와 소비자 간 상생의 가능성을 제시하였다. 그러나 지역화폐의 발행과 사용 확대에 따라 중앙 및 지방자치단체의 보조금 증가 등 경제적 역효과에 대한 우려의 의견도 있었다.

본 연구의 공헌도는 다음과 같다. 학술적으로는 본 연구가 지역화폐에 대한 사회적 관심이 높아지고 이에 대한 신문기사 보도량이 증가하기 시작한 시점에서 토픽 모델링 기법을 이용하여 사회적 이슈와 변화를 파악하고 그 결과를 제시하였다는 점에서 의의가 있으며, 실무적으로는 향후 지역화폐 연구에서 방향성을 제시할 때 기초자료로 활용될 수 있을 것이다.

주제어 - 지역화폐, 빅데이터, 텍스트마이닝, 토픽 모델링분석, LDA

이 논문은 2018년 대한민국 교육부와 한국연구재단의 지원을 받아 수행된 연구임
(NRF-2018S1A3A2075240)

[DAY 1]

E2 [KIISS-Paper Session]
인공지능과 딥러닝 2

E2.1 CNN과 분류기의 결합을 이용한 피부질환 분류모델 구축

정선경
 순천향대학교 미디어랩스대학
 sk1012@sch.ac.kr

우지영
 순천향대학교 미디어랩스대학
 jywoo@sch.ac.kr

I. 연구배경 및 목적

서양인에게 흔한 질환으로 알려져 있던 피부암이 국내에서도 급증하는 양상을 보이고 있다. 피부암은 조기 발견 시 90% 이상 완치가 가능하지만 대부분의 환자가 피부암을 육안으로 판별하기 어렵기 때문에 상당히 진행된 후에 병원을 찾게 되어 치사율이 높다.

최근 한림대 강남성심병원 성형외과팀은 딥러닝 기술 기반으로 한 인공지능이 피부암을 정확하게 찾아낸다는 연구결과[1]를 발표해 주목을 받고 있다. 이에 김성환 교수는 “실제 진료에서 전문의는 시각 정보에만 의존하지 않고, 환자의 여러 특징과 병력을 종합해 진단한다.” 라고 인터뷰했다. 서울 아산병원 피부과 장성은 의사 또한 “병변의 사진만 보고 진료하는 방식은 병원에서 의사가 실제로 환자의 병변을 보고 진료하는 것 보다는 아직 부정확하며 한계가 있다.” 며 지적했다. 실제 아직 많은 피부과 전문의들은 AI진단모델이 진료에 도입하기에는 성급하다고 판단하고 있다.

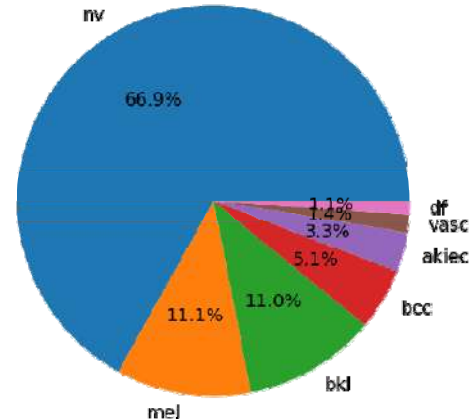
앞서 지적했던 피부암 AI진단모델의 단점은 시각정보에만 의존한다는 점이다. 이를 보완하고자 환자의 다양한 특성을 고려해 만든 CNN-분류기 결합 모델을 제안한다.

II. 연구 방법

2.1 데이터 소개 및 전처리

데이터 출처는 HARVARD dataverse Medical University of Vienna이며, HAMmetadata(Human Against Machine with 10000 training images metadata) [<https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/DBW86T>] 데이터 세트를 사용했다. 이 데이터는 다양한 인구로부터 수집된 피부경 이미지로 총 10015개의 피부경 이미지로 이루어져 있다. Metadata는 총 7개의 칼럼이 존재하며, 피부질환

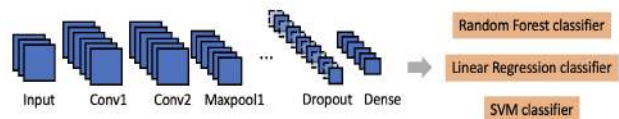
종류는Melanocytic nevi(nv), Melanoma(mel), Benign keratosis-like lesions(bkl), Basal cell carcinoma(bcc), Actinic keratoses(akiec), Vascular lesions(vasc), Dermatofibroma(df) 7가지이다.



<그림1> 피부질환 종류 파이차트

위의 그림에서 보듯이, 분류해야 할 피부질환 종류 7개중nv가 전체 데이터의 약 67%로 클래스 불균형임을 알 수 있다. 이를 해결하고, 과적합을 피하고자 이미지증강(image augmentation) 기법을 사용했다.

2.2 모델 구조



<그림2> CNN-분류기 모델 결합 예시 구조

CNN모델과 세가지 분류기(RandomForest[2], Linear Regression, SVM) 를 결합하는 모델을 제안한다. CNN모델은 Xception네트워크를 사용하고, 분류기는 세가지를 비교해 볼 예정이다.

2.3 모델 구축 과정

<표 1> CNN에 적용한 값

CNN(Xception)에 적용한 값	
train/validation/test	6/2/2
loss function	categorical_crossentropy
optimizer	adam(lr=0.001)
epoch/batch_size	50/256

CNN(Xception)모델로부터 이미지의 특징을 추출한 값과 기존 HAMmetadata를 합친 데이터프레임을 만들어준다. 이 데이터프레임에서 dx_type(진단유형), localization(피부질환 부위), sex(성별), age(나이) 와 앞서 CNN에서 추출한 특징(length 52)이 독립변수가 되고, cell_type_idx(피부질환 7가지 종류를 0-6으로 변환한 값)가 종속변수가 된다. 그리고나서 RandomForest, LinearRegression, SVM 세가지 분류기에 대입한다.

2.4 성능평가지표

클래스가 불균형한 데이터이기 때문에 minor class에 대한 precision과 recall을 위주로 비교하고, F1-score를 최종 성능평가로 사용한다. F1-score 중에서도 weighted average값을 사용해 비교해볼 것이다. minor class는 7가지 피부질환 중 데이터 개수 하위 3가지로 정의한다.

III. 연구 결과

<표 2> 소수클래스에 대한 분류기별 precision, recall값 비교

		precision	recall	F1-score
RF	akiec	79%	80%	79%
	df	86%	83%	84%
	vasc	89%	86%	87%
LR	akiec	87%	82%	84%
	df	90%	83%	86%
	vasc	88%	82%	85%
SVM	akiec	86%	78%	82%
	df	95%	83%	88%
	vasc	92%	82%	87%

Precision과 recall값을 보면 전체적으로 RandomForest보단 LinearRegression과 SVM이 더 높다.

<표 3> 전체 클래스에 대한 분류기별 F1-score값과 accuracy값 비교

	RF	LR	SVM
F1-score	92.85%	93.21%	92.96%
accuracy	92.96%	93.15%	92.84%

F1-score는 LinearRegression의 F1-score가 93.21%로 가장 높은 것을 알 수 있다. Xception 단독모델일 때의 정확도는 81%로 세 분류기의 정확도와 비교해보면 성능이 높아진 것을 알 수 있다.

IV. 결론

클래스가 불균형한 데이터였으나 F1-score와 accuracy의 차이가 거의 없으므로 클래스 불균형으로 인한 문제는 적어 보이는 것을 알 수 있다. 또한 세가지 분류 모델 중 Linear Regression의 F1-score와 accuracy가 가장 높았다.

한림대 강남성심병원 성형외과 팀은 전문의 피부암진단 정확도는 약 95%라고 발표했다. 이는 이번 구축 모델의 성능인 93%와 비교해보았을 때 전문의와 비슷한 성능을 보인다. 또한 앞에서 여러 전문의들이 AI진단모델에서 지적인 ‘병변의 사진에만 의존하는 방식’을 보완하고자 이미지 외에도 환자의 다양한 특성을 고려해 만든 모델이라는 점에서 기존의 AI진단모델과 차별화 된다.

환자가 직접 병원에 방문하지 않고도 스스로 피부암을 발견할 수 있게 해줄 뿐만 아니라 AI진료의 안정성과 효과성을 높여줄 것이다. 더 나아가 실제 피부암의 주된 원인인 다양한 기저질환과 같은 환자의 특성을 추가한다면 더욱 높은 성능을 보일 것이다.

V. 참고문헌

- [1] LouisR, S., T.-K, and M.Gray, “Using deep learning for dermatologist-level detection of suspicious pigmented skin lesions from wide-field images” Journal of Science Translational Medicine, Vol.13, No.581(2021).
- [2] Kwak, G. H., and C. H, “Potential of Hybrid CNN-RF Model for Early Crop Mapping with Limited Input Data”, Department of Geoinformatic Engineering, Inha University, Korea, 2021.

E2.2 비전 트랜스포머와 K-최근접 트리플 마이닝을 활용한 시각예술 이미지의 검색에 관한 연구

간정현
연세대학교 디지털애널리틱스융합학과
jhgan00@yonsei.ac.kr

김우주
연세대학교 산업공학과
wkim@yonsei.ac.kr

Abstract - 최근 시각예술 분야에서 다양한 디지털화 데이터셋이 구축되고 있으며, 이에 따라 머신러닝 기반 이미지 검색 기술의 활용 가능성이 열리고 있다. 이러한 흐름에 따라 본 연구에서는 디지털화 시각예술 이미지의 검색 성능을 고도화하기 위한 검색 모델 학습 방법을 제안한다. 본 연구에서는 이미지의 스타일과 장르를 하나의 임베딩 벡터에 동시에 반영하기 위한 K-최근접 트리플 마이닝 기법을 제안한다. 해당 기법을 비전 트랜스포머 모델에 적용하여 합성곱 신경망 기반의 모델들보다 위키아트 데이터셋에서 뛰어난 검색 성능을 얻을 수 있었다.

Key Terms - 비전 트랜스포머, 메트릭 러닝, 시각예술 이미지, 이미지 검색

I. 서론

최근 딥러닝 기반 이미지 처리 기술은 급속도로 발전하였으며, 이러한 발전에 따라 다양한 응용 서비스들이 제공되고 있다. 모바일 기기로 촬영한 이미지를 시스템에 질의하면 유사한 상품, 혹은 관련 있는 문서들을 검색해주는 이미지 기반 검색 서비스가 대표적인 사례이다. 예술 분야도 이러한 흐름에서 예외가 아니다. 시각예술 분야에서도 이미 적게는 수천 건부터 많게는 수천만 건의 이미지를 포함하는 디지털화 데이터셋이 구축되어 있다(Castellano and Vessio, 2021). 이렇게 축적된 데이터셋을 기반으로 시각예술 이미지 검색 기술 역시 활발하게 연구되고 있다.

하지만 기존의 연구들에서는 작품의 스타일과 장르를 동시에 고려하려는 시도가 많지 않았다. 기존의 시각예술 이미지 검색 연구 대부분 작품의 스타일에만 초점을 맞추어왔다(Matsuo et al., 2016; Tan et al., 2021; Ruta et al., 2021). 하지만 그림의 장르는 스타일과 함께 그림의 시각적인 성질을 표현하는 중요한 메타데이터이다. <그림 1>을 보면 스타일만을 학습한 모델과 스타일과 장르를 모두 학습한 모델의 차이를 파악할 수 있다. 두 모델의 검색 결과는 모두 쿼리 이

미지와 일치하는 스타일을 갖는다. 하지만 스타일만 학습한 모델의 검색 결과는 쿼리 이미지의 의미를 적절하게 반영하지 못하는 경우가 많다. 반면 스타일과 장르를 모두 학습한 모델의 경우 쿼리 이미지의 스타일뿐 아니라 ‘아기예수를 안은 성모’라는 이미지의 내용까지 상당히 유사하게 반영하고 있음을 알 수 있다.

또한 이미지 처리에 사용되는 뉴럴 네트워크 구조가 계속해서 발전되어왔음에도 불구하고 기존의 연구들은 대부분 합성곱 신경망에 기반한 네트워크를 사용해왔다(Seguín et al., 2016; Matsuo et al., 2016; Castellano et al., 2020; Tan et al., 2021; Ruta et al., 2021). 특히 최근 이미지 관련 처리 관련 태스크에서 뛰어난 성능을 보이는 비전 트랜스포머(Dosovitskiy et al., 2021)를 활용한 시각예술 이미지 검색 연구는 찾아보기 어렵다. 하지만 비전 트랜스포머를 기반으로 다른 분야의 많은 연구들이 이미지 인식에서 뛰어난 성능을 보이고 있는 바(Dong et al., 2021; He et al., 2021), 시각예술 이미지 분야에서도 충분히 해당 모델 구조를 적용하고 연구해볼 필요가 있다.

따라서 본 연구에서는 작품의 스타일과 장르 정보를 동시에 반영하는 멀티 태스크 학습 기법을 제안한다. 제안된 프레임워크에서 모델은 스타일/장르 분류 손실함수와 K-최근접 이웃 트리플 손실함수를 통해 학습된다. 이러한 방식으로 학습된 검색 모델은 위키아트 데이터셋에 대한 스타일/장르 검색 성능 모두에서 합성곱 신경망 기반의 모델들보다 뛰어난 성능을 보인다. 또한 <그림 3>에서 볼 수 있듯 스타일/장르가 일치하지 않은 검색 결과에서도 모델이 쿼리 이미지의 구도, 색조, 의미 등을 유사하게 반영하고 있음을 알 수 있다.

II. Figures and Tables

<표 1> 위키아트 검색 성능(Precision at k)

Tan et al., 2021	0.5232	0.5829
Proposed	0.6860	0.7909



<그림 1> 스타일을 학습한 모델(상)과 스타일/장르를 모두 학습한 모델(하)



<그림 2> 제안된 모델의 검색 결과



<그림 3> 스타일/장르가 일치하지 않는 검색 결과

III. 참고문헌

Castellano, Giovanna and Gennaro Vessio. "Deep learning approaches to pattern extraction and recognition in paintings and drawings: an overview." *Neural Comput. Appl.* 33 (2021): 12263-12282.

Dong, Xiaoyi et al. "PeCo: Perceptual Codebook for BERT Pre-training of Vision Transformers." ArXiv abs/2111.12710 (2021): n. pag.

Dosovitskiy, Alexey et al. "An Image is Worth 16x16 Words: Transformers for Image Recognition at Scale." ArXiv abs/2010.11929 (2021): n. pag.

He, Kaiming et al. "Masked Autoencoders Are Scalable Vision Learners." ArXiv abs/2111.06377 (2021): n. pag.

Jun, HeeJae et al. "Combination of Multiple Global Descriptors for Image Retrieval." ArXiv abs/1903.10663 (2019): n. pag.

Matsuo, Shin and Keiji Yanai. "CNN-based Style Vector for Style Image Retrieval." *Proceedings of the 2016 ACM on International Conference on Multimedia Retrieval* (2016): n. pag.

Tan, Wei Sheng, Wan Yoke Chin, and Khai Yin Lim. "CONTENT-BASED IMAGE RETRIEVAL FOR PAINTING STYLE WITH CONVOLUTIONAL NEURAL NETWORK." *International Conference on Digital Transformation and Applications (ICDXA)*. Vol. 25. 2021.

E2.3 CEP를 활용한 데이터센터 통합 장애 분석

신현종

한화시스템/ICT, IDC운영혁신팀
hjshin09@hanwha.com

양승정

한화시스템/ICT, IDC운영혁신팀
yeod0301@hanhwa.com

김성근

한화시스템/ICT, IDC운영혁신팀
kimsk800527@hanwha.com

천병환

한화시스템/ICT, IDC운영혁신팀
thousand@hanwha.com

초록

데이터센터의 장애 사전 분석을 위해 로그분석, 시계열 분석 기반의 패턴 분석, 빅데이터 분석을 활용한 이상 감지 등 다양한 방법들이 시도되고 있다. 이러한 방법들은 단일 장비 기준으로 적용되고 있으나, 실제 발생하는 이벤트 및 수치 값의 종류는 방대할 뿐만 아니라, 관련된 업무와 시스템의 종류가 상당히 복잡하여 통합장애관리가 쉽지 않다. 이에 다양한 장비의 통합장애관리를 위해서는 단일 장비에서 발생하는 이벤트뿐만 아니라 다양한 장비들에서 발생하는 복합적인 이벤트들이 서로 상호작용하며 적용되어야 한다.

본 논문에서는 인프라에서 발생하는 이벤트를 중심으로 2차 활용이 가능한 이벤트를 생성한 뒤, 의미를 순차적으로 추적할 수 있는 구간별 분석을 병행하게 된다. 또한, 인프라 장애 이상징후 사전 감지와 신속한 대응을 위해 Causal Reasoning 기반의 분석을 활용하였다.

주제어

인프라장애 분석, 복합이벤트프로세스, 이상징후사전감지, Causal Reasoning, Anomaly Detection

E2.4 Masked Autoencoder와 SE-block 기반의 Vision Transformer 을 활용한 딥페이크 탐지에 관한 연구

박동재
연세대학교 디지털애널리틱스 융합협동과정
pdj1018@gmail.com

김우주
연세대학교 산업공학과
wkim@yonsei.ac.kr

Abstract - 최근 다양한 딥페이크 생성 알고리즘을 이용한 디지털 범죄가 증가함에 따라, 딥페이크 탐지 알고리즘의 개발 또한 필수적이게 되었다. 이에 따라 영상의 이미지에서 전역정보와 지역정보를 모두 활용할 수 있는 비전 트랜스포머 기반에 Squeeze and Excitation Block을 이용한 딥페이크 탐지 알고리즘을 개발하게 되었다. 또한 Masked Auto Encoder 기법으로 사전학습된 방법을 이용해 탐지 알고리즘의 정확도를 향상 시켰다.

Key Terms - Deepfake Detection, Face Detection, Masked Autoencoder, Squeeze and Excitation Block, Vision Transformer,

I. 서론

적대적 생성 신경망(Generative Adversarial Network) 알고리즘이 활성화 됨에 따라 다양한 딥페이크 방식 또한 많은 발전을 이루었다. 딥페이크 방식이란 인공지능을 기반으로 한 얼굴 합성기술을 일컫는 용어로, 원본 영상의 특정 인물에 대해 다른 영상의 인물을 합성하는 방식으로 생성이 된다.

최근 이러한 딥페이크 생성방식이 고도화됨에 따라 기술사용자가 나쁜의도를 가지고 조작된 영상들을 생성한다면 다양한 상황에서 정치적으로 악용될 뿐만 아니라 많은 디지털 범죄에서 활용될 가능성이 있기 때문에 디지털 범죄의 예방차원에서 딥페이크 탐지 알고리즘의 고도화가 필요해 보인다고 생각하여 본 연구를 수행하게 되었다.

기존의 딥페이크 탐지 알고리즘에 관한 선행 연구는 크게 2가지로 나뉘게 되는데 CNN기반의 알고리즘과 VIT기반의 알고리즘이다.

CNN기반의 모델의 경우 Local Feature들에 초점을 맞춘 모델 이기 때문에 전체를 조감하는 global한 특징들에 조금 취약하다는 단점이 있다.

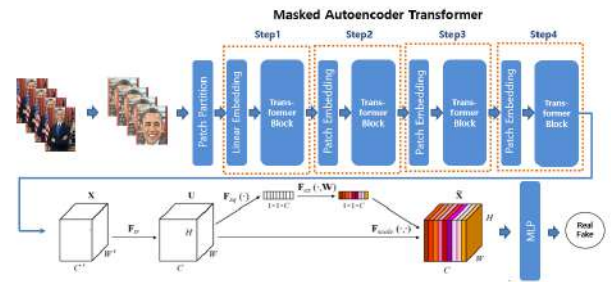
VIT기반의 모델의 경우 하나의 이미지에 대해서 통제로 self-attention을 진행하기 때문에 지역정보(Local Feature)보다는 전역정보에 더 치우쳐져 있다. 그렇기 때문에 Inductive bias가 강하지 않아서 데이터의 양이 적은 경우에는 성능이 낮은 문제가 있다.

앞선 2가지의 선행연구는 모두 Local Feature와 Global Feature간의 Trade-off 를 적절히 조절하지 못하였기 때문에 생긴다고 생각하였다.

따라서 본 연구에선 이미지 단계에서 전역정보(Global Feature)를 잘 활용가능한 Vision Transformer를 Back bone으로 활용하고 이에 지역정보(Local Feature)를 잘 이용한 Masked Autoencoder 기반의 훈련방식을 채택하였고, 마지막 Attention map channel단계에서Squeeze and Excitation Block을 이용하여 지역정보와 전역정보의 trade-off 를 극복하였다.

해당 제안 모델을 이용하여 FaceForensics++ 데이터셋에 현재 알려진 State-of-art 모델 알고리즘과 동일한 조건에서 훈련 및 시험해본 결과, 더 높은 정확도를 보인다.

II. Figures and Tables



<그림 1> 제안 모델 구조도

III. 참고문헌

Rössler, Andreas, et al. "Faceforensics: A large-scale video dataset for forgery detection in human faces." *arXiv preprint arXiv:1803.09179* (2018).

Hu, Jie, Li Shen, and Gang Sun. "Squeeze-and-excitation networks." *Proceedings of the IEEE conference on computer vision and pattern recognition*. 2018.

Dosovitskiy, Alexey, et al. "An image is worth 16x16 words: Transformers for image recognition at scale." *arXiv preprint arXiv:2010.11929* (2020).

MONTERRAT, Daniel Mas, et al. Deepfakes Detection with Automatic Face Weighting. *arXiv preprint arXiv:2004.12027*, 2020. BONETTINI,

Deng, Jiankang, et al. "Retinaface: Single-stage dense face localisation in the wild." *arXiv preprint arXiv:1905.00641* (2019).

He, Kaiming, et al. "Masked autoencoders are scalable vision learners." *arXiv preprint arXiv:2111.06377* (2021).

Liu, Ze, et al. "Swin transformer: Hierarchical vision transformer using shifted windows." *Proceedings of the IEEE/CVF International Conference on Computer Vision*. 2021.

Chollet, F. "Xception: Deep Learning with Depthwise Separable Convolutions [Internet]. *arXiv [cs. CV]*. 2016." (2018).

[DAY 1]

A3 [Academic Forum] Bright Internet
and Emerging Technologies

A3.1 Cryptocurrency Price Fluctuations and Prices of Non-Fungible Tokens: Empirical Evidence from OpenSea

Jaehyeong Park
College of Business, KAIST

Daegon Cho
College of Business, KAIST

Non-fungible tokens (NFTs) have drawn massive attention from creators and collectors to companies outside the art and media industries. Especially, The transparency and credibility of the NFTs amplify the expectations for NFTs as they were expected to solve the royalty and ownership problems. Despite rapidly growing marketplaces and business applications, however, it is not much known about the complex dynamics that play out underneath – how sellers and buyers trade NFTs and how their prices are formed in online marketplaces. It is not only because the concept of NFTs is new but also because the extreme fluctuations of cryptocurrencies used for payment complicate the evaluation of historical prices and the prediction of future prices for NFT traders. In this study, we collected granular data on NFT transactions from OpenSea, the first and largest NFT marketplace, to investigate whether and how ETH fluctuations are related to the listing price set by sellers and the selling price taken by buyers of NFTs listed in ETH, the dominant cryptocurrency of NFT market. Panel regression analyses on repeatedly sold NFTs and the result show that sellers who chose ETH set the listing price much higher (or lower) than they purchased when ETH appreciated (or depreciated). And once listed in ETH, buyers paid a much higher (or lower) price when ETH was stronger. This study is one of the first to inspect NFT pricing with pricing steps. In addition, the results extend the literature on denomination and anchoring effects by examining the effect when using highly volatile currencies in the multi-currency market.

A3.2 Will Cryptocurrency-Based Loyalty Programs Thrive as the Coin Price Rises?

Euro Bae
*College of Business,
KAIST*

Hyeokkoo Eric Kwon
*Nanyang Technological
University*

Jaywon Lee
Sejong University

Daegon Cho
*College of Business,
KAIST*

Cryptocurrencies have emerged as a new means of loyalty programs that platforms can employ to enhance user participation with greater transparency. However, without a well-orchestrated system that can address the unique vulnerabilities stemming from cryptocurrencies' high volatility and liquidity, the virtue of a cryptocurrency-based loyalty program (i.e., CBLP) will not be realized. Therefore, platforms often adopt a "two-stage" CBLP design, which first awards loyalty points with stable value and allows their conversion into platform-specific cryptocurrencies. We investigate how a two-stage CBLP improves users' participation, exploiting a dataset obtained from a ride-hailing platform that suspended users' point-to-cryptocurrency conversion until 14 weeks after the start of its CBLP. The results illustrate that awarding points enhances users' participation, and the positive effect does not reduce after users encounter the volatility and liquidity of cryptocurrencies through the conversion. We further find that, after the conversion, the loyalty effect becomes more prominent when the cryptocurrency price increases. Notably, however, the loyalty effect diminishes with a coin price increase before the conversion, contrary to platforms' general expectation. We propose an alternative design strategy of encouraging the conversion with additional empirical support, which contradicts common practice.

A3.3 Quantifying Knowledge Synchronization in the 21st century

Jisung Yoon
POSTECH

Jinseo Park
Indiana University

Jinhyuk Yun
KISTI

Woo-Sung Jung
POSTECH

Humans acquire and accumulate knowledge through language usage and eagerly exchange their knowledge for advancement. Although geographical barriers had previously limited communication, the emergence of information technology has opened new avenues for knowledge exchange. However, it is unclear which communication pathway is dominant in the 21st century. Here, we explore the dominant path of knowledge diffusion in the 21st century using Wikipedia, the largest communal dataset. We evaluate the similarity of shared knowledge between population groups, distinguished based on their language usage. When population groups are more engaged with each other, their knowledge structure is more similar, where engagement is indicated by socioeconomic connections, such as cultural, linguistic, and historical features. Moreover, geographical proximity is no longer a critical requirement for knowledge dissemination. Furthermore, we integrate our data into a mechanistic model to better understand the underlying mechanism and suggest that the knowledge "Silk Road" of the 21st century is based online.

[DAY 1]

B3 [Special Session]
인텔리전스 대상 기업 세션 II

B3.1 생성적 AI 기술 기반 가상 아이덴티티 서비스 및 솔루션

한진태 (자이냅스)

B3.2 GeoAI를 활용한 농경지 변화탐지 및 면적 산출 시스템

이민영
선도소프트
mylee@sundosoft.co.kr

최인호
선도소프트
ihchoi@sundosoft.co.kr

손수진
선도소프트
sjsun@sundosoft.co.kr

Abstract - 우리나라는 지역적 안보 요인 때문에 위성영상의 폐쇄적 사용정책으로 민간분야의 위성영상 활용은 한계성이 있다. 또한 우리나라와 중앙아시아의 중위도 국가는 상대적으로 식량안보 공적개발원조 사업 및 해외 직접 투자 흐름에서 소외되었다. 또한 기존에는 지구관측데이터 이용이 부족하여 농경지 파악 및 작물 현황에 대한 사용 가능한 공간자료에 한계가 있었고, 실시간 모니터링에 따른 지표 도출이 이루어지지 않았으며, 통계청과 농촌경제연구원의 통계에 의존한 단순한 비공간 지표 활용이 이루어졌다. 본 연구에서는 코페르니쿠스 데이터 허브를 통해 데이터베이스 연계하여 위성영상 다운로드하고, GeoAI를 통해 경작지의 작황분석하는 과정의 아키텍처와 농작물 작황분석의 프로세스에 대해 설계를 하여 농경지 분석 시스템을 제안한다.

Key Terms - GeoAI, GIS, 빅데이터, 위성영상, 퍼실러닝, 딥러닝

본 연구는 중소기업기술정보진흥원의 창업성장 기술개발사업(과제명 : GeoAI를 활용한 농경지분석 플랫폼 개발) 결과의 일부입니다.

I. 서론

우리나라는 지역적 안보 요인 때문에 위성영상의 폐쇄적 사용정책으로 민간분야의 위성영상 활용은 한계성이 있다. 또한 우리나라와 중앙아시아의 중위도 국가는 상대적으로 식량안보 공적개발원조 사업 및 해외 직접 투자 흐름에서 소외되었다. 또한 기존에는 지구관측데이터 이용이 부족하여 농경지 파악 및 작물 현황에 대한 사용 가능한 공간자료에 한계가 있었고, 실시간 모니터링에 따른 지표 도출이 이루어지지 않았으며, 통계청과 농촌경제연구원의 통계에 의존한 단순한 비공간 지표 활용이 이루어졌다. 기존의 통계자료에 의존을 탈피하여 위성영상을 활용한 농경지 중심의 위도별 접근을 통해 식량안보 관련 콘텐츠를 새롭게 개발하는 혁신이 필요하다.

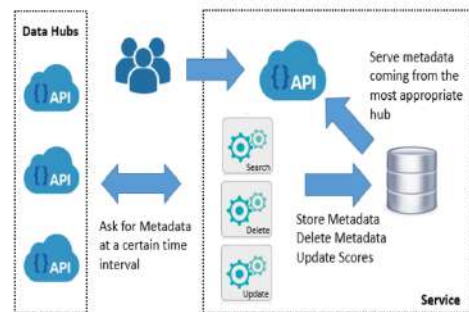
본 논문에서는 EO(Earth Observation) 자료를 활용하여 공간자료를 확보하고, non-EO 자료와 융합하여 식량안보 및 관련된 농경지의 시공간 지표

를 개발하여 기존 한계점을 극복하는 것을 목표로 한다. 코페르니쿠스에서 제공하는 데이터베이스 연계를 통해 위성영상을 GeoAI를 통해 비 경작지의 작황분석하는 과정의 아키텍처와 농작물 작황분석의 프로세스에 대해 설계하여 GeoAI를 활용한 농경지 분석 시스템을 제안한다.

II. 본론

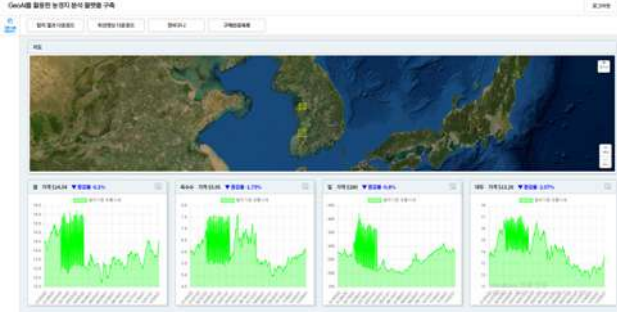
유럽의 혁신 기술인 Copernicus EO(Earth Observation, 지구관측) 수집 및 저장 기법, RNN 기반의 공간 빅데이터 위성영상 이미지 처리기법, JDIG(Joint-Decision Making & Information Governance) 기술을 확보하여 식량안보 분야 의사결정 지원 플랫폼을 개발하는데 혁신성이 있으며, 세부 내용으로는 크게 네 가지를 진행하였다.

첫째로는, 코페르니쿠스에서 제공하는 Sentinel 1과 Sentinel 2 위성영상의 수집 및 다운로드 프로세스를 코페르니쿠스 허브별 데이터 다운로드 링크별 다운로드 속도 스코어링을 통한 최적의 다운로드 방식 고려하며 설계하였고, 수집한 데이터로부터 메타데이터를 추출하여 위성영상 이미지와 함께 아카이빙할 수 있는 방안을 설계하였다.



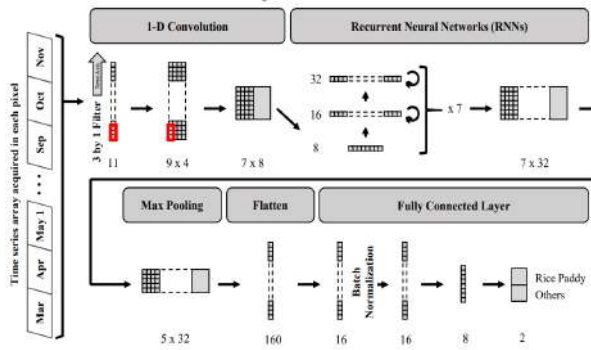
<그림 1> 코페르니쿠스 Hub Data 접근 아카이빙

두 번째로는, 기존에는 식량 안보 관련 데이터 예상과 평가 정보가 미흡하였으나, 본 플랫폼에서는 콘텐츠 개발과 연계하여 정밀 농업 예상치, 관리 정보, 경작지도 등을 제작하였다.



<그림 2> 곡물시세정보

마지막으로는, 현재 기후변화에 따른 식량 안보에 대한 분석 접근방식은 전통적인 통계자료 위주이지만, 유럽의 혁신 기술인 Copernicus 데이터인 EO와 non-EO 데이터를 융합한 상세 시공간 공간 빅데이터 딥러닝 분석을 통한 분석 접근법으로 기술적 혁신을 도모하였다.



<그림 3> RNN 기반의 논 경작지 예측 알고리즘



<그림 4> 논 경작지 면적 예측 결과

III 결론

이와 같은 플랫폼 및 기술 개발을 통해 차세대 성장 동력으로 지구변화의 선진 데이터베이스인 Copernicus 데이터를 바탕으로 유럽의 EO 및 non-EO 데이터에 대한 선진 접근 방식을 확보하고, 국내 실정에 맞는 종합 솔루션으로 개발하여 시장을 확대할 수 있을 것으로 판단되며 향후 국가적 플랫폼 및 서비스를 구성할 것으로 기대한다.

IV. 참고문헌

Jung-Bin Lee, Hieu Cong Nguyen, Jeong-Hyun Kim, "Comparative Analysis of Crop Monitoring System Based on Remotely-Sensed Data", Korean Journal of Remote Sensing, Vol.30, No.5, 2014, pp.641~650

Soyeon Park, Yeseul Kim et al., "Evaluation of Spatio-temporal Fusion Models of Multi-sensor High-resolution Satellite Images for Crop Monitoring: An Experiment on the Fusion of Sentinel-2 and RapidEye Images", KJRS, 2020, vol.36, no.5, pp. 807-821 (15 pages)

Qi Yin, Maolin Liu, Junyi Cheng et al., "Mapping Paddy Rice Planting Area in Northeastern China Using Spatiotemporal Data Fusion and Phenology-Based Method", Remote Sens. Vol.11 No.14, 2019

Kim, Yun Ki (2019). An Analysis of Forest Health Using Machine Learning Algorithms. Journal of The Korean Cadastre Information Association, 2019, vol.21, no.1, pp. 13-38 (26 pages)

R. Sonobe et al., "Assessing the suitability of data from Sentinel-1A and 2A for cropclassification," GISci. Remote Sens. 54, 918-938, 2017

B3.3 잘나가는 이커머스는 이런 기술들을 사용합니다


신현규
서울벤처스

쿠키가 사라지고 D2C로의 전환은 기본이 된다.

고객유입은 무조건 싸게 유입된 고객은 무조건 사게

플랫폼에 종속되어 판매하는 것은 이제 그만

더이상 비싸게 수수료를 내고 싶지 않다



온라인에서도 나의 고객을 알아 볼 수 있다

개발자 없이 꼭 필요한 소프트웨어를 사용하자

이커머스통합솔루션의 필요성

모든 솔루션을 하나로...쉽고 편하고 빠르게 사용할 순 없을까?

Copyright 2021. Seoulventures inc. all rights reserved.

이커머스 고객의 행동패턴에 맞는 SaaS 솔루션이 필요

← 오프사이트(미디어)
→ 오프사이트(리텐션)

← 온사이트 →

채널

광고

오가닉

배인

상세

가입

장바구니

구매

...

리뷰
홍기

리타겟

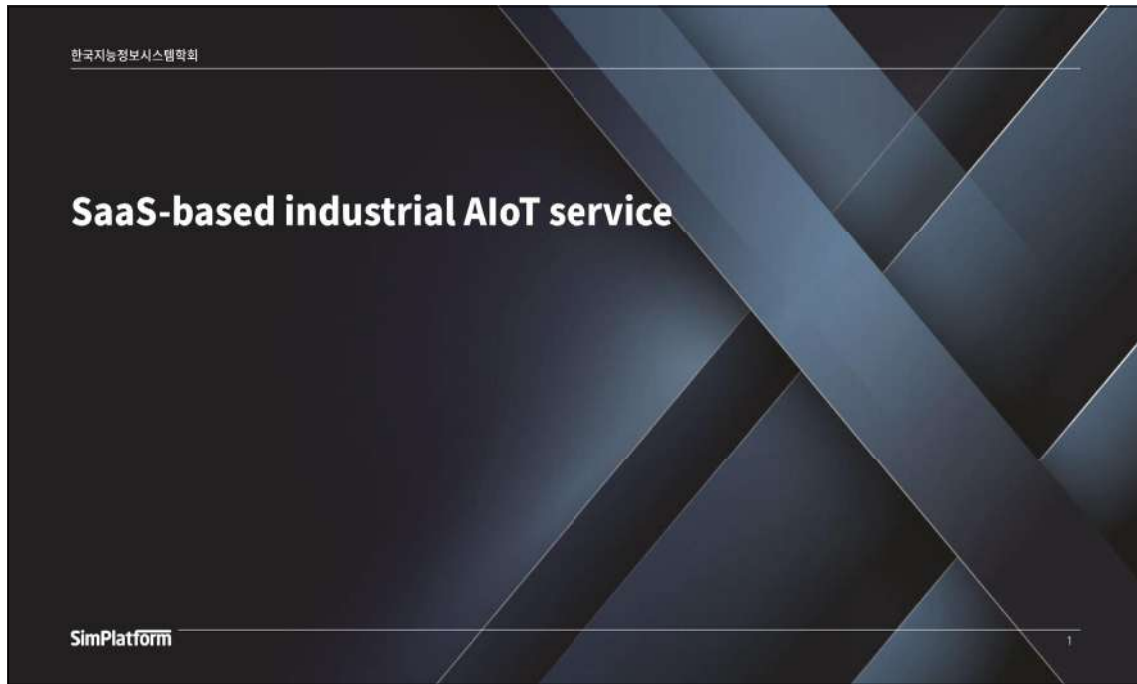
푸시
메시지

유입/운영 비용 상승	고객 이탈	구매 이탈	리뷰 미작성	재방문 재구매
디지털 마케팅 관리 솔루션	이탈방지 솔루션	온사이트 솔루션	리뷰 솔루션	푸시/메시지 솔루션
CX 그로스	리타쿠	온사이트 - 에임드	CX 스피드	CX 리뷰
빅데이터 분석 기반 컨설팅	중간질 리타겟 배너	초 개인화 상품추천 솔루션	사이트 속도개선 솔루션	리뷰 크롤링 및 분석 솔루션
이커머스 전용 분석들 - SVA				
상품/매체/매출 별 주요 지표 데이터 통합 대시보드				

Copyright 2021. Seoulventures inc. all rights reserved.

B3.4 SaaS-based industrial AIoT service

임대근
심플렛폼



소통이란, 연결을 기반으로 가치를 공유하는 것



이러한 흐름을 기반으로 미래에는 사람과 사람·사람과 사물·사람과 환경이 소통하는 시대가 열릴 것으로 예상

심플랫폼의 비전

심플랫폼이 보는 미래의 시대, 즉 사람과 사물이 소통하는 시대는 연결과 그 연결을 바탕으로 하는 가치의 공유



심플랫폼은 다가오는 시대에 IoT와 산업용 AI의 결합을 통해 이러한 시대를 열어가는 서비스를 제공하는 역할을 하고자 합니다.

B3.5 인공지능 기반 하수관로 결함탐지 시스템

고설태 (디지털재단)

[DAY 1]

C3 [ICEC-Paper Session]
Recommender System

C3.1 Incorporating price preferences for product recommendation in electronic commerce

Han Chen^a and Weiwei Deng^{b*}

^a College of Teacher Education, South China Normal University

E-mail: 1107162944@qq.com

^b School of Economics and Management, South China Normal University

*Corresponding Author: weiweideng@m.scnu.edu.cn

Abstract

Product recommendation methods have become the cornerstone of electronic commerce platforms due to their ability to solve the information overload problem and inform customers about their potentially interesting products. However, previous recommendation methods fail to consider customers' price preferences, which are essential in recommending suitable products. To bridge this gap, this study proposes a hybrid recommendation method that combines customer behaviors, product content, and price preferences for product recommendations. In the proposed method, two strategies are designed to model customers' price preferences. The proposed method is evaluated with a real-world data set and compared with three baseline methods. The evaluation results show that the proposed recommendation method with either strategy significantly outperforms the three baseline methods in terms of precision, recall, F-score, and mean average precision (MAP) measures.

Keywords: Electronic commerce, product recommendation, price preference

Introduction

The increasingly large number of products on electronic commerce platforms has led to the information overload problem that customers have difficulty finding products they are interested in. To solve the information overload problem, product recommendation methods are widely used to suggest suitable products for customers (Ma 2022). Previous product recommendation methods mainly leverage customers' behaviors and product content to generate recommendations (Deng 2020; Islek and Oguducu 2022). However, customers' price preferences are largely ignored in previous recommendation methods even though the price is essential in decision-making (Maslowska et al. 2017).

To bridge this gap, this study proposes a hybrid recommendation method that combines customers' behaviors, product content, and customers' price preferences for product recommendations. In the hybrid method, collaborative filtering (CF) methods are used to analyze customers' behaviors, content-based (CB) filtering methods are used to analyze product content, and statistical analysis methods are used to analyze customers' price preferences. The analysis results are linearly aggregated and the aggregated result is then used to generate recommendations. At the price preference analysis stage, two strategies are proposed to model customers' price preferences in one product category and use the modeled preferences to recommend products in the category. Given the prices of the products that a customer interacted with before, the first strategy models the customer's price preference as the arithmetic mean of the prices and estimates his or her price preference for a new product as the difference between the product's price and the mean. The second strategy models the customer's price preference as a price range based on the arithmetic mean and the mean absolute deviation of the prices. The customer's price preference for the new product is then determined according to whether the product's price is outside the price range. The proposed hybrid recommendation method is evaluated

with an online transactional data set (Chen et al. 2012). The evaluation results demonstrate that the two strategies are useful in capturing customers' price preferences and the proposed recommendation method with either strategy significantly outperforms the baseline methods.

The remaining of this paper is organized as follows. Section 2 reviews studies on recommendation methods and product recommendation. Section 3 presents the proposed product recommendation method. Section 4 introduces the design of the experimental evaluation. Section 5 reports and discusses the evaluation results. The last section concludes this study with major contributions.

Related Work

Recommendation methods are information filtering techniques that enable online platforms to suggest personalized content and services. Existing product recommendation methods can be generally classified into CF, CB, and hybrid methods. CF methods recommend products to target customers based on the preferences of their like-minded customers. They are very simple and efficient when using only the interactions between customers and products. For example, Linden et al. (Linden et al. 2003) proposed the item-based CF method based on customers' purchasing behavior to recommend products. Koren et al. (2009) proposed to use matrix factorization techniques for recommender systems. However, the interactions between customers and products are usually sparse given the large number of customers and products on the electronic commerce platforms. Hence, CF methods usually suffer from the data sparsity problem which results in difficulty in finding like-minded customers. Attempts have been made to incorporate other information to ease the data sparsity problem. For example, Ma et al. (2017) proposed a user-preference-based CF method that infers customers' aspect preferences from their ratings and online reviews. Sun et al. (2018) proposed a multi-aspect user-interest model that mines sentiments and interests from multi-aspect reviews for product recommendation.

CB methods recommend products with features that are liked by target customers. For example, Melo et al. (2015) proposed a novel CB method that combines textual attributes, visual features, and human visual attention to profile clothes and recommends products with similar profiles to customers. Dong et al. (2016) proposed a product recommendation method that profiles products by extracting textual features and the sentiments associated with these features from user-generated reviews. CB methods can use rich and heterogeneous features for product recommendation; however, they suffer from the difficulty of extracting useful features from product content due to the lack of standardized features. Besides, there is a risk of overspecialization because CB methods only recommend products with features that are previously liked by customers (Aggarwal 2016).

Hybrid methods are the combination of two or more methods. They take the advantages and overcome the disadvantages of CF or/and CB methods. One frequently used hybrid mechanism is to estimate customers' preferences for products using different methods and linearly aggregate the estimated preferences with certain weights. For example, Li et al. (2013) proposed a social recommender mechanism that recommends products based on preference analysis, recommendation trust analysis, and social relation analysis. Choi et al. (2012) and Dixit et al. (2018) proposed hybrid online-product recommendation methods that combine CF and sequential pattern analysis methods.

A few studies take product prices into account in product recommendations. For example, Umberto (2015) proposed a multi-dimensional CF method that considers prices for product recommendation; however, the price information considered is coarse. Shiu et al. (2018) proposed a user behavior probability transition model to identify price-sensitive customers in electronic commerce platforms for product recommendation. Chen et al. (2016) transferred customers' preferences from one product category to another and proposed to use customers' price preferences in explored product categories to boost the recommendation in unexplored product categories. Although price preferences are useful in enhancing recommendations in unexplored product categories in general, not every customer has consistent price preferences across product categories. Different from previous studies, this study models customers' price preferences in one product category based on the original and continuous price value and uses the price preferences to boost recommendations in the product category.

Several conclusions can be drawn from the review of previous studies. First, most previous studies on product recommendations ignore customers' price preferences even though the price is an important

factor in making purchasing decisions. Second, modeling customers' price preferences based on the original and continuous price value needs further investigation. Third, there is a need to propose a hybrid recommendation method that combines behavior, content, and price preference information for product recommendation in electronic commerce.

The Proposed Product Recommendation Method

This section introduces the proposed hybrid product recommendation method that combines behavior, content, and price preference information. Figure 1 shows the framework of the proposed hybrid recommendation method and illustrates how to analyze the three types of information for product recommendation. There are three steps in the proposed product recommendation method. The first step is to collect data that is related to customers and products. The second step estimates customers' preferences by analyzing different types of data using different methods. The last step aggregates the estimated preferences and generates recommendations based on the aggregated preferences. Details of the three steps are introduced in the following subsections.

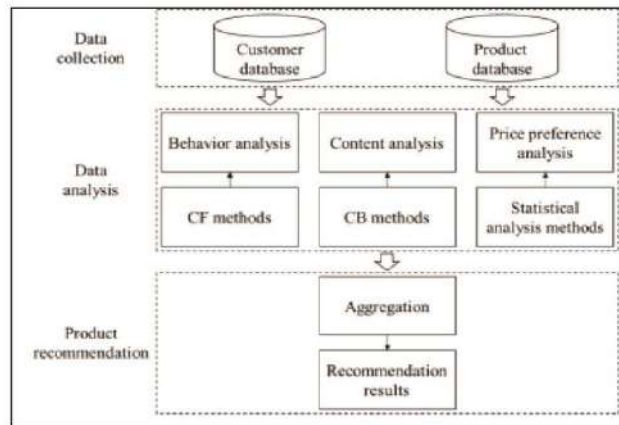


Figure 1. The Framework of the Proposed Product Recommendation Method

Data Collection

This step collects three types of data that are useful in product recommendation, i.e., behavior data, content data, and price data. Behavior data refers to the interactions between customers and products, such as clicking, rating, or purchasing behaviors. Content data refers to the data that describes products, such as product descriptions and user-generated reviews. Price data refers to the prices associated with products. The three types of data can be pre-processed and then used in the next step.

Data Analysis

The data analysis step employs different methods to analyze different types of data for predicting customers' preferences. Details are introduced in the following subsections.

Behavior Analysis

For behavior analysis, behavior data is organized as a customer-product interaction matrix. Elements of the matrix indicate whether a specific customer interacts with a specific product. Given the interaction matrix, CF methods can be used to predict customers' preferences for products that they have not interacted with before. As an example, this study employs the traditional user-based CF method (Koren and Bell 2015) for behavior analysis. The user-based CF method calculates customers' similarities

based on the cosine similarity measure and predicts customers' preferences based on their top K nearest neighbors. The method is mathematically defined as follows:

$$Sim(c, c') = \frac{\sum_{i=1}^{|Product|} cpm(c, p_i) \times cpm(c', p_i)}{\sqrt{\sum_{i=1}^{|Product|} cpm(c, p_i)^2} \times \sqrt{\sum_{i=1}^{|Product|} cpm(c', p_i)^2}} \quad (1)$$

$$PF(c, p)_{CF} = \frac{1}{K} \sum_{i=1}^K Sim(c, c_i) \times cpm(c_i, p) \quad (2)$$

where $Sim(c, c')$ is the similarity between customer c and c' , $|Product|$ is the total number of products, $cmp(c, p_i)$ is an element of the customer-product matrix that indicates the interaction between customer c and product p_i , $PF(c, p)_{CF}$ is the predicted preference of customer c for product p based on the CF method, and c_i is the i -th neighbor of customer c out of his or her top K nearest neighbors.

Content Analysis

For content analysis, keywords are extracted from the content data through case conversion, stop word removal, and word stemming. After extracting the keywords, a word-product matrix is formed to represent products' profiles. An element in the matrix indicates whether a specific product contains a specific word. CB methods are then used to predict customers' preferences. As an example, this study uses a traditional CB method for predicting customers' preferences. It calculates products' similarities using the cosine similarity measure and predicts customers' preferences based on the products they interacted with before. The method is mathematically defined as follows:

$$Sim(p, p') = \frac{\sum_{i=1}^{|Word|} wpm(w_i, p) \times wpm(w_i, p')}{\sqrt{\sum_{i=1}^{|Word|} wpm(w_i, p)^2} \times \sqrt{\sum_{i=1}^{|Word|} wpm(w_i, p')^2}} \quad (3)$$

$$PF(c, p)_{CB} = \frac{1}{|Product_c|} \sum_{i=1}^{|Product_c|} cpm(c, p_i) \times Sim(p, p_i) \quad (4)$$

where $Sim(p, p')$ is the similarity between product p and p' , $|Word|$ is the total number of words, $wpm(w_i, p)$ is an element of the word-product matrix that indicates whether product p contains word w_i , $PF(c, p)_{CB}$ is the predicted preference of customer c for product p based on the CB method, and $Product_c$ is the set of products that customer c interacted with before.

Price Preference Analysis

The price preference analysis module aims to model customers' price preferences and estimate their preferences for new products in terms of prices. This study proposes two strategies to analyze price preferences based on statistical analysis methods. Given the prices of the products that a customer interacted with, the first strategy models the customer's price preference as the arithmetic mean of the prices. The customer's price preference for a new product is estimated as the variation of the product's price from the mean. The first strategy is mathematically defined as follows:

$$\bar{x}_c = \frac{1}{|Product_c|} \sum_{p' \in Product_c} x_{p'} \quad (5)$$

$$Variation(c, p)_{S1} = |x_p - \bar{x}_c| \quad (6)$$

$$PF(c, p)_{S1} = 1 - \frac{\ln[1 + Variation(c, p)_{S1}] - \min\{\ln[1 + Variation(c, p)_{S1}]\}}{\max\{\ln[1 + Variation(c, p)_{S1}]\} - \min\{\ln[1 + Variation(c, p)_{S1}]\}} \quad (7)$$

where $x_{p'}$ is the price of product p' , $Product_c$ is the set of products that customer c interacted with before, $S1$ indicates the first strategy, and $\ln(\cdot)$ is the natural logarithm. The logarithmic scale is used to reduce the skewness toward large variations.

Given the prices of the products that a customer interacted with, the second strategy considers not only the arithmetic mean but also the mean absolute deviation of the prices. The strategy models the customer's price preference as a price range. A new product is more acceptable for the customer if its

price is within the range and less acceptable if its price is out of the range. The second strategy is mathematically defined as follows:

$$MAD_c = \frac{1}{|Product_c|} \sum_{p' \in Product_c} |x_{p'} - \bar{x}_c| \quad (8)$$

$$Variation(c, p)_{S2} = \begin{cases} |x_p - (\bar{x}_c - MAD_c)|, & \text{if } x_p < \bar{x}_c - MAD_c \\ 0, & \text{if } x_p \in [\bar{x}_c - MAD_c, \bar{x}_c + MAD_c] \\ |x_p - (\bar{x}_c + MAD_c)|, & \text{if } x_p > \bar{x}_c + MAD_c \end{cases} \quad (9)$$

$$PF(c, p)_{S2} = 1 - \frac{\ln[1+Variation(c, p)_{S2}] - \min\{\ln[1+Variation(c, p)_{S2}]\}}{\max\{\ln[1+Variation(c, p)_{S2}]\} - \min\{\ln[1+Variation(c, p)_{S2}]\}} \quad (10)$$

where MAD_c is the mean absolute deviation of the prices for customer c , $[\bar{x}_c - MAD_c, \bar{x}_c + MAD_c]$ is the price preference range of the customer, and $S2$ indicates the second strategy.

Product Recommendation

The product recommendation step linearly aggregates the predicted preferences that are obtained from behavior analysis, content analysis, and price preference analysis, respectively. Products with the highest aggregated preferences are then recommended to target customers. Given a customer c and the candidate products that the customer did not interact with before, the predicted preferences for the candidate products can be organized as the following matrix:

$$PF(c) = \begin{bmatrix} PF(c, p_1)_{CF} & PF(c, p_1)_{CB} & PF(c, p_1)_{Sj} \\ PF(c, p_2)_{CF} & PF(c, p_2)_{CB} & PF(c, p_2)_{Sj} \\ \vdots & \vdots & \vdots \\ PF(c, p_m)_{CF} & PF(c, p_m)_{CB} & PF(c, p_m)_{Sj} \end{bmatrix} \quad (11)$$

where $Sj \in \{S1, S2\}$, m is the number of the candidate products, each row represents different preferences for a specific candidate product, and each column represents a specific type of preference for all candidate products.

The aggregated preference of customer c for product p_j is calculated by Equation 12 and products with the highest aggregated preferences are recommended to the customer.

$$APF(c, p_j) = \sum_{y \in \{CF, CB, Sj\}} Weight_y \times PF(c, p_j)_y \quad (12)$$

where $y \in \{CF, CB, Sj\}$ indicates different methods, $Weight_y$ is the weight of method y , and $Weight_y \in (0, 1)$.

In this study, the greedy optimization method (Yang et al. 2015) is used to calculate the weights of different recommendation methods. The greedy optimization method works by trying different sets of weights and keeping the weights when the best recommendation performance on a validation set is obtained. The detailed calculation process is as follows. First, a set of values ranging from 0 to 1 with equal intervals (e.g., 0.1) is assigned to a method randomly selected from $\{CF, CB, Sj\}$. For each value in the set, randomly generated weights are assigned to the other two methods. Therefore, different sets of weights are obtained for the three methods. Among all the sets of weights, the set of weights that generates the best recommendation performance on the validation set is recorded. Thus, the optimal weight for the randomly selected method is determined. Keeping the weight of the first selected method unchanged, the next step is to repeat the above process for the next randomly selected method until the optimal weights of the three methods are determined.

Experimental Evaluation

Data

The online transactional data set collected by Chen et al. (2012) is used to evaluate the proposed product recommendation method. The data set was collected from an online retail company that sells all-

occasion gifts. We processed the data by removing records with missing values and obtained 4371 unique customers, 3684 unique products, and 267605 unique customer-product interactions (i.e., a customer has bought a product).

Evaluation Metrics

The recommendation performance is evaluated based on four commonly used evaluation metrics, namely, precision, recall, F-score, and MAP. The four evaluation metrics are mathematically defined as follows:

$$precision = \frac{|RS \cap TS|}{|RS|} \quad (13)$$

$$recall = \frac{|RS \cap TS|}{|TS|} \quad (14)$$

$$F\text{-score} = \frac{2 \times precision \times recall}{precision + recall} \quad (15)$$

$$MAP = \frac{1}{|RS|} \times \sum_{k=1}^{|RS|} [rel(k) \times precision@k] \quad (16)$$

where RS is the set of products recommended to a target customer, TS is the set of products that belong to the test set and were bought by the customer, $precision@k$ is the precision when the size of RS is k , and $rel(k)$ equals 1 if the recommended product at rank k is in TS and 0 otherwise.

Experimental Procedure

To compare the recommendation performance, three baseline methods are selected, i.e., the CF method introduced in Section 3.2.1, the CB method introduced in Section 3.2.2, and the hybrid method that linearly combines the two methods. Following the common procedure of evaluating the recommendation performance (Sarwar et al. 2000), this study randomly selects 20% of the customer-product interactions as the test set and the remaining data as the training set. To tune the parameters of the CF, the hybrid, and the proposed recommendation methods, 20% of the training data is randomly selected as the validation set. The parameters are tuned to obtain the best F-score on the validation set. The proposed method and the three baseline methods are used to recommend products, which are then compared with the test set to calculate the precision, recall, F-score, and MAP for each method.

Results and Discussions

Table 1 reports the recommendation performance of different methods. S1 and S2 indicate the proposed method with the first and the second strategies. The results show that the proposed method with either strategy outperforms the baseline methods. This indicates that the proposed two strategies are useful in capturing customers' price preferences. The results also show that the second strategy contributes more to the recommendation performance than the first strategy. Therefore, representing price preferences as the price range is better than the mean price. We also conducted the pairwise t-test and demonstrated that our methods are significantly better than the best baseline.

Table 1. Results of Different Recommendation Methods

Metric	Method	Number of recommendations					
		5	10	15	20	25	30
Precision	CF	0.1676	0.1277	0.1077	0.0954	0.0866	0.0794
	CB	0.0915	0.0711	0.0618	0.0551	0.0507	0.0469
	Hybrid	0.1706	0.1310	0.1108	0.0983	0.0891	0.0818
	S1	0.1788*	0.1372*	0.1167*	0.1036*	0.0938*	0.0861*
	S2	0.1812*	0.1384*	0.1180*	0.1044*	0.0946*	0.0868*

Recall	CF	0.0991	0.1478	0.1820	0.2087	0.2300	0.2502
	CB	0.0666	0.0963	0.1228	0.1432	0.1582	0.1705
	Hybrid	0.1027	0.1531	0.1887	0.2184	0.2427	0.2629
	S1	0.1137*	0.1652*	0.2040*	0.2339*	0.2586*	0.2780*
	S2	0.1154*	0.1654*	0.2057*	0.2336*	0.2592*	0.2788*
F-score	CF	0.0991	0.1075	0.1073	0.1054	0.1027	0.0993
	CB	0.0597	0.0640	0.0652	0.0642	0.0629	0.0610
	Hybrid	0.1017	0.1109	0.1110	0.1091	0.1062	0.1028
	S1	0.1092*	0.1176*	0.1177*	0.1156*	0.1121*	0.1085*
	S2	0.1109*	0.1183*	0.1190*	0.1162*	0.1129*	0.1093*
MAP	CF	0.0675	0.0793	0.0854	0.0892	0.0920	0.0942
	CB	0.0417	0.0477	0.0513	0.0535	0.0549	0.0560
	Hybrid	0.0702	0.0828	0.0892	0.0934	0.0964	0.0986
	S1	0.0777*	0.0911*	0.0984*	0.1029*	0.1061*	0.1084*
	S2	0.0798*	0.0931*	0.1006*	0.1049*	0.1082*	0.1106*

Note: values marked in bold indicate that the proposed methods are better than the best baseline and the asterisk label indicates that the improvement compared to the best baseline is significant in the pairwise t-test at a 99.9% confidence interval.

Conclusion

This study proposes a hybrid recommendation method for product recommendation in electronic commerce. The proposed recommendation method includes behavior analysis, product content analysis, and price preference analysis, and generates recommendations by linearly combining the analysis results. Two strategies are proposed to model customers' price preferences. Given the prices of the products a customer bought before, the first strategy represents the customer's price preference as the mean of the prices and measures the customer's price preference for a new product based on the difference between the mean and the product's price. The second strategy represents the customer's price preference as a price range and measures the customer's price preference for a new product according to whether the product's price is in the price range. Experiments on real-world data reveal that the two strategies are useful in capturing customers' price preferences and the proposed recommendation method with either strategy significantly outperforms the baseline methods.

The contributions of this study are summarized. This study proposes a hybrid recommendation method that considers customers' price preferences for product recommendations. Further, two strategies are proposed to model customers' price preferences based on the products they have bought before. The effectiveness of the proposed recommendation method with the two strategies is demonstrated by comprehensive experiments. This study provides practical and novel solutions to incorporating price preferences for product recommendations. Through the proposed recommendation method, customers can find suitable products more easily.

Acknowledgements

This research was supported by grants from the Natural Science Foundation of Guangdong (No. 2022A1515011363) and the China Postdoctoral Science Foundation (No. 2020M682757).

References

- Aggarwal, C. C. 2016. "Content-Based Recommender Systems," in *Recommender Systems: The Textbook*, C. C. Aggarwal (ed.), Cham: Springer International Publishing, pp. 139–166.
- Chen, D., Sain, S. L., and Guo, K. 2012. "Data Mining for the Online Retail Industry: A Case Study of RFM Model-Based Customer Segmentation Using Data Mining," *Journal of Database Marketing & Customer Strategy Management* (19:3), pp. 197–208.
- Chen, J., Jin, Q., Zhao, S., Bao, S., Zhang, L., Su, Z., and Yu, Y. 2016. "Boosting Recommendation in Unexplored Categories by User Price Preference," *ACM Trans. Inf. Syst.* (35:2), 12:1-12:27.
- Choi, K., Yoo, D., Kim, G., and Suh, Y. 2012. "A Hybrid Online-Product Recommendation System: Combining Implicit Rating-Based Collaborative Filtering and Sequential Pattern Analysis," *Electronic Commerce Research and Applications* (11:4), pp. 309–317.
- Deng, W. 2020. "Leveraging Consumer Behaviors for Product Recommendation: An Approach Based on Heterogeneous Network," *Electronic Commerce Research*.
- Dixit, V. S., Gupta, S., and Jain, P. 2018. "A Propound Hybrid Approach for Personalized Online Product Recommendations," *Applied Artificial Intelligence* (32:9–10), pp. 785–801.
- Dong, R., O'Mahony, M. P., Schaal, M., McCarthy, K., and Smyth, B. 2016. "Combining Similarity and Sentiment in Opinion Mining for Product Recommendation," *Journal of Intelligent Information Systems* (46:2), pp. 285–312.
- Islek, I., and Oguducu, S. G. 2022. "A Hierarchical Recommendation System for E-Commerce Using Online User Reviews," *Electronic Commerce Research and Applications* (52), p. 101131.
- Koren, Y., and Bell, R. 2015. "Advances in Collaborative Filtering," in *Recommender Systems Handbook*, F. Ricci, L. Rokach, and B. Shapira (eds.), Boston, MA: Springer US, pp. 77–118.
- Koren, Y., Bell, R., and Volinsky, C. 2009. "Matrix Factorization Techniques for Recommender Systems," *Computer* (8:42), pp. 30–37.
- Li, Y.-M., Wu, C.-T., and Lai, C.-Y. 2013. "A Social Recommender Mechanism for E-Commerce: Combining Similarity, Trust, and Relationship," *Decision Support Systems* (55:3), pp. 740–752.
- Linden, G., Smith, B., and York, J. 2003. "Amazon.Com Recommendations: Item-to-Item Collaborative Filtering," *IEEE Internet Computing* (7:1), pp. 76–80.
- Ma, L.-C. 2022. "Novel Next-Group Recommendation Approach Based on Sequential Market Basket Information," *Electronic Commerce Research*.
- Ma, Y., Chen, G., and Wei, Q. 2017. "Finding Users Preferences from Large-Scale Online Reviews for Personalized Recommendation," *Electronic Commerce Research* (17:1), pp. 3–29.
- Maslowska, E., Malthouse, E. C., and Viswanathan, V. 2017. "Do Customer Reviews Drive Purchase Decisions? The Moderating Roles of Review Exposure and Price," *Decision Support Systems* (98), pp. 1–9.
- Melo, E. V. de, Nogueira, E. A., and Guliato, D. 2015. "Content-Based Filtering Enhanced by Human Visual Attention Applied to Clothing Recommendation," in *2015 IEEE 27th International Conference on Tools with Artificial Intelligence (ICTAI)*, , November, pp. 644–651.
- Sarwar, B., Karypis, G., Konstan, J., and Riedl, J. 2000. "Analysis of Recommendation Algorithms for E-Commerce," in *Proceedings of the 2Nd ACM Conference on Electronic Commerce, EC '00*, New York, NY, USA: ACM, pp. 158–167.
- Shiu, Y., Guo, C., Zhang, M., Liu, Y., and Ma, S. 2018. "Identifying Price Sensitive Customers in E-Commerce Platforms for Recommender Systems," *Information Retrieval*, pp. 225–236.
- Sun, L., Guo, J., and Zhu, Y. 2018. "A Multi-Aspect User-Interest Model Based on Sentiment Analysis and Uncertainty Theory for Recommender Systems," *Electronic Commerce Research*.
- Umberto, P. 2015. "Developing a price-sensitive recommender system to improve accuracy and business performance of ecommerce applications," *International Journal of Electronic Commerce Studies* (6:1), pp. 1–18.
- Yang, C., Ma, J., Silva, T., Liu, X., and Hua, Z. 2015. "A Multilevel Information Mining Approach for Expert Recommendation in Online Scientific Communities," *The Computer Journal* (58:9), pp. 1921–1936.

C3.2 A multimodal deep learning approach for online course recommendation

Weiwei Deng^a, Lingjun Fu^a, Han Chen^{b*}

^a School of Economics and Management, South China Normal University

E-mails: weiweideng@m.scnu.edu.cn, linchin@qq.com

^b College of Teacher Education, South China Normal University

* Corresponding Author: 1107162944@qq.com

Abstract

With the rapid development of massive open online course (MOOC) platforms, learners are overloaded by numerous online courses. Many online course recommendation methods have been developed to facilitate learners to find suitable courses on the platforms. However, existing methods mainly focus on mining textual data and are inflexible to incorporate other types of data, which also benefit course recommendation. To bridge this gap, we propose a multimodal deep learning approach that leverages multiple types of course data for online course recommendation. The proposed approach employs multiple embedding techniques to process textual, relational, and categorical course data and uses the processed data to profile courses and learners for course recommendation. Experimental results on a real-world dataset show that the proposed approach outperforms multiple baselines in terms of precision and mean average precision.

Keywords: MOOC, online course recommendation, multimodal data, deep learning

1. Introduction

With the rapid development of MOOC platforms, the public has become more aware of online courses and their benefits, especially during the COVID-19 pandemic. However, with the explosive growth of online courses, users face an information overload problem, meaning that the amount of information exceeds the processing and utilization capacity of individuals (Khaleel et al. 2020). The information overload problem hinders users from selecting suitable courses and, therefore, may result in negative impacts, such as increasing the withdrawal rate and decreasing the learning satisfaction of the users. Consequently, identifying suitable online courses for users is of practical importance.

Recommendation methods are a common means to address the information overload problem and they have been used in various domains. For example, Netflix uses a collaborative filtering method to recommend movies or videos to users (Bennett et al. 2007). Liu et al. (2021) proposed a novel concept-aware denoising graph neural network for micro-video recommendation. The application of recommendation methods can help users discover better content. To achieve better recommendations, many existing recommendation methods leverage auxiliary information about users or items. For example, Zheng et al. (2017) used item reviews to complement user ratings for enhancing recommendation performance. Lei et al. (2016) employed visual information of items to capture the comprehensive interests of users for better recommendation. Jing and Tang (2017) leveraged user demographics and course prerequisites to better reveal the potential choices of users and recommend courses accordingly. Even though different types of data have been demonstrated to be useful for recommendations, few studies have explored multimodal course data, which are beneficial to online course recommendation. For example, textual data like course titles and descriptions reflect course content, relational data like prerequisite relations between courses indicate learning sequences, and

categorical data like disciplines and affiliations may also affect user preferences. Fusing the multimodal course data for online course recommendation is underexplored. It is unaware whether multimodal data can actually enhance online course recommendation and how to fuse the multimodal data for better course recommendation.

To address the research gap, this study proposes a multimodal deep learning approach for online course recommendation. Specifically, the proposed approach applies different embedding techniques to obtain representation vectors of textual, relational, and categorical course data. Then, it fuses the three vectors with an autoencoder to obtain an integrated representation vector for each course. The proposed approach represents a learner by averaging the representation vectors of the courses studied by the learner. Last, it concatenates representation vectors of a learner and a course and inputs the concatenated vector into a deep neural network to predict whether the learner likes the course. To evaluate the proposed approach, we collected real-world data from XuetangX¹, one of the largest MOOC platforms in China. Comprehensive experiments have been conducted and results show that multimodal data outperforms unimodal and bimodal data in online course recommendation. Besides, an early fusion strategy is better than a late fusion strategy when fusing multimodal data for online course recommendation. This research not only contributes to the online course recommendation domain but also provides a practical solution for MOOC platforms to address the information overload problem.

The remaining of this paper is organized as follows. Section 2 reviews related studies on course recommendation and multimodal data. Section 3 presents the proposed course recommendation method. Section 4 designs experiments for evaluating the proposed method. Section 5 reports and discusses the experimental results. Section 6 concludes this study with major contributions and possible future work.

2. Related work

2.1 Course recommendation

Course recommendation aims at finding suitable courses for learners and, therefore, reducing their search cost and enhancing their learning satisfaction (Kulkarni et al. 2020). As MOOC platforms are getting popular, many course recommendation methods have been developed. Existing course recommendation methods can be classified into three main categories, namely collaborative filtering (CF), content-based filtering (CB), and hybrid methods.

CF methods generate recommendations mainly based on the interactions between users and items (Goldberg et al. 1992). For example, Aher and L.M.R.J (2012) designed an association rule mining technique to extract association rules between courses and employ them to recommend courses to learners if they have learned certain courses. Jing and Tang (2017) proposed a CF strategy that leverages course prerequisites and user demographics for course recommendation. Bousbahi and Chorfi (2015) develop a case-based reasoning approach to find appropriate courses that fit the requests of learners. CF methods are simple and effective, but they suffer from cold start and data sparsity problems. The former means that learners or courses have no interactions while the latter refers to the sparse interactions between learners and courses.

CB methods focus on mining content features and matching users and items based on the features. For example, Huang and Lu (2018) designed a content-based course recommender that bases on mining features from course descriptions. Apaza et al. (2014) applied the Latent Dirichlet Allocation model to extract topics from course syllabi and used the topics to infer the preferences of learners for courses. Ji et al. (2018) extracted readability features and keywords from text scripts of educational videos and used them to recommend videos that meet the levels and topics of learners. CB methods are favorable when rich features are available, but they rely on extracting useful features, which is difficult and tricky.

Hybrid methods combine multiple techniques to overcome the disadvantages of each component. For example, Qi and Tong (2015) demonstrated that combining CF and CB methods can better recommend courses to learners than either method individually. Ibrahim et al. (2019) proposed an ontology-based

¹ <https://www.xuetangx.com>

personalized course recommendation approach that combines collaborative and content information to enhance recommendation efficiency and user satisfaction. Chang et al. (2022) designed a hybrid course recommendation system based on multiple CF and CB methods and recommends courses that meet the interests, abilities, and career development of learners. Although existing hybrid course recommendation methods have better performance than CF and CB methods, they fail to explore multimodal course data for online course recommendation. Consequently, this study aims to examine whether multimodal course data benefit online course recommendation and which way of multimodal data fusion is better for the recommendation.

2.2 Research on multimodal data

While most traditional recommendation methods focus on mining numeric and textual data, more advanced methods leverage multimodal data (e.g., textual, relational, categorical, and visual data) to profile users or items for better recommendation (Baltrušaitis et al. 2019). Different techniques have been proposed to process multimodal data. For example, word embedding techniques like Word2Vec (Le and Mikolov 2014), GloVe (Pennington et al. 2014), and FastText (Bojanowski et al. 2017) have been proposed to represent textual data as dense numeric vectors; graph embedding methods like TransE (Bordes et al. 2013), TransH (Wang et al. 2014), TransR (Lin et al. 2017), and TransD (Ji et al. 2015) have been proposed to map relational data from a symbolic space to a numeric vector space; neural network embedding techniques (Dahouda and Joe 2021) have been proposed to encode categorical data from a discrete space to a continuous space.

Fusing multimodal data is a critical step in the recommendation process. Two common multimodal data fusion strategies are early and late fusion strategies. The former integrates features of multimodal data and uses the integrated features for prediction (Park et al. 2020; Xie et al. 2019). The latter uses the features of each type of data to generate predictions independently and then fuses the predictions (Deng et al. 2020; Huang et al. 2020). Although the two strategies have different characteristics, no previous have examined which strategy is more suitable for online course recommendation.

3. The proposed approach

We propose a multimodal deep learning approach for online course recommendation. Figure 1 presents the framework of the proposed approach. The framework includes three steps: extracting features from multimodal data (feature extraction), fusing the features of multimodal data (feature fusion), and recommending courses with the fused features (recommendation).

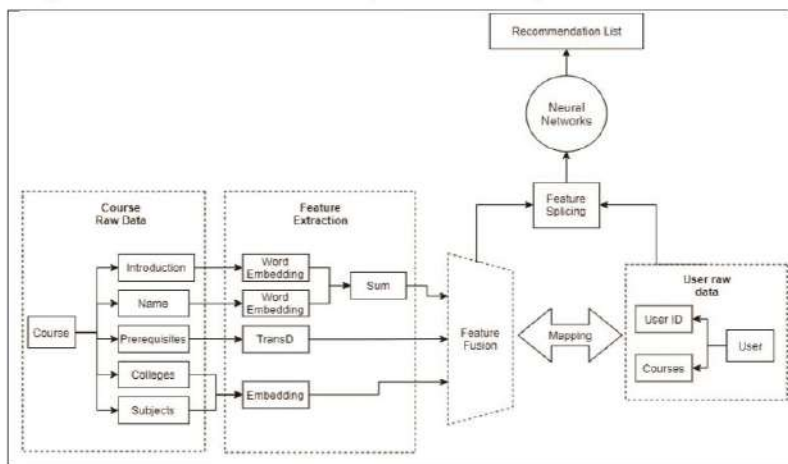


Figure 1. The framework of the proposed approach

3.1 Feature Extraction

For textual course data, such as the names and introductions of courses, we use the Tencent AI Lab Embedding Corpus (Song et al. 2018) to obtain representation vectors. Specifically, each word in the textual data is converted into a 200-dimensional vector. The word vectors of course introductions and names are averaged separately. Then the average vectors of course introductions and names are aggregated to obtain a 200-dimensional integrated vector. For relational course data like prerequisite relations between courses, we model them as a graph and use TransD, one of the most popular graph embedding techniques, to obtain a 100-dimensional vector for each course to represent the relational information. For categorical course data like disciplines and affiliations, we employ a neural network embedding technique to obtain a 20-dimensional vector for each of the categorical data.

3.2 Feature Fusion

After extracting the features of multimodal course data, we fuse them as an integrated vector for each course by a deep autoencoder (Zhou and Paffenroth 2017). The autoencoder has multiple hidden layers with a good nonlinear fitting ability and can fully learn the relations among different modalities through multiple fully connected layers. To fuse the features of the multimodal data, we concatenate the vectors of the multimodal data and obtain a 320-dimensional concatenated vector. Then, we input the concatenated vector into the deep autoencoder and output a 100-dimensional vector for each course. The output vector fully represents a course since it has fused the features of the multimodal course data.

3.3 Course recommendation

To generate recommendations for a target learner, we first profile the learner by averaging the 100-dimensional vectors of courses that have been studied by the learner. Then, we concatenate the representation vectors of the learner and a candidate course to obtain a 200-dimensional vector for the learner and course pair. Finally, the concatenated vector of the pair is input to a deep neural network to predict whether the learner likes the candidate course.

4. Experimental evaluation

4.1 Data set

We evaluate the proposed approach with real-world data collected from XuetangX. The collected data have 706 courses, 199,199 learners, and 682,753 selection records between learners and courses. Besides, there are 945 prerequisite relations involving 297 courses, 151 universities offering the collected courses, and 23 disciplines related to the courses.

4.2 Experimental Settings

We divide the selection records randomly into a training set and a test set with a ratio of 0.8 to 0.2. Each sample in the training set and test set represents a selection record between a learner-course pair, meaning that the learner has studied the course. The original training set and test contain positive samples only. Therefore, we populate the two sets with negative samples following a common procedure (Yuan and Deng 2021). Specifically, for each learner in the training set, we randomly select 2 courses the learner has not studied and construct 2 negative learner-course pairs. Similarly, we generate 100 negative learner-course pairs for each learner in the test set. After negative sampling, the training set and test set consist of 1,638,609 and 4,144,150 samples, respectively.

We implement our recommendation model by Keras with python. We employ a back-propagation and a batch training method for the training step. In neural networks, the Rectified Linear Unit (ReLU) function is used as the activation function for each hidden layer and L2 regularization is used to avoid model overfitting. The activation function of the output layer is the Sigmoid function. We use Adam as an optimizer and the binary cross-entropy as the loss function. Other parameters are as follows: the batch size is 1024, the number of iterations is 50, and the learning rate is 0.001.

4.3 Baseline Methods

We compare the proposed approach with multiple baselines shown below.

Baseline 1 (Late fusion): Instead of using an early fusion strategy as the proposed approach does, this baseline uses a late fusion strategy. Specifically, this baseline uses a neural network for each type of data to predict the probability that a target learner will select a candidate course. Then, it averages the three probabilities to generate a fused probability for the target learner and candidate course.

Baseline 2 (Text): This baseline follows the procedure of the proposed approach except that the baseline extracts only the textual features and requires no feature fusion step.

Baseline 3 (Relationship): This baseline is similar to baseline 2, but it extracts features from the relational course data.

Baseline 4 (Category): This baseline is similar to baseline 2, but it extracts features from the categorical course data.

Baseline 5 (Text & Category): This baseline follows the procedure of the proposed approach except that the baseline excludes the relational course data.

Baseline 6 (LR): Logistic Regression with the multimodal course data.

Baseline 7 (RF): Random Forest with the multimodal course data.

Baseline 8 (SVM): Support Vector Machine with the multimodal course data.

Baseline 9 (XGB): eXtreme Gradient Boosting with the multimodal course data.

Baseline 10 (NB): Naive Bayes with the multimodal course data.

We can know which multimodal data fusion strategy is better for online course recommendation with baseline 1. The outcomes of baselines 2 to 5 will show whether multimodal data benefit online course recommendation. Comparing the proposed approach with baselines 6 to 10 will show whether a deep learning approach is better than traditional machine learning models for online course recommendation.

4.4 Evaluation Metrics

We model the recommendation problem as a binary classification task. Therefore, we apply two commonly used metrics to evaluate recommendation performance. The first one is the precision of top k recommended items (Precision@K), which measures the percentage of the recommended courses that were studied by the learners. The second one is the mean Average Precision of top k recommended items (mAP@K), which considers both precision and rankings of recommended courses in all recommendation lists. We set K to 5, 10, and 15 and calculate all the metrics for each method.

4.5 Performance Analysis

Table 1 shows the recommendation performance of different methods. The proposed approach is marked in bold in the table.

Table 1. Recommendation performance of different methods

Methods	Precision@5	Precision@10	Precision@15	mAP@5	mAP@10	mAP@15
The proposed approach	0.5556	0.3110	0.2150	0.9764	0.9672	0.9635
Late fusion	0.5504	0.3101	0.2145	0.9722	0.9608	0.9568
Text	0.5427	0.3067	0.2128	0.9607	0.9476	0.9423
Relationship	0.4856	0.2977	0.2128	0.8745	0.8283	0.8077
Category	0.4565	0.2696	0.1955	0.8889	0.8444	0.8205

Text & Category	0.5456	0.3082	0.2141	0.9649	0.9526	0.9478
LR	0.2170	0.1522	0.1191	0.4134	0.4019	0.3914
RF	0.2841	0.2032	0.1586	0.5284	0.5130	0.4960
SVM	0.2168	0.1519	0.1185	0.4074	0.3985	0.3882
XGB	0.3457	0.2267	0.1707	0.6711	0.6374	0.6152
NB	0.1470	0.1163	0.0957	0.2486	0.2567	0.2556

Several conclusions can be observed from the above table. First, different multimodal fusion strategies have an impact on the final course recommendation results. The comparison reveals that the course recommendation results based on early fusion outperform those of late fusion. This indicates that the vector after multimodal data fusion captures the interactions among the three modalities, thus enhancing the course recommendation.

Second, the multimodal course data lead to better recommendation than unimodal and bimodal course data. The maximum improvement of multimodality over unimodal recommendations is about 21%, indicating that the fusion of multimodal data is beneficial to profile courses and learners. For course recommendation with a single modality, the performance of the textual data is better than that of the relational data or the categorical data. The reason is that there is a large amount of missing prerequisite relations and characterizing each course through the relational data only is impossible. Recommendation with only the categorical course data also has poor performance. This may be attributed to the small number of disciplines. Many courses belong to the same disciplines, which leads to the difficulty of differentiating one course from another through disciplines. The above findings show that different types of course data can complement each other and enhance the course recommendation.

Third, the deep neural network can better model the preferences of learners for courses than traditional machine learning methods. The proposed approach outperforms baselines 6 to 10 significantly in terms of both Precision@K and mAP@K. Besides, the mAP@K of the proposed approach is high, meaning that the proposed approach not only recommends courses correctly but also places the correct courses at the front in recommendation lists.

5 Conclusion

In this work, we propose a multimodal deep learning approach for online course recommendation. The proposed approach employs multiple techniques to process textual, relational, and categorical course data and uses a deep autoencoder to fuse the processed multimodal data. The fused data are then used to profile courses and learners and are input to a deep neural network for the course recommendation. We evaluate the proposed approach with real-world data from XuetangX. The experimental results have confirmed the effectiveness of the proposed course recommendation approach. We have three findings in this study: (1) fusing multimodal course data benefits the course recommendation; (2) the early fusion strategy is more suitable than the late fusion strategy in the course recommendation; (3) deep learning can better capture the preferences of learners for the courses than traditional machine learning in the current research.

This research not only contributes to the literature on course recommendation but also provides a practical solution to solving the information overload problem in MOOC platforms. We will extend this study from two aspects in the future. First, adapt the proposed approach to more types of data. We consider only the textual, relational, and categorical data in the current research. However, online courses have visual and vocal data, which may also benefit the course recommendation. We will incorporate more types of data to profile courses and learners for better recommendation in the future. Second, consider learning sequences in the course recommendation. Sequences of learning courses are important to learners since many courses have relevant course topics. In future work, we plan to combine the learning sequences with multimodal course data to further enhance the course recommendation.

Acknowledgements

This research was supported by grants from the Natural Science Foundation of Guangdong (No. 2022A1515011363) and the China Postdoctoral Science Foundation (No. 2020M682757).

References

- Aher, S. B., and L. M. R. J. L. 2012. "Mining Association Rule in Classified Data for Course Recommender System in E-Learning," *International Journal of Computer Applications* (39), pp. 1–7.
- Apaza, R. G., Cervantes, E. V. V., Quispe, L., and Luna, J. E. O. 2014. "Online Courses Recommendation Based on LDA," in *SIMBig*.
- Baltrušaitis, T., Ahuja, C., and Morency, L.-P. 2019. "Multimodal Machine Learning: A Survey and Taxonomy," *IEEE Transactions on Pattern Analysis and Machine Intelligence* (41:2), pp. 423–443.
- Bennett, J., Lanning, S., and Netflix, N. 2007. "The Netflix Prize," in *In KDD Cup and Workshop in Conjunction with KDD*.
- Bojanowski, P., Grave, E., Joulin, A., and Mikolov, T. 2017. "Enriching Word Vectors with Subword Information," *Transactions of the Association for Computational Linguistics* (5), pp. 135–146.
- Bordes, A., Usunier, N., Garcia-Durán, A., Weston, J., and Yakhnenko, O. 2013. "Translating Embeddings for Modeling Multi-Relational Data," in *Proceedings of the 26th International Conference on Neural Information Processing Systems - Volume 2, NIPS'13*, Red Hook, NY, USA: Curran Associates Inc., pp. 2787–2795.
- Bousbahi, F., and Chorfi, H. 2015. "MOOC-Rec: A Case Based Recommender System for MOOCs," *Procedia - Social and Behavioral Sciences* (195), World Conference on Technology, Innovation and Entrepreneurship, pp. 1813–1822.
- Chang, H.-T., Lin, C.-Y., Wang, L.-C., and Tseng, F.-C. 2022. "How Students Can Effectively Choose the Right Courses: Building a Recommendation System to Assist Students in Choosing Courses Adaptively," *Educational Technology & Society* (25:1), Douliu City: Int Forum Educational Technology & Soc-Ifets, pp. 61–74.
- Dahouda, M. K., and Joe, I. 2021. "A Deep-Learned Embedding Technique for Categorical Features Encoding," *Ieee Access* (9), Piscataway: Ieee-Inst Electrical Electronics Engineers Inc, pp. 114381–114391.
- Deng, Y., Xu, X., Qiu, Y., Xia, J., Zhang, W., and Liu, S. 2020. "A Multimodal Deep Learning Framework for Predicting Drug-Drug Interaction Events," *Bioinformatics (Oxford, England)* (36:15), pp. 4316–4322.
- Goldberg, D., Nichols, D., Oki, B. M., and Terry, D. 1992. "Using Collaborative Filtering to Weave an Information Tapestry," *Communications of the ACM* (35:12), pp. 61–70.
- Huang, R., and Lu, R. 2018. "Research on Content-Based MOOC Recommender Model," in *2018 5th International Conference on Systems and Informatics (Icsai)*, New York: Ieee, pp. 676–681.
- Huang, S.-C., Pareek, A., Zamanian, R., Banerjee, I., and Lungren, M. P. 2020. "Multimodal Fusion with Deep Neural Networks for Leveraging CT Imaging and Electronic Health Record: A Case-Study in Pulmonary Embolism Detection," *Scientific Reports* (10:1), p. 22147.
- Ibrahim, M. E., Yang, Y., Ndzi, D. L., Yang, G., and Al-Maliki, M. 2019. "Ontology-Based Personalized Course Recommendation Framework," *IEEE Access* (7), pp. 5180–5199.
- Ji, G., He, S., Xu, L., Liu, K., and Zhao, J. 2015. "Knowledge Graph Embedding via Dynamic Mapping Matrix," in *Proceedings of the 53rd Annual Meeting of the Association for Computational Linguistics and the 7th International Joint Conference on Natural Language Processing (Volume 1: Long Papers)*, Beijing, China: Association for Computational Linguistics, July, pp. 687–696.
- Ji, S., Kim, Y., Jung, S., and Hwang, E. 2018. "An Educational Video Scoring Scheme for Level and Topic-Based Recommendation," in *Proceedings of the 12th International Conference on Ubiquitous Information Management and Communication, IMCOM '18*, New York, NY, USA: Association for Computing Machinery, pp. 1–5.

- Jing, X., and Tang, J. 2017. "Guess You like: Course Recommendation in MOOCs," in *Proceedings of the International Conference on Web Intelligence, WI '17*, New York, NY, USA: Association for Computing Machinery, August 23, pp. 783–789.
- Khaleel, I., Wimmer, B. C., Peterson, G. M., Zaidi, S. T. R., Roehrer, E., Cummings, E., and Lee, K. 2020. "Health Information Overload among Health Consumers: A Scoping Review," *Patient Education and Counseling* (103:1), pp. 15–32.
- Kulkarni, P. V., Rai, S., and Kale, R. 2020. "Recommender System in ELearning: A Survey," in *Proceeding of International Conference on Computational Science and Applications, Algorithms for Intelligent Systems*, S. Bhalla, P. Kwan, M. Bedekar, R. Phalnikar, and S. Sirsikar (eds.), Singapore: Springer, pp. 119–126.
- Le, Q., and Mikolov, T. 2014. "Distributed Representations of Sentences and Documents," in *Proceedings of the 31st International Conference on International Conference on Machine Learning - Volume 32, ICML'14*, Beijing, China: JMLR.org, II-1188-II-1196.
- Lei, C., Liu, D., Li, W., Zha, Z.-J., and Li, H. 2016. "Comparative Deep Learning of Hybrid Representations for Image Recommendations," in *2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR)*, June, pp. 2545–2553.
- Lin, H., Liu, Y., Wang, W., Yue, Y., and Lin, Z. 2017. "Learning Entity and Relation Embeddings for Knowledge Resolution," *Procedia Computer Science* (108), International Conference on Computational Science, ICCS 2017, 12-14 June 2017, Zurich, Switzerland, pp. 345–354.
- Liu, Y., Liu, Q., Tian, Y., Wang, C., Niu, Y., Song, Y., and Li, C. 2021. "Concept-Aware Denoising Graph Neural Network for Micro-Video Recommendation," in *Proceedings of the 30th ACM International Conference on Information & Knowledge Management*, New York, NY, USA: Association for Computing Machinery, pp. 1099–1108.
- Park, C., Ha, J., and Park, S. 2020. "Prediction of Alzheimer's Disease Based on Deep Neural Network by Integrating Gene Expression and DNA Methylation Dataset," *Expert Systems with Applications* (140), p. 112873.
- Pennington, J., Socher, R., and Manning, C. 2014. "GloVe: Global Vectors for Word Representation," in *Proceedings of the 2014 Conference on Empirical Methods in Natural Language Processing (EMNLP)*, Doha, Qatar: Association for Computational Linguistics, pp. 1532–1543.
- Qi, T., and Tong, G. X. 2015. "Research on Personalized Courses Recommendation Technology Based on Hybrid Model," in *International Conference on Advanced Educational Technology and Information Engineering (Aetie 2015)*, Lancaster: Destech Publications, Inc, pp. 746–753.
- Song, Y., Shi, S., Li, J., and Zhang, H. 2018. "Directional Skip-Gram: Explicitly Distinguishing Left and Right Context for Word Embeddings," in *Proceedings of the 2018 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 2 (Short Papers)*, New Orleans, Louisiana: Association for Computational Linguistics, pp. 175–180.
- Wang, Z., Zhang, J., Feng, J., and Chen, Z. 2014. "Knowledge Graph Embedding by Translating on Hyperplanes," in *Proceedings of the Twenty-Eighth AAAI Conference on Artificial Intelligence, AAAI'14*, Québec City, Québec, Canada: AAAI Press, pp. 1112–1119.
- Xie, G., Dong, C., Kong, Y., Zhong, J. F., Li, M., and Wang, K. 2019. "Group Lasso Regularized Deep Learning for Cancer Prognosis from Multi-Omics and Clinical Features," *Genes* (10:3), p. E240.
- Yuan, H., and Deng, W. 2021. "Doctor Recommendation on Healthcare Consultation Platforms: An Integrated Framework of Knowledge Graph and Deep Learning," *Internet Research* (ahead-of-print: ahead-of-print).
- Zheng, L., Noroozi, V., and Yu, P. S. 2017. "Joint Deep Modeling of Users and Items Using Reviews for Recommendation," in *Proceedings of the Tenth ACM International Conference on Web Search and Data Mining, WSDM '17*, New York, NY, USA: Association for Computing Machinery, February 2, pp. 425–434.
- Zhou, C., and Paffenroth, R. C. 2017. "Anomaly Detection with Robust Deep Autoencoders," in *Proceedings of the 23rd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining, KDD '17*, New York, NY, USA: Association for Computing Machinery, pp. 665–674.

C3.3 TransformRec: User-Centric Recommender System for e-Commerce Using Transformer

Kyoung Jun Lee,^{a,b} Yujeong Hwangbo,^{b*} Hokyoung Jung,^a Baek Jeong,^a Jong Il Park^c

^aDepartment of Big Data Analytics, Kyung Hee University, Seoul, Korea

^bBig Data Research Center, Kyung Hee University, Seoul, Korea

^cHAREX INFOTECH, Seoul, Korea

{klee, hwangbo, hoky1227, ylbaek} @khu.ac.kr, jipark@ubpay.com

Abstract

We propose a new User-Centric recommender system using Transformer model called TransformRec, which uses receipt data without personal information and identity and considers only the relationships between tokenized product names. TransformRec recommends a product based on its most recent receipt, which includes product names. Although a receipt includes a product that the Transformer has not learned, TransformRec can recommend a real product that is considered as most relevant to the user's last purchase. We used two commercial datasets, an e-commerce dataset and Instacart dataset, and compared the performances of TransformRec, TransformRec without tokenizing, and Word2Vec. The experimental results demonstrated that the performance of TransformRec is superior to that of the other two models. Thus, we conclude that it is possible to recommend a product without using user identity or demographic information with higher performances. In addition, we confirmed that reflecting the relationship among tokens can improve recommendation performance.

Keywords: TransformRec, User-Centric, Recommender System, e-Commerce

Introduction

A recommender system usually collects, stores, and archives large amounts of data, including demographic information such as gender, age, purchase history, product or service preference, and search history, to provide users with appropriate recommendations. In this process, there is a risk of infringement of users' sensitive personal information. Recent studies have attempted to develop so-called User-Centric recommender systems that do not use demographic information (Hwangbo et al. 2021). Wang et al. (2020) used group preferences in surrounding areas without exposing individuals. Lee et al. (2021) used purchased products, time, and location information, without demographic information. Katariya et al. (2018) classified short-text messages and calendar titles without using personal identification. User-Centric recommendation research tries to minimize the use of user information. We propose TransformRec, which can recommend without using personal information. It analyzes purchase patterns among products using receipt data, which includes only a list of purchased products (Figure 1).

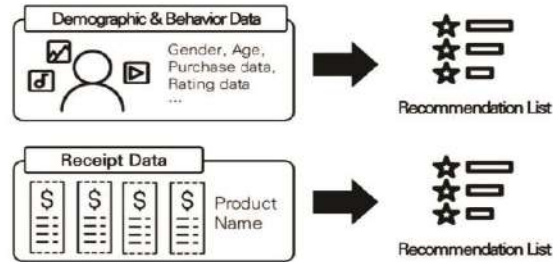


Figure 1. Comparison of using demographic and behavior data and only receipt data

This technique is similar to content-based methodology, which recommends similar products that reflect the characteristics of products. However, it differs from the existing content-based methodology, which uses the product’s metadata. Our TransformRec model is more efficient because it does not require additional information regarding the product to identify similar products. To reflect the relationship between product characteristics, we developed an NLP (Natural Language Processing) based recommender system that uses purchased product names. Both Transformer and Word2vec analyze purchase patterns using receipt data. In particular, they perform tokenization of product names and examine the relationship between products without considering metadata.

Background and Related Works

The personal information stored in the database of a recommendation system may threaten user privacy (Verma et al. 2019). Research is underway to address privacy issues in recommender systems using encryption (Armknecht and Strufe 2011; Badsha et al. 2017). Nevertheless, the risk remains. This study examines the methods of NLP-based recommendations for privacy preservation.

NLP-based Recommendation

Embedding techniques for recommender systems have demonstrated outstanding performances (Jun et al. 2020; Mikolov et al. 2013a). Multiple studies have been conducted on recommender systems using Word2Vec. Barkan and Koenigstein (2016) implemented an Item2Vec-based recommender system using Word2Vec and item-based collaborative filtering. Product2Vec (Chen et al. 2020) was developed to use the details in shopping carts as input values for marketing. Lee et al. (2021) used payment details to build a purchased product to vector (PP2Vec) model for recommending products. Studies have also used transformers for recommending the next product based on sequential user behavior data (Chen et al., 2019; Wu et al., 2020), identifying the user’s status, and recommending financial products over time (Lian and Li, 2020).

Word2Vec and Transformer

Word2Vec (Mikolov et al. 2013a) is a technique for inserting words in a vector space. The words are represented by dense vectors composed of decimal points. In the well-learned vector space, the more similar the meaning of words, the closer they are (Mikolov et al. 2013b). A previous study developed sequence-based recommender systems using Word2Vec by treating products as words (Barkan and Koenigstein 2016; Chen et al. 2020). In this study, we implemented a model that uses Word2Vec to learn using only receipt data.

Transformers are used in various fields from natural language fields such as machine translation to computer vision such as image analysis (Chen et al. 2020). The Transformer was developed to process natural language by stacking multiple attention mechanisms (Vaswani et al. 2017). In this study, we propose a Transformer-based recommender system that can recommend novel products through changes in token learning methods.

Methods

TransformRec

TransformRec recommends products based on the historical data of the products purchased by all users. To explore the relationship between products, TransformRec attempts to increase its performance by tokenizing product names and analyzing product names in token units. By tokenizing, we can explore the similarity of meaning between products. Tokenizing allows us to closely examine the relationship between words that form a product. For example, although [White Bag] and [Black Bag] refer to the same product, bag, but of different colors, the color name is included in the product name and thus, the terms are analyzed as belonging to completely different products. However, if natural language analysis is performed using [White / Bag] and [Black / Bag] by tokenizing each product name, 50% can be explored as a similar product with a common token known as Bag (Figure 2). Using this principle, product names were tokenized to analyze the relationship between each product. TransformRec comprises two stages. The first is a Transformer model that analyzes the product list of receipts in natural language. The Transformer stage searches for products by tokenizing the purchased product names. In this process, the Transformer exports only one product name as output.

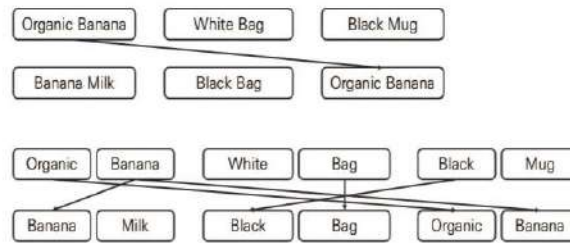


Figure 2. Comparison of product names with and without tokenizing

The structure of the proposed TransformRec is depicted in Figure 3.

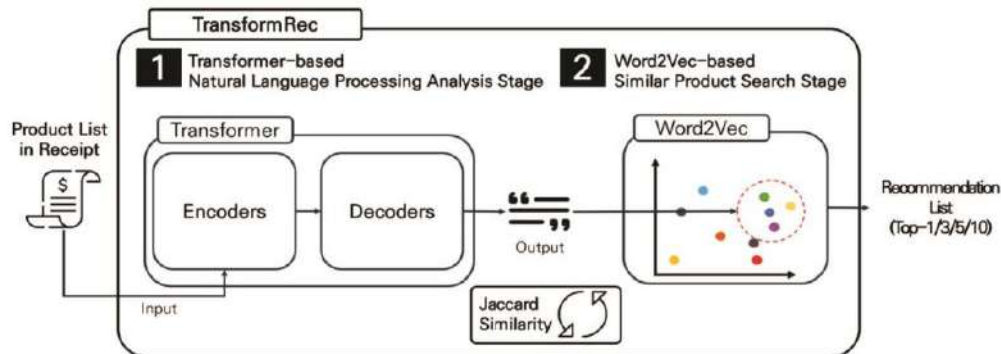


Figure 3. Framework for the TransformRec recommender system

The Transformer may recommend a non-existent product name. If a product name that does not exist is derived by combining tokens, then it must be converted to an existing product name for recommending existing products. Jaccard similarity (Resnick et al., 1994), a method for measuring the similarity between sets, was used to calculate the similarity of an existing product name with the highest similarity to the derived word of TransformRec. The Transformers' derived words and existing product names were split into two sets of spaces. We calculated the Jaccard similarity between the words and obtained the product name with the highest value. The similarity was

measured by dividing the number of common words at the intersection of the two sets of tokens by the total number of words that are the sum of the two sets. Depending on the number of common elements, the resulting value lies between zero and one; if the value is closer to one, it indicates a higher similarity. The formula for calculating the Jaccard similarity between two sets, A and B, is as follows (Resnick et al. 1994):

$$J(A, B) = \frac{|A \cap B|}{|A \cup B|} = \frac{|A \cap B|}{|A| + |B| - |A \cap B|}$$

Preprocessing

We preprocessed the data to maximally exploit the relationship between product names (Figure 4). Referring to Chen et al. (2019), we separated the purchase product data into five units in the same receipt and set the last product name to the label value. Thereafter, we generated data by separating the purchased products in the same manner. The data were selected for analysis only when more than five products were purchased on an order. The final preprocessed data comprised 80% training data for model training and 20% test data for model evaluation.

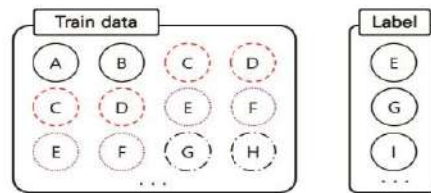


Figure 4. Preprocessing for TransformRec

Experiment

Datasets

For conducting experiments using the proposed model, we preferred a dataset with purchase sequences as well as product names. Kaggle released two open e-commerce datasets that satisfied the following conditions: an e-commerce dataset provided by a British e-commerce company and an Instacart dataset provided by Instacart (Table 1).

Table 1. Raw datasets EDA

	E-commerce	Instacart
# of Transactions	210,367	33,819,106
# of Invoices (Orders)	12,397	3,346,083
# of Users	2,920	206,209
Product Types	3,741	49,685

- **An e-commerce Dataset¹.** The number of transactions of raw e-commerce data were 210,367, with 2,920 users and 3,741 product types. We formed a sequence based on the invoice data. After preprocessing, the number of final records were 71,205; the number of products were 3,485; the average number of transactions per product were 46.2.

¹ <https://www.kaggle.com/theopenk/2017online-retail>

- **Instacart Dataset²**. The number of transactions of raw Instacart data were 33,819,106, with 206,209 users and 49,685 product types. We sampled 1% of the data randomly. There were 331,824 transactions after preprocessing, 25,614 product types, and 13.0 average transactions per product. After preprocessing, there were 137,177 transactions in the final data.

Table 2 lists the final data of e-commerce and Instacart datasets after preprocessing.

Table 2. Final data of EDA

	E-commerce	Instacart
# of transactions	161,040	331,824
# of rows	71,205	137,177
Product types	3,485	25,614
Avg. # of Transactions per product type	46.2	13.0

Baselines

- **Random**. This method randomly recommends sampling of n products for all the products. We averaged the measurements 100 times.
- **POP**. This method recommends N products that most frequently come out.
- **Word2Vec**. TransformRec comprises a transformer and Word2Vec; we compared TransformRec with Word2Vec to examine the effectiveness of the Transformer. For this comparison, we used Word2Vec’s hyperparameter, which is similar to that of TransformRec. Word2Vec’s output is a product name similar to the input; thereafter, we used the entire product name as an input.
- **TransformRec without tokenization** Tokenized product name input is one of the features of TransformRec. Product names without tokenization were used to confirm the performance contribution of the tokenization. For a fair comparison, the hyperparameters were used in the same manner as in TransformRec.

All the experiments used a single NVIDIA Tesla T4 GPU. For the hyperparameters used in the Transformer stage during TransformRec learning, the number of encoder-decoder layers were 1, D_MODEL = 128, NUM_HEADS = 4, d_ff = 256, and DROPOUT = 0.2. The optimizer used was Adam, the same as that of Vaswani et al. (2017), and it was trained using the sparse categorical cross-entropy loss function. Word2Vec’s hyperparameters were alpha = 0.025, min_count = 1, window = 3, size = 300, negative = 20, and sample = 0.00001. Twenty iterations were learned using Skip-Gram. This was equally applied to the baseline models. We repeated Word2Vec, TransformRec, and TransformRec without tokenizing 50 times, while changing the random seed and averaging the measured values.

Evaluation Metric

We used Hit-Rate (HR) as the evaluation metric (Deshpande and Karypis, 2004) and measured the HR by specifying the last purchase product of all users as a label value and recommended a product through the purchase record of users excluding the last product. N is the total number of users. *Number of hits in Top_n* is the number of hit products that the user actually purchased from the n recommended products. We measured the HR by recommending 1, 3, 5, and 10; thus, the definition of Hit-Rate $HR@n$ for n recommendations is as follows:

² <https://www.kaggle.com/c/instacart-market-basket-analyst>

$$HR@n = \frac{\text{Number of hits in Top}_n}{N}$$

Results

Table 3 lists the performance differences between TransformRec and other models. It indicates that TransformRec outperformed the other models. In particular, in all situations, TransformRec exhibited considerably better performance than Word2Vec. TransformRec’s HR@1, the Transformer stage in TransformRec’s recommendation, demonstrated superior performance compared to Word2Vec’s HR@1. Similarly, the performance of TransformRec was 25% higher on e-commerce data and 268% higher on Instacart data than that of TransformRec without tokenizing, whereas that of HR@10 was 28% higher on e-commerce data and 92% higher on Instacart data (Figure 5). The HR@1 comparison per epoch between TransformRec and TransformRec without tokenizing are depicted in Figures 6. In most epochs, the performance of the tokenized model was the best. Although the maximum performance of TransformRec without tokenizing converges quickly, TransformRec exhibited a higher performance despite it being trained for a few epochs.

Table 3: Results of recommender systems.

	E-commerce				Instacart			
	HR@1	HR@3	HR@5	HR@10	HR@1	HR@3	HR@5	HR@10
Random	0.03%	0.07%	0.13%	0.24%	0.00%	0.01%	0.02%	0.03%
Word2Vec	0.40%	0.93%	1.36%	2.33%	0.09%	0.25%	0.42%	0.81%
TransformRec without Tokenizing	2.25%	2.32%	2.38%	2.50%	1.36%	2.06%	2.64%	3.86%
POP	0.76%	1.35%	2.11%	3.64%	1.35%	3.23%	4.56%	6.98%
TransformRec	2.82%	2.95%	3.04%	3.21%	5.01%	5.63%	6.24%	7.43%

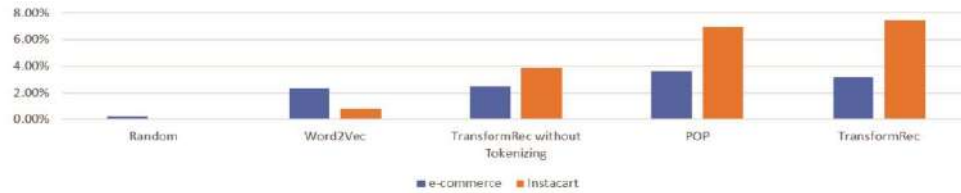


Figure 5. Comparison of recommender systems

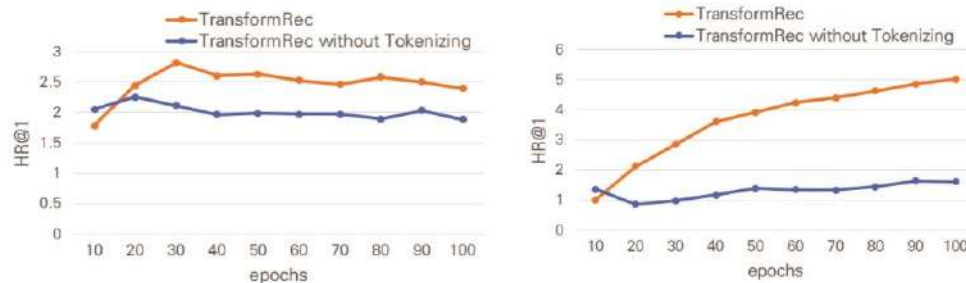


Figure 6. Comparison of epochs for HR@1 in e-commerce (left) and Instacart (right)

Conclusion

In this study, we proposed TransformRec, which provides recommendations without using personal information. TransformRec uses only the receipt of data without demographic information. The experimental results demonstrated that tokenizing the product name can improve performance. In particular, the lower the average transactions per product, that is, the fewer data the product name matches, the more difficult it is to learn, and we could confirm that the tokenizing effect of TransformRec was maximized. In conclusion, we found that it is possible to recommend a product without using user identity or demographic information with the greatest performance. We expect that using TransformRec will contribute to the prevention of privacy risk problems in recommender systems. In addition, we confirmed that reflecting the relationship among tokens can improve recommendation performance. In the future, this study will contribute to the development of sustainable AI algorithms that enhance privacy preservation through User-Centric research.

Acknowledgments

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF2020S1A5B8103855). This research was supported by the BK21 FOUR (Fostering Outstanding Universities for Research) funded by the Ministry of Education (MOE, Korea) and National Research Foundation of Korea (NRF). This work was supported under the framework of international cooperation program managed by the National Research Foundation of Korea (NRF 2020K2A9A2A06069972, FY2020).

References

- Armknecht, F.; and Strufe, T. 2011. An efficient distributed privacy-preserving recommendation system. In 2011 The 10th IFIP Annual Mediterranean Ad Hoc Networking Workshop: IEEE. doi.org/10.1109/Med-Hoc-Net.2011.5970495.
- Badsha, S.; Yi, X.; Khalil, I.; and Bertino, E. 2017. Privacy preserving user-based recommender system. In 2017 IEEE 37th International Conference on Distributed Computing Systems (ICDCS): IEEE. https://doi.org/10.1109/ICDCS.2017.248.
- Barkan, O.; and Koenigstein, N. 2016. Item2vec: neural item embedding for collaborative filtering. In 2016 IEEE 26th International Workshop on Machine Learning for Signal Processing (MLSP): IEEE. doi.org/10.1109/MLSP.2016.7738886.
- Chen, F.; Liu, X.; Proserpio, D.; and Troncoso, I. 2020. Product2Vec: Understanding Product-Level Competition Using Representation Learning. NYU Stern School of Business. doi.org/10.2139/ssrn.3519358.
- Chen, Q.; Zhao, H.; Li, W.; Huang, P.; and Ou, W. 2019. Behavior sequence transformer for e-commerce recommendation in alibaba. In Proceedings of the 1st International Workshop on Deep Learning Practice for High-Dimensional Sparse Data. doi.org/10.1145/3326937.3341261.
- Deshpande, M.; and Karypis, G. 2004. Item-based top-n recommendation algorithms. *ACM Transactions on Information Systems (TOIS)*, 22(1): 143-177. doi.org/10.1145/963770.963776.
- Hwangbo, Y.; Lee, K. J.; Jeong, B.; & Park, K. Y. 2021. Recommendation system with minimized transaction data. *Data Science and Management*, 4, 40-45. doi.org/10.1016/j.dsm.2022.01.001.
- Jun, H. J.; Kim, J. H.; Rhee, D. Y.; and Chang, S. W. 2020. "SeoulHouse2Vec": An embedding-based collaborative filtering housing recommender system for analyzing housing preference. *Sustainability*, 12(17): 6964. doi.org/10.3390/su12176964.
- Katariya, S.; Bose, J.; Reddy, M. V.; Tappashetty, S.; and Sharma, A. 2018. A privacy preserving approach to generating personalized recommendations based on short text classification. In 2018 15th IEEE India Council International Conference (INDICON): IEEE. doi.org/10.1109/INDICON45594.2018.8987121.
- Lee, K. J.; Hwangbo, Y. J.; Jeong, B.; Yoo, J. W.; and Park, K. Y. 2021. Extrapolative collaborative filtering recommendation system with Word2Vec for purchased product for SMEs. *Sustainability*, 13(13): 7156. doi.org/10.3390/su13137156.

- Lian, M.; and Li, J. 2020. Financial product recommendation system based on transformer. In 2020 IEEE 4th Information Technology, Networking, Electronic and Automation Control Conference (ITNEC): IEEE. doi.org/10.1109/ITNEC48623.2020.9084812.
- Mikolov, T.; Chen, K.; Corrado, G.; and Dean, J. 2013a. Efficient estimation of word representations in vector space. arXiv:1301.3781.
- Mikolov, T.; Sutskever, I.; Chen, K.; Corrado, G.; and Dean, J. 2013. Distributed representations of words and phrases and their compositionality. arXiv:1310.4546.
- Resnick, P.; Iacovou, N.; Suchak, M.; Bergstrom, P.; and Riedl, J. 1994. Grouplens: An open architecture for collaborative filtering of netnews. In Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work. doi.org/10.1145/192844.192905.
- Vaswani, A.; Shazeer, N.; Parmar, N.; Uszkoreit, J.; Jones, L.; Gomez, A. N.; Kiser, L.; and Polosukhin, I. 2017. In Proceedings of the 31st International Conference on Neural Information Processing Systems: NIPS'17.
- Verma, P.; Vaishnav, H.; Mathuria, A.; and Dasgupta, S. 2019. An enhanced privacy-preserving recommender system. In International Conference on Security & Privacy. Springer, Singapore. doi.org/10.1007/978-981-13-7561-3_18.
- Wang, X.; Nguyen, M.; Carr, J.; Cui, L.; and Lim, K. 2020. A group preference-based privacy-preserving POI recommender system. *ICT Express*, 6(3): 204-208. doi.org/10.1016/j.ict.2020.05.005.
- Wu, L.; Li, S.; Hsieh, C. J.; and Sharpnack, J. 2020. SSE-PT: Sequential recommendation via personalized transformer. In 2020 The 14th ACM Conference on Recommender Systems: RecSys '20. doi.org/10.1145/3383313.3412258

C3.4 Multi-dimension recommender system based on hotel selection attribute provided by TripAdvisor online reviews

Kang, K. M.^a, Son, Y. G.^b, Lee, S. W.^c, and Kim, J. K.^d

^a Department of Big Data Analytics, Kyunghee University

E-mail: rudah96@khu.ac.kr

^b Graduate School of Business Administration, Kyunghee University

E-mail: son8027@khu.ac.kr

^c Department of Big Data Analytics, Kyunghee University

E-mail: sun2bryant@khu.ac.kr

^d School of Management, Kyunghee University

E-mail: jaek@khu.ac.kr

Abstract

This study aims to predict more accurate user preferences by developing a multi-dimension recommender system through hotel selection attributes provided by TripAdvisor.com. The hotel selection attribute is very diverse compared to general consumer products, and the reason is that the hotel type and the purpose of customers' visit to the hotel are so diverse. In addition, since the hotel includes not only tangible products but also intangible services, and these characteristics of the hotel are combined and considered by customers, the types of hotel selection attribute become more diverse. Considering various hotel selection attributes, that is, multidimensional attribute scores, consumers' opinions can be understood in detail and reflected in recommendations rather than a single-dimensional overall score. The multi-dimension recommender system proposed in this study shows a better F1-score than a single-dimensional CF and maintains a similar diversity.

Keywords: Multi-dimension, Hotel recommender system, Hotel selection attribute, Online review, TripAdvisor

1. Introduction

Online information such as online reviews and ratings is becoming an important decision-making tool for prospective consumers, such as leisure and tourism activities necessary for life, especially hotel reservations. According to (Gretzel et al., 2007), 77.9% of TripAdvisor users referred to online reviews for choosing their hotel. In the hotel industry, a wide variety of factors affect user satisfaction, and there are many subdivisions in the hotel market. Several precedent studies have investigated the hotel selection attributes, and it has been confirmed that various factors such as hotel type and travel purpose affect the hotel selection attributes.

Collaborative Filtering(CF), which is most commonly used in recommender systems, finds users similar to recommended users and generates a recommendation list based on a single overall rating. However, this single(one-dimensional) rating recommender system reflects the overall evaluation of the item but does not reflect the preference for each item in terms of detail. In other words, the sensitivity of each attribute expressed by the user or the inherent characteristics of the product is ignored. Therefore, in this research, we propose a multi-dimension recommender system that more accurately predicts users' preferences by utilizing the six-dimensional properties provided by TripAdvisor.

2. Literature Review

2.1. Hotel Selection Attributes

A hotel includes not only tangible products such as facilities owned by the general manufacturing industry but also intangible services. Hotels are special products sold to customers by combining these characteristics of the hotel, and the types of hotel selection attribute become more diverse. Therefore, it can be seen that the hotel selection attribute has a very large influence on customer decision-making compared to general products.

2.2. Multi-Dimension Recommender Systems

Traditional CF is a technique of finding similar neighbors and recommending items preferred by similar neighbors, based on a user-item rating matrix. Therefore, it is widely known that a recommendation list is generated only by a user's single rating pattern or purchase history without having to understand the characteristics (detailed attributes) of each item and is significantly superior in terms of recommendation accuracy. However, there is a limitation in that the overall evaluation score of a single dimension only provides the overall preference for the item and does not provide information on the detailed characteristics of the item.

3. Methodology

In this section, we describe the structure of our proposed method. In brief, the first stage in our method is collect the hotel reviews with multidimensional rating. Then, considering the time sequence, we divide the dataset into train data to build the model and test data to measure the model's performance. We compare performance with benchmark systems for accurate recommended performance measurements. Figure 1 depicts an overview of our proposed method.

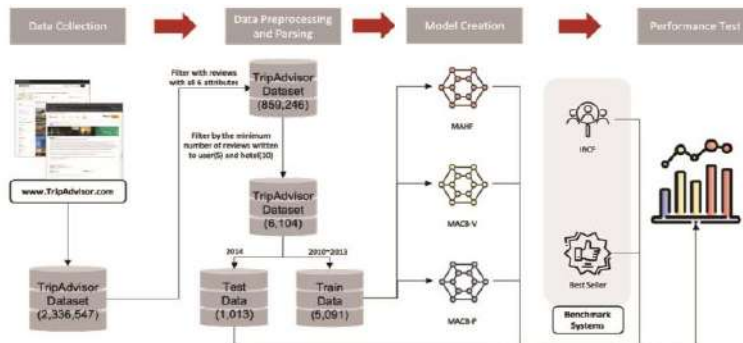


Figure 1. Example of hotel review including 6 dimensions on TripAdvisor

3.1. Proposal Methodologh #1: MAHF

MAHF (Multi-Aspect Hybrid Filtering Method) is a methodology for calculating a CRV (rating vector for a customer) and building a user profile by utilizing six attribute ratings given to a hotel by a user. It is a methodology to recommend Top N hotels visited by similar neighbors by exploring neighboring users of CRVs similar to CRVs of target users.

3.2. Proposal Methodologh #2: MACB-P

MACB-P (Multi-Aspect Content-Based Filtering Method-Positive) is a method of similarity between a CRV using six attribute ratings assigned to a hotel by a user and an HRV (rating vector for a hotel) by a

target user. Here, HRV is defined as a PRV(positive rating vector) considering six positive attributes of the hotel to the user.

3.3. Proposal Methodologh #3: MACB-V

MACB-V (Multi-Aspect Content-Based Filtering Method-V) is a methodology that recommends hotels similar to HRV that are visited by target users on Train Data. The HRV of MACB-V is defined as the average for six dimensions of a hotel.

4. Experiment and Result

4.1. Experiment Reuslt

To compare the performance of MAHF, MACB-P, and MACB-V proposed in this study, the results of benchmark models (IBCF, BS), F1-score and diversity are shown in Figure 2. MAHF showed superior F1-score compared to other models, and MACB methodologies even showed lower F1-score than benchmark models. Diversity shows similar diversity, except for BS models that provide the same recommendation list to all users. These results show that the MAHF proposed in this study has a higher visit prediction rate than the benchmark system and is similarly diverse.

5. Conclusion

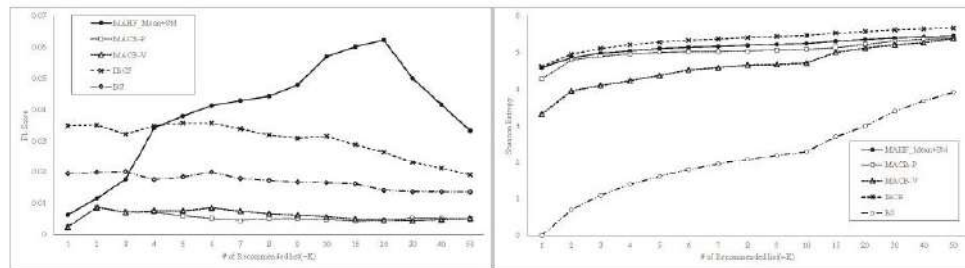


Figure 2. Experiemnt Result(F1-score, Diversity)

In this study, we propose a multidimensional-based recommender system to enhance the personalization of the hotel recommender system by utilizing reviews left online. Using various hotel selection attributes (multidimensional) rather than a single-dimensional overall rating, it was possible to build a tailored recommender system for each user by reflecting the preferences of individual users that could not be captured by the overall rating. In particular, the MAHF proposed in this study showed higher prediction accuracy than IBCF and BS, which showed excellent performance in existing recommendation systems.

Acknowledgements

This research was supported by the BK21 FOUR (Fostering Outstanding Universities for Research) funded by the Ministry of Education (MOE, Korea) and National Research Foundation of Korea(NRF), and the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea(NRF-2020S1A5B8103855).

References

Gretzel, U., Yoo, K. H., & Purifoy, M. (2007). Online travel review study: Role and impact of online travel reviews.

C3.5 AMPER(Aim-Measure-Predict-Evaluate-Recommend): The Paradigm of Digital Me

Kyoung Jun Lee,^{a,b} Baek Jeong,^{a*} Yujeong Hwangbo,^b Youngchan Kim,^c Sungwon Bae,^a
Taecheon Baek^d

^aDepartment of Big Data Analytics, Kyung Hee University, Seoul, Korea

^bBig Data Research Center, Kyung Hee University, Seoul, Korea

^cGraduate School of Artificial Intelligence, POSTECH, Pohang, Korea

^dHarex Infotech, Seoul, Korea

{klee, ylbaek, hwangbo, s1} @khu.ac.kr, kyc618@postech.ac.kr, teddy@ubpay.com

Abstract

AI services can help people live healthier and richer lives, and such services can be collectively referred to as Digital Me. The purpose of this paper is to research Digital Me service and suggests AMPER (Aim-Measure-Predict-Evaluate-Recommend) approach to implement a general Digital Me algorithm for providing actual services. Digital Me is defined as an AI-based product service system (PSS) that makes it possible to manage the individual's state (health, beauty, memory, knowledge, finance, and happiness, etc.) in real-time. We studied cases of Digital Me service of edutech and healthcare. In order to enable a Digital Me service, it is necessary to measure, predict and evaluate the user's future states, and recommend actions to improve the states. We developed a structure of a purely data-based algorithm that set a user-centric aim (A), measures the user's states (M), predicts the user's future states (P), evaluates and compares the user's performance (E), and recommends desirable action (R). As a result of experimenting with the proposed algorithm structure with EdNet dataset, we verified the AMPER structure for the user-centric aim of improving the user's English score that measures the correct answer to the question solved by the user, predicts the correct answer to the next question using Transformer model, evaluates the user's English ability, and recommends the question that will improve English scores the fastest.

Keywords: Digital Me, Aim, Measure, Predict, Evaluate, Recommend

Introduction

In the recently released SF film *Don't Look Up*, there is a scene concerning an AI service that collects tens of millions of users' state data and predicts health conditions. It even predicts when and how the main character dies, and the main character encounters the predicted actual situation. *AI 2041*, an AI novel and AI manual co-authored by AI experts and SF novelists, deals with similar AI services (Lee & Chen 2021). In addition, even with small changes in a user's behavior, insurance premiums may be raised or lowered, and continuous alarms may make them, for example, quit smoking. These services guide you to take medicine as necessary and remind you to schedule a hospital appointment. The advent of AI services in movies and novels suggests a future that is gradually approaching us. AI services that helps people live healthier and richer lives can be collectively referred to as "Digital Me." Digital Me is defined as an AI-based product service system (PSS) that makes it possible to manage the individual's state (health, beauty, memory, knowledge, finance, happiness, etc.) in real time (Lee 2022). For example, in various healthcare cases, user state data such as pulse, blood pressure, and body temperature are secured. Healthcare services are provided by analyzing the health status of users through AI algorithms. It supports real-time monitoring through intelligent exercise devices and mobile and cloud linkage with health devices and provides healthcare services by securing self-diagnosis health data through repeated health check surveys. There are algorithmic studies on health status analysis that predict health, such as AdaCare (Ma et al. 2021), which

considers the characteristics of behavioral change rates, and ConCare (Ma et al. 2020), which refers to individual learning by clinical function. In addition, there are studies on healthcare services such as treatment recommendation algorithms based on health prediction (Wang et al. 2018). Digital Me services exist not only in healthcare but also in edutech, and the most representative example is Riid. It is currently operating as a service using various algorithms for predicting and recommending users' English skills.

AMPER(Aim-Measure-Predict-Evaluate-Recommend)

In this work, AMPER is proposed as an algorithmic structure for implementing a digital service, as shown in Figure 1. The Digital Me algorithm can maximize user state improvement by recommending desirable behaviors by deriving R (Recommend) for going to the target state based on user state data. The Digital Me algorithm uses user state data, according to user-centered objective A (Aim), to establish M (Measure) to measure the current state of the user, and only using data to predict the user's future states through P (Predict). After evaluating the user's future states through E (Evaluate), it is possible to maximize the user's state improvement by providing an R (Recommendation) of behavior for achieving the target state.

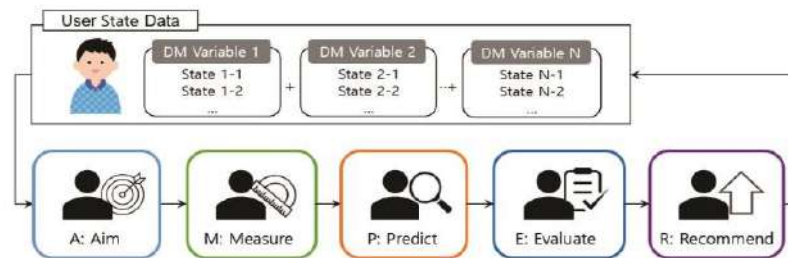


Figure 1. AMPER(Aim-Measure-Predict-Evaluate-Recommend)

Experiment

Datasets

To verify AMPER, we used EdNet data, including user problem solving data and problem information data, released by Riid. We used the data for the experiment with 7,843 total users, 81,618 problem-solving data points, and 11,276 question types through preprocessing.

Application of AMPER

This research implements the Digital Me service in the structure of the 5-stage AMPER using user state data as follows:

- **(A) Aim:** Users aim to improve their English scores.
- **(M) Measure:** Through the correct answer of the problem information data, the user's English ability (state) is measured by checking the correct answer of the problem solved by the user.
- **(P) Predict:** From the user's correct answer to the question, predict the correct answer to the next question.
 - Algorithms for Predicting were developed using Transformer Model (Vaswani et al. 2018). By learning the correct answers to the 20 questions (Train) solved by the user, the correct answers to the 21st questions (Label) were predicted, and the accuracy was 70.77%.
- **(E) Evaluate:** For each question, the incorrect answer rate of overall user is given as the score of the question, and then the user's problem-solving data is calculated as a score.
 - If the incorrect answer rate for question No. 511 is 45%, then 0.45 points will be given, and if the incorrect answer rate for question No. 82 is 30%, 0.3 points will be given. If you get both No.511 and No.82, you get 0.75 points.

- **(R) Recommend:** Provides questions to maximize the achievement of the goal of improving English scores. This is the result of randomly extracting three users to check the AMPER result and confirming the improvement of the English score.

		User A	User B	User C
(Time: t) Learning 20 questions	The score of the first 20 questions	5.0	1.7	3.1
(time: t+1) Learning 40 questions	[Randomly recommend 20 questions] Cumulative score when solving a question	8.3	4.4	6.0
	[(R) Recommend 20 questions] Cumulative score when solving a question	20.8	18.3	19.1

Conclusion

In this study, we confirm viability of Digital Me research and services through various literature studies, and propose an AMPER structure for Digital Me services. Beyond the Digital Me study conducted by domain for healthcare or edutech, from a more macroscopic point of view, we design a Digital Me algorithm with a five-step AMPER structure and validate it using EdNet data. As a result, we confirmed that users' English scores improved. In a future study, it is necessary to apply the AMPER structure of Digital Me to other domains.

Acknowledgments

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF2020S1A5B8103855). This research was supported by the BK21 FOUR (Fostering Outstanding Universities for Research) funded by the Ministry of Education (MOE, Korea) and National Research Foundation of Korea (NRF). This work was supported under the framework of international cooperation program managed by the National Research Foundation of Korea(NRF 2020K2A9A2A06069972, FY2020).

References

- Lee, K. F., & Chen, Q. (2021). AI 2041: Ten visions for our future. Currency.
- Lec, K. J. (2022). Digital Me as AI-based Education Paradigm. 2022 Global Human Engagement Conference: 'Engagement for future: AI and beyond'
- Ma, L., Gao, J., Wang, Y., Zhang, C., Wang, J., Ruan, W., Tang, W., Gao, X., & Ma, X. (2020). Adacare: Explainable clinical health status representation learning via scale-adaptive feature extraction and recalibration. In Proceedings of the AAAI Conference on Artificial Intelligence, 34(1), 825-832.
- Ma, L., Zhang, C., Wang, Y., Ruan, W., Wang, J., Tang, W., Ma, X., Gao, X., & Gao, J. (2020). Concare: Personalized clinical feature embedding via capturing the healthcare context. In Proceedings of the AAAI Conference on Artificial Intelligence, 34(1), 833-840.
- Vaswani, A., Shazeer, N., Parmar, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser, L., & Polosukhin, I. (2017). Attention is all you need. Advances in neural information processing systems, 30.
- Wang, L., Zhang, W., He, X., & Zha, H. (2018). Supervised reinforcement learning with recurrent neural network for dynamic treatment recommendation. In Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining, 2447-2456.

C3.6 Analyzing the Impact of Components of Yelp.com on Recommender System Performance

Lee, S. W.^a, Shin, H. J.^b, Kang, K. M.^c and Kim, J. K.^d

^a Department of Big Data Analytics, Kyunghee University
E-mail: sun2bryant@khu.ac.kr

^b Department of Management, Kyunghee University
E-mail: nayarexia@nate.com

^c Department of Big Data Analytics, Kyunghee University
E-mail: rudah96@khu.ac.kr

^d School of Management, Kyunghee University
E-mail: jaek@khu.ac.kr

Abstract

As people's demand for eating out is steadily increasing, the number of restaurants is continuously increasing, and catering industry platforms such as Yelp, Open Table, and Zomato provide basic information and evaluation information of restaurants and restaurant recommendation services suitable for users. Existing research on recommending restaurants mainly uses only evaluation information to find neighbors, and the use of user and restaurant information is still in its infancy. In addition, there is no study on how various types of input information affect the performance of the recommender system. This study examines the influence of three components information provided by Yelp.com on the performance of the recommender system using various real restaurants, reviews, and users dataset provided by Yelp.com, a global restaurant review platform. For this purpose, 2-Phase Experiment was designed, and restaurant data located in Austin, Texas, USA, which has the largest number of review data, was collected.

Keywords: Restaurant Recommender Systems, Yelp, Experimental Design

Introduction

Most recommendation services are based on users' explicit information on items, such as ratings or stars. However, it is impossible to provide a personalized recommendation service because it cannot consider implicit information related to users and items. To resolve the limitation, some studies on a recommender system(RS) considering implicit information are actively being conducted. However, these studies aim to develop new models to improve the accuracy or diversity of RS without knowing which information could improve the performance. It causes the models to be restrained in explaining to people why the recommendations are suggested to them. Also, restaurant managers cannot focus on specific information to improve customers' satisfaction. Therefore, this study aims to measure the impact of diverse implicit information on RS and analyze it to determine which information positively affects RS.

We collected the dataset from Yelp.com, a global platform for restaurants, generated from 2010 to 2019 before the COVID-19 virus became prevalent. It contains 4,259 users, 4,469 restaurants, and 196,934 reviews. We designed a 2-phase experiment to measure the impact of information on RS more precisely. In phase 1, we develop a model adding a filtering neighborhood step to traditional CF(Collaborative

Filtering), the most popular RS. Each feature of users and reviews information is put into the new step, and the accuracy of RS based on all features is calculated. The accuracy derived from traditional CF is compared to the accuracy with each feature. When the accuracy improves considering a specific feature, we infer it affects RS positively. As the same, we develop a model adding a filtering recommendation candidates step to traditional CF and compare accuracy according to restaurant features in phase 2.

Literature Review

Restaurant Recommender System

The current studies for restaurant RS have been exploiting implicit information to extract users' preferences. Unlike explicit feedback, such as ratings or stars, implicit information does not literally indicate the preferences. For example, it cannot be assumed that a user prefers a restaurant because he has visited it several times before. Nevertheless, implicit information has significant advantages in terms of diversity and amount of data to discover preferences. Therefore, most current RSs exploit implicit information to reduce users' burden and identify more accurate preferences.

Most existing studies on RS with implicit information have been conducted about how to reflect them in RS, but few studies on which information contributes to improving recommendation performance. It causes RS performance to be improved but non-explainable at once. Therefore, this study aims to measure the impact of diverse implicit information on RS and analyze it to define which information positively affects RS.

Experimental design

Dataset

The dataset on Yelp.com, a global restaurant platform, has been used to conduct the 2-phase experiment in this study. It comprises sub-datasets on three components with users, restaurants, and reviews. Each sub-dataset includes numerous features. We have filtered the dataset generated from 2010 to 2019 before the COVID-19 virus spread to derive more accurate results. Also, 4,509 restaurants in Austin, Texas, have been selected for the experiment because people commonly do not visit restaurants across cities.

2-Phase Experiment

Recommendations have been generated by only the user's quantitative preferences, such as ratings or stars, on traditional CF. However, this study desires to measure the impact of features from users, restaurants, and reviews information on RS and reveal which features could improve the performance. To measure the impact of features more precisely, we developed two different RS models considering features; one is for features of users and reviews, and the other is for features of restaurants. That is because the features of users and reviews are closer to a factor of users, and the features of restaurants are closer to a factor of items in RS. Therefore, we developed 2-phase experiment shown in Figure 1. Each phase experiment is conducted independently.

Evaluation

Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE) are computed in the first phase, which are widely used to evaluate the predictive accuracy of RS. Both measures evaluate predictive performance by calculating the difference between the actual rating and the predicted one. In the second phase, the performance was calculated by F-1 score, assembling measures of Precision and Recall. It is a trade-off between Precision and Recall. As the number of recommendations increases, Recall improves while Precision worsens. Therefore, this study used F-1 score to compensate for the trade-off. As F-1 score approximates 1, both Precision and Recall are improved.

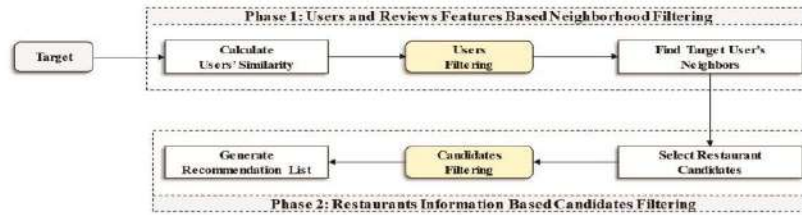


Figure 1. Framework of the 2-Phase Experiment

Result

Phase-1 Experimental Results

The experiment in the first phase demonstrates a feature that improves RS performance belonging to users and reviews information. It was tested and compared by varying the size of neighbors from 2 to 30. The experimental results show that the performance could be improved in all neighborhood sizes compared to CF when reflecting elite status and cumulative number of reviews. All of them belong to users information. Contrariwise, it was not found that the performance was improved when reviews information was considered. Also, this result shows how much the performance can be improved.

Phase-2 Experimental Results

The experiment in the second phase demonstrated a feature that positively affects the RS performance belonging to restaurant information. The accuracy was calculated by varying the size of recommendations from 2 to 20. As a result of the experiment, when CF considered the price range or average rating, the performance improved regardless of the size of recommendations. In the case of categories of restaurants, the performance improved when the recommendation size was less than 10.

Conclusions

Most of the current studies focus on developing a model for improving the accuracy or diversity of recommendations. However, they have not focused on which information could improve or worsen the performance. It makes recommendations yielded from the models that cannot explain why a user receives them. Therefore, this study aims to measure the impact of numerous implicit information on RS and analyze it to determine which information positively affects RS.

A two-phase experiment was designed to measure the impact of users, restaurants, and reviews information on RS performance. The first phase experiment was conducted to see the change in performance according to the features of users and reviews information. As a result, when recommendations reflect elite status and the cumulative number of reviews, the RS performance improves in all neighbors' sizes compared to traditional CF. Conversely, reviews information did not help the performance to improve. The second phase experiment was conducted to confirm the change in performance according to the features of restaurant information. As a result, CF considering the restaurant price range and average rating, improved the performance regardless of the size of recommendations compared to traditional CF.

Acknowledgements

This research was supported by the BK21 FOUR (Fostering Outstanding Universities for Research) funded by the Ministry of Education(MOE, Korea) and National Research Foundation of Korea(NRF).

[DAY 1]

D3 [KIISS-Paper Session] 자연어 처리

D3.1 복수 텍스트(text)로 단수 컨텍스트(context)의 의미를 분해하는 인공지능 자연어처리 기술 개발*

김원희
브레인벤처스

* 본 연구는 중소벤처기업부 중소기업기술정보진흥원 창업성장기술개발사업(디딤돌, 첫걸음)의 지원에 의해 연구되었다(과제번호: S3054215).

인공지능 자연어처리 기술 중에서 산업계에서 가장 주목하고 실질적으로 사용 가능한 기술은 바로 텍스트 등에서의 의미 추출 기술과 감성 평가 기술이다. 그동안 비정형 데이터로서 그 처리에 많은 노력을 기울였음에도 불구하고 괄목할 만한 결과를 도출하기 못하고 있는 현재 상황에서 브레인벤처스는 한국어 BIO 태깅 기반 Triplet 기술을 응용 개발하여 위에서 언급한 텍스트와 컨텍스트에서 의미를 추출하고 그것의 감성을 긍정, 부정, 중립으로 자동 평가하는 기술을 개발하였다.

우선 컨텍스트와 텍스트의 상관관계 그리고 텍스트를 통하여 컨텍스트를 어떻게 의미 분해한다는 것인지에 대한 개괄적 설명을 하면 다음과 같다.

<p>공동체 문화이다. 고온 다습한 인도에서 소는 키우기 쉽고 유용한 가축이다. 소는 초식 동물로서 먹이를 조 달하기 쉬우며, 무엇보다 비농사를 주업으로 하는 이 지역에서 훌륭한 노동력을 제공한다. 여러 해 키운 후에 육우로 소비 하는 것보다는 가축으로 계속 키우는 것이 장기적으로 훨씬 득이 된다. 따라서 인도 경제에서는 소를 식량으로 소비하는 것을 금기시할 필요가 있었고, 이것이 암소 숭배로 이어졌다고 할 수 있다. 이슬람에서 돼지 혐오가 나타나게 된 과정도 이와 유사하다.</p>	
<p>(관점 1) 사회문화의 전통을 지키는 것이 중요하다. 따라서 인도에서 소 숭배 전통은 지켜져야 한다.</p>	<p>(관점2) 인도의 식량난과 다수의 기아자들을 생각하면 소를 식용으로 먹는 것이 더 좋은 선택이다.</p>

[표1: 인도 소 숭배 전통에 대해 두 가지 논점으로 분석하기, 전통을 지켜야한다(좌측 관점), 지키지 않아야한다(우측 관점)]

위의 용례에서 보여지는 바와 같이 컨텍스트(공통 제시문)에서는 인도 경제 상황, 소 숭배 문화 등의 주제를 담고 있는데, 제시문의 전체적인 내용은 소 숭배 전통을 지키는 것이 필요하다는 관점이다. 그 아래에는 인도의 어려운 경제사향으로 말미암아 소를 식용으로 활용하는 것이 경제적 효용 가치가 있다는 주장과 전통적 문화를 지키려는 경향이 강한 인도에서 소는 어떠한

경우에도 식용을 활용할 수 없다는 주장이 담겨있다. 결론적으로 말하면 관점1의 시각에서는 컨텍스트의 내용과 긍정성을 공유하고, 관점2의 시각에서는 컨텍스트와 서로 다른, 부정성을 공유하고 있다. 이와 같이 하나의 컨텍스트를 두 개 이상의 관점으로 그 감성을 분석하는 기술이 본 연구발표의 주제이며, 이러한 감성을 자동 추출하는 기술이 바로 Triplet 기술이다.

II. 중심 말

II-1 Triplet 기술 개요 및 이론적 진화

대부분의 경우 의미 추출은 문장 단위에서 이루어진다.¹⁾ 그동안 문장 의미 추출 분야에서 연구되어온 ABSA(Asspect-based Sentiment Analysis) 방법은 aspect-sentiment 2가적 요소 추출로서 opinion term을 추출하지 않는 문제점을 안고 있었고, 경우에 따라서는 aspect-opinion 추출은 그들의 감성적 상관성을 추출해내지 못하는 문제점을 안고 있었다.

Example sentence:	The atmosphere is attractive , but a little uncomfortable .
Aspect-sentiment pair extraction :	[(atmosphere, positive), (atmosphere, negative)]
Aspect-opinion co-extraction :	[atmosphere, attractive, uncomfortable]
Opinion triplet extraction :	[(atmosphere, attractive, positive), (atmosphere, uncomfortable, negative)]

Figure 1: Differences among aspect-sentiment pair extraction, aspect-opinion co-extraction, and opinion triplet extraction. Words in blue are aspect terms. Words in red are opinion terms. [] denotes a set of extracted patterns, and () denotes an extracted pattern.

[그림1: ABSA 방법의 한계]

위의 한계점이 Aspect Sentiment Triplet Extraction가 왜 필요한가? 에 대한 대답이 될 것이다. 즉, 그 이유는 문장의 감성 분석은 target, opinion, sentiment 등의 3가지 요소가 모두 추출되어야 가능하다고 판단하기 때문이다. 이후 Triplet 추출을 위하여 다양한 방법이 시도되어 왔다. 유사한 연구에서 가장 인정받는 연구는 Peng et al(2019)이다. 이들은 우선 aspect-sentiment 쌍과 opinion을 연속적인 두 개의 태커(Tagger)를 결합하여 추출한다. 이 태거에서 감성은 통합된 태그(Unified Tag)를 통해 aspect에 첨가된다. 그리고 opinion은 추가적인

1) 이들이 단어가 아니라 구나 단어의 연속이 될 수 있으므로 span이라는 용어를 추가하여 사용하기도 한다.

분류기(Classifier)를 통하여 첨가된다. 여기에는 두 가지 문제점이 존재하는 데 그것들은 다음과 같다.

- a. 통합된 태그(Unified tag)를 통하여 감성을 예측할 때 생기는 감성 의존도 감소의 문제 (Degrading the Sentiment Dependency)
- b. Aspect-sentiment 결합 형식이 Opinion과의 상호 작용(Interaction)의 중요성을 무시하는 문제: aspect나 opinion이 중첩(Overlap)되는 경우 문제가 발생한다. 다음은 그런 경우의 용례이다.

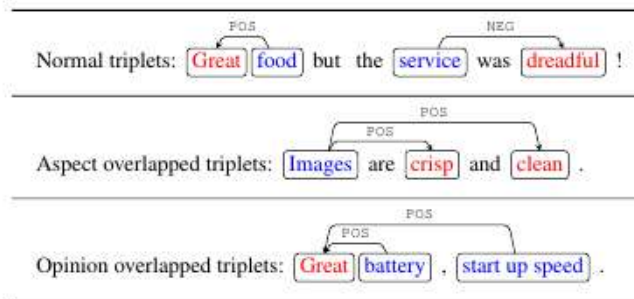


Figure 2: Categories of triplets. Spans in blue are aspects and spans in red are opinions. Arcs indicate sentiment dependencies and are always directed from an aspect to opinion.

[그림2: Peng, 2019 방법의 문제점 예시]

다음의 주요 방법은 triplet 추출 과정을 여러 단계로 나누어 파이프라인으로 연결, 접근하는 방식이었다. 우선 첫 번째 단계에서 BIOES(Begin, Inside, Outside, End, Single) 태깅 구조와 LSTM, CRF(Conditional Random Fields), GCN(Graph Convolutional Network)을 이용하여 타겟, 감성, 오피니온을 추출하기 위한 순차적 라벨링(Sequence Labeling)을 수행한다. 두 번째 단계에서는 Multi-Layer Perception(MLP)를 기반으로 하는 분류기(Classifier)를 사용하여 target과 opinion을 결합시켜서 triplet을 완성한다.

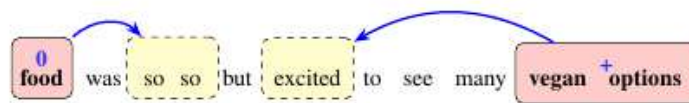


Figure 1: ASTE with targets in bold in solid squares, their associated sentiment on top, and opinion spans in dashed boxes. The arc indicates connection between a target and the corresponding opinion span.

[그림3: ASTE 기본 개념도]

BIOES 태깅 기법도 효율적이기는 하지만 위치 정보가 없는 경우에는 그 효용성이 떨어진다. 이런 경우 타겟과 오피니온을 연결하는 두 번째 처리 단계를 필요로 하기 때문이다.

Chen Zhang et al(2020)은 자신들의 논문에서 ABSA의 관점을 수용하며 aspect-term, opinion-term과 함께 동시에 그들 사이의 감성 상관관계를 biaffine score를 기반으로 parsing하는 multi-task learning framework를 제안한다(OTE-MTL). 이 방법은 멀티 헤드 구조를 이용하여 aspect와 opinion을 두 개의 독립적인 헤드에서 추출하고, 감성 예측을 aspect 추출에서 분리하는 방법을 통해 실현되는 것이다. 또한 세 번째 헤드로서 감성 의존 파서(Sentiment Dependency Parser)를 도입하여 단어 레벨에서의 감성 의존을 예측하고 향후 추가적인 상위 레벨(Further Decode Span-level)에서의 활용을 시도할 것을 제안하였다. 본 기술을 ASBA를 위한 4가지 SemEval benchmarks에서 시험을 수행하였다.

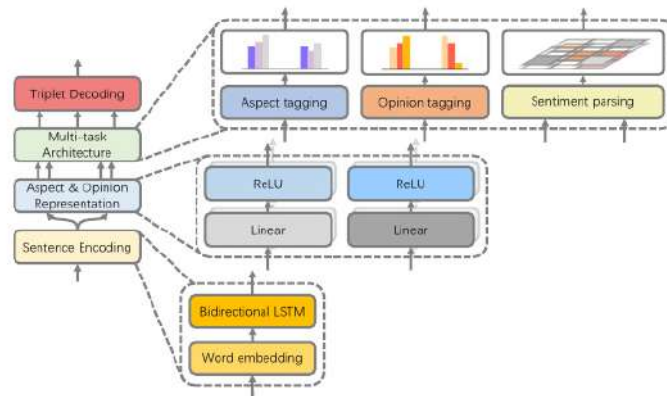


Figure 3: An overview of our proposed framework.

[그림4: Chen Zhang et al(2020)의 OTE-MTL 프레임워크]

Multi-task 구조 내에서는 aspect and opinion tagging과 word-level sentiment dependency parsing을 수행한다. 이 과정을 통해서 추출된 3가지 요소(Asspect, Opinion, Word-level Sentiment Dependency)는 휴리스틱 규칙(Heuristic Rule)을 통하여 triplet decoding 프로세스를 진행한다.

"Great battery, start up speed."
 aspect tag {O, B, O, B, I, I, O}
 opinion tag {B, O, O, O, O, O, O}
 word-level sentiment dependency (6, 1, POS)²⁾
 final output [(4,6), (1,1), POS]

2) Index 형식으로서 6: aspect의 마지막 단어 speed의 문장 내 위치, 1: opinion의 마지막 단어 great의 문장 내 위치를 위미한다.

이들이 실제 수행한 연구 결과는 다음과 같다.

Case	Ground truth	OTE-MTL-Unified	OTE-MTL
Great food but the service was dreadful !	[(food, Great, POS), (service, dreadful, NEG)]	[(food, Great, POS), (service, dreadful, NEG)]	[(food, Great, POS), (service, dreadful, NEG)]
The atmosphere is attractive , but a little uncomfortable .	[(atmosphere, attractive, POS), (atmosphere, uncomfortable, NEG)]	[(atmosphere, attractive, POS), (atmosphere, uncomfortable, POS ^x)]	[(atmosphere, attractive, POS), (atmosphere, uncomfortable, NEG)]
I am pleased with the fast log on , speedy WiFi connection and the long battery life .	[(log on, fast, POS), (WiFi connection, speedy, POS), (battery life, long, POS), (log on, pleased, POS), (WiFi connection, pleased, POS), (battery life, pleased, POS)]	[(log ^x , fast, POS), (WiFi connection, speedy, POS), (battery life, long, POS), (log ^x , pleased, POS), (] ^x , (] ^x)]	[(log ^x , fast, POS), (WiFi connection, speedy, POS), (battery life, long, POS), (log ^x , pleased, POS), (WiFi ^x , pleased, POS), (] ^x)]

Table 3: Case study. Marker ^x indicates incorrect predictions.

[그림5: Chen Zhang et al(2020)의 OTE-MTL 처리 결과표]

그러나 이들의 연구에서는 구조 내에서 중심이 되는 요소(Core Component)의 필요성이 제기되었고, 보다 강건한 aspect, opinion 추출 태거 개발, triplet 추출을 위한 좀 더 유연한 평가 메트릭(Flexible Evaluation Metric) 개발, 좀 더 강력한 triplet 상호 작용 매커니즘(Interaction Mecanism) 개발 등의 이슈가 발생하였다.

문장의 감성을 추출하기 위해서는 Aspect, opinion term의 추출도 중요하지만 이들 사이의 연관성(Dependency)를 추출하는 것이 더욱 중요하다는 접근법도 논의되었다. 그것은 이를 통하여 높은 정확도를 달성할 수 있기 때문이다.

위치적 연관성에 착안한 연구도 진행되었는데, Lu Xu, et al (2021)는 triplet의 3가지 요소가 모두 위치적으로 긴밀하게 연결되어 있다는 점에 착안하여, 순차적 태깅 접근법(Sequence Tagging Approach)을 이용하는 결합 모델을 제안하였다. 이 방법에서는 어떻게 하면 태깅 접근법을 효율적으로 디자인하여 이들 3요소 사이의 풍부한 상호작용을 포착하는가가 제일 중요한 해결과제이다. 이것의 해결책으로 triplet을 협업적으로 추출하는 위치-기반 태깅(Position-aware) 구조 JET(Jointly Extract the Triplet)를 제안한다. 이를 통하여 Target, Target Sentiment, Opinion span을 추출한다는 것이다. 이것을 실현하는 단계는 다음과 같다.

a. 새로운 위치 기반 태깅 구조 도입:

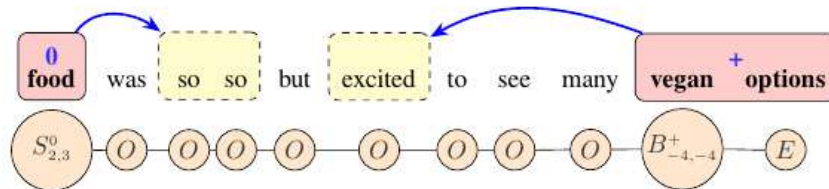


Figure 2: The position-aware tagging scheme for the example instance.

[그림6: 위치-기반 태깅(Position-aware) 구조 JET(Jointly Extract the Triplet)]

- S: a single-word target
- 0: neutral
- 2, 3: 오른쪽 위치 지정
- B: a target beginning
- 4: 왼쪽 위치 지정

위의 구조를 보면 target word의 정보를 중심으로 opinion word, sentiment의 값들을 동시에 tagging하는 방식(Sub-tags BIOES)을 보여주고 있다. 특별히 이러한 위치 지정 정보를 "offset" 이라고 표시한다. 이러한 태깅은 기존의 연구가 2개의 태그로 분리하던 방식을 하나로 합쳐서 처리할 수 있는 장점이 있다.

The salad is cheap with fresh salmon
 (salad, cheap with fresh salmon, positive)
 (salmon, fresh, positive)

b. 단순 LSTM-기반 뉴럴 구조 도입

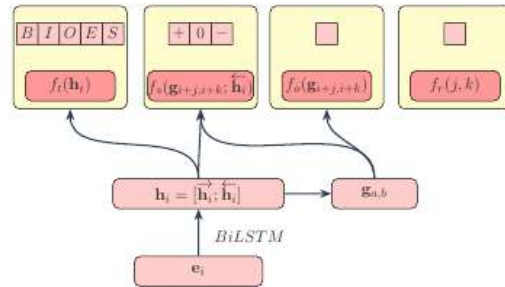


Figure 3: Neural Module for Feature Score

[그림7: 단순 LSTM-기반 뉴럴 구조]

특성 학습(Feature Learnig)을 위해서 단순 LSTM-기반 뉴럴 구조를 도입한다. 위의 3번 그림의 맨 윗 부분 4개의 박스에서는 Factorized feature score가 계산된다. 활용한 데이터으로는 Peng et al(2019)에서 제공한 것(ASTE-Data-V1)을 활용하였으며 여기에 더하여 하나의 opinion 이 여러 개의 target과 연결된 경우(*Best service and atmosphere*) 등을 포함하는 데이터를 추가하여 ASTE-Data-V2로 명명하고 활용하였다. 그러나 이러한 방법은 최적화된 JET 모델도 target, opinion, sentiment 등의 span 길이가 길어지면 추출 정확도의 하락을 가져온다는 단점을 내포하고 있다. 그럼에도 불구하고 기존의 pipeline 모델에 비하여 향상된 precision, recall, F1 score 값을 보여준다는 장점은 인정해야 할 것이다.

II-2 한국어 Triplet 응용 기술

브레인벤처스는 ASTE 작업을 위해 GTS모형을 채택했으며 CNN, BiLSTM, BERT 각 세 가지로 구현된 모델 중 BERT GTS 모델을 사용하여 감성추출 기술개발을 진행하였다. 그 방법을 구체적으로 설명하면 다음과 같다. GTS란 Grid Tagging Scheme의 약자로, [그림8]과 같이 모든 단어 간의 관계를 5개의 태그 {A, O, Pos, Neu, Neg, N}를 이용해 나타내는 방법이다(Fang Wang, Yuncong Li et al (2021)). A는 aspect term, O는 opinion term을 뜻하고, Pos, Neu, Neg는 각각 positive, neutral, negative를 나타내며, N은 none으로 아무런 관계가 없음을 의미한다. 모든 단어 간의 태깅을 마치면, 설계한 디코딩 알고리즘을 통해 Triplets를 추출한다.

분위기	는	중	지만	직원	은	불친절	해요	분위기
A	N	Pos	N	N	N	N	N	N
	N	N	N	N	N	N	N	N
		O	N	N	N	N	N	는
			N	N	N	N	N	중
				N	N	N	N	지만
				A	N	Neg	N	직원
					N	N	N	은
						O	N	불친절
							N	해요

[그림8: Triplet 추출을 위한 태깅 예시]

먼저, Grid Tagging을 위해 데이터 포맷과 BIO 표현법을 사용한다. 데이터 포맷에 맞춰 데이터를 넣을 때, GTS 모델이 영어 데이터를 기반으로 설계되었기 때문에 공백을 기준으로 문장을 토큰나이징한다는 점에 착안하여, 한글 데이터를 토큰나이징 하기 위해 형태소마다 공백을 넣어주어야 한다. 또한 한 문장에 aspect term이 여러 개일 경우, 구분하여 태깅해야 한다. 반대로 하나의 aspect term에 대해 여러 개(2개 이상)의 opinion term이 존재한다면 각각 나누지 않고 하나에 다 태깅해준다. 데이터 태깅 작업이 끝나면 인코딩 알고리즘을 통해 Triplet 추출 작업과 모델 훈련을 위한 작업을 한다. 입력으로 BIO 태깅된 문장이 들어가면 우선 BIO 태그를 이용해 aspect term과 opinion term을 찾아 문장 내 위치를 저장한다. 저장된 위치 정보와 인코더를 통해 문장에서 aspect term은 '1'로, opinion term은 '2'로 각 negative, neutral, positive는 '3', '4', '5'로 그 외 나머지는 -1로 바꿔주고 BERT 모델 훈련을 위한 마스크를 만들어준다. 이 값들을 통해 모델을 훈련한다. 그 후, 디코더를 통해 훈련한 모델이 예측한 Triplets를 추출한다.

브레인벤처스는 한글 데이터에서 Triplets를 추출하기 위해 게임, 도서, 식당/카페, 호텔 분야에서 리뷰 데이터를 수집했다. 테스트하기 위해 그중 50개 데이터를 GTS 모델 데이터 포맷에 맞게 BIO 태깅을 했다. 그 후, 사전 훈련된 'Multilingual' 모델과 토큰나이저를 사용해 훈련을 진행했다. 그리고 모델이 예측한 Triplets를 출력하기 위해 기존 코드를 수정하여 추출한 Triplets를 출력하는 함수를 추가해주었다. 브레인벤처스가 개발한 한국어 Triplet 응용 기술을

활용하여 한국어 문장에서 화자와 논제 그리고 극성값 추출하는 정확도를 실험한 결과, 0.770을 기록하였고, 극성 값인 Opinion을 추출해 내는 정확도는 그보다 높은 0.852를 기록하였다.

7.2. 시험 결과

시험항목	시험결과	비고
상대적 극성 평가	0.852	극성 값인 opinion 추출 정확도
화자와 논제의 구분	0.770	화자와 논제, 극성 값을 포괄하는 Triplet 추출 정확도
사전학습 언어모델 성능평가	0.894	-

총 9페이지 중 2페이지 양식TOP-12-01-03(1)

[그림9: 브레인벤처스 한국어 Triplet 추출 공인시험성적표 일부]

III. 맺는 말

앞에서 언급한 바와 같이 Triplet은 관점(Aspect), 의견(Opinion), 감성(Sentiment)로 구성되는 문장의 특성을 자동으로 추출하는 인공지능 기술을 의미한다. 비정형 데이터인 자연어 문장에서 그 의미를 자동추출하는 기술은 전 산업계에 꼭 필요한 기술이고 나날이 그 수요가 늘어가고 있는 것이 사실이다. 이러한 기술 개발, 특히 한국어에서 Triplet 기술 실현을 위해 선결되는 것은 바로 한국어 BIO 태깅 기술과 Triplet 응용 기술이다. 이 두 기술이 합쳐져서 인공지능은 컨텍스트 내에 존재하는 다양한 관점과 감성을 자동으로 추출하게 된다. 현재 브레인벤처스는 관련한 데이터셋(정제된 4만개 데이터셋)을 보유하고 있으며, 다양한 산업분야에서 관련 인공지능 데이터 추가확보, 모델을 개발, 적용하고 있다.

IV. 참고문헌

Chen Zhang, Qiuchi Li, Dawei Song, Benyou Wang (2020) A Multi-task Learning Framework for Opinion Triplet Extraction, arXiv:2010.01512v2[cs.CL]31 Oct 2020.

Fan, Z., Wu, Z. et al (2019) Target-oriented opinion words extraction with target-fused neural sequence labeling. Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies, Volume 1 (Long and Short Papers), 2509-2518.

Fang Wang, Yuncong Li et al (2021) A More Fine - Grained Aspect - Sentiment - Opinion Triplet Extraction Task. arXiv:2021.15255v4[cs.CL].

Haiyun Peng, Lu Xu et al (2019) Knowing What, How and Why: A Near Complete Solution for Aspect-based Sentiment Analysis. In Proc. of AAAI.

Lu Xu, Hao Li, Wei Lu, Lidong Bing (2021) Position-Aware Tagging for Aspect Sentiment Triplet Extraction, arXiv:2010.02609v3[cs.CL]9 Mar 2021.

Peng, H., Xu, L., Bing, L., Huang, F., Lu, W., & Si, L. (2020) Knowing what, how and why: A near complete solution for aspect-based sentiment analysis. Proceedings of the AAAI Conference on Artificial Intelligence Vol. 34, No. 05,, 8600-8607.

김원희, 이서지, 이준호(2021) 한국어 문장 감성 추출 정확도 향상을 위한 BIO 태깅과 Triplet 방법론 연구, 외국학연구, 제57집, 347-368.

D3.2 기업의 조직문화가 재무성과에 미치는 영향에 대한 연구: Word2Vec 모델과 패널 데이터를 이용하여

김한솔
한양대학교 일반대학원
비즈니스인포매틱스학과
khs4140@hanyang.ac.kr

김혜민
한양대학교 경영대학 경영학부
hyeminkim@hanyang.ac.kr

백승익
한양대학교 경영대학 경영학부
sbaek@hanyang.ac.kr

초록

본 연구는 기업에 존재하는 조직문화가 기업의 재무성과에 어떤 영향을 주는지를 탐색하는 것을 주요 목표로 한다. 이를 위해 우리나라의 온라인 구인·구직 플랫폼인 잡플래닛 (JobPlanet)으로 부터 KOSPI 200에 포함된 59개의 기업을 선정하고, 해당 기업의 조직문화를 파악하기 위하여 전·현직 구성원들이 잡플래닛에서 작성한 81,067개의 리뷰 데이터를 수집하여 분석에 이용하였다. 리뷰 데이터로부터 해당 기업의 조직문화를 정의하기 위하여 본 연구에서는 기존의 조직문화 관련 연구와 유사어 도출을 위하여 널리 사용되어지고 있는 Word2Vec 분석 방법을 이용하여 본 연구에서 사용될 문화사전 (Culture Dictionary)을 구축하였다. 문화사전에 포함된 기본적인 5개의 문화적 가치 (Innovation, Integrity, Teamwork, Quality, Respect)는 기존 연구로부터 도출하였고, 각 문화적 가치와 연관된 유사어들은 Word2Vec 분석 방법을 이용하여 도출하였다. 본 연구에서 문화적 가치가 기업의 재무 성과에 미치는 영향을 탐색하기 위하여 기업의 가치 및 성장성을 나타내는 지표로 알려진 Tobin's Q와 기업의 수익성을 나타내는 지표인 총자산영업이익률 (ROA: Return on Asset)을 본 연구의 종속변수로 활용하였다. 본 연구에서는 5개의 문화적 가치 비율, 제조업과 서비스업을 통제하는 통제 변수, 그리고 기업의 재무성과를 연도별로 정리한 패널 데이터를 이용하여 분석하였다. 분석 결과 총자산영업이익률과 Tobin's Q에 영향을 미치는 문화 가치는 Innovation과 Quality로 나타났으며, 총자산영업이익률에서는 기업의 산업 구분 변수가 통계적으로 유의미함을 확인하였으며, 기업의 산업별로 차이가 있음을 또한 확인하였다.

주제어

기업 문화, 문화 사전, 자연어 처리, 재무 성과, 패널 데이터 분석

D3.3 MIS Quarterly 연구동향 분석: 토픽모델링 및 키워드 네트워크분석

강은경
경희대학교 일반대학원
빅데이터응용학과
luckiness1@khu.ac.kr

정연식
경희대학교 일반대학원
경영학과
2018310440@khu.ac.kr

양선욱
경희대학교 일반대학원
빅데이터응용학과
seonuk.yang@khu.ac.kr

권지윤
경희대학교 일반대학원
빅데이터응용학과
kwon31403@khu.ac.kr

양성병
경희대학교 경영대학
빅데이터응용학과
sbyang@khu.ac.kr

Abstract - 지식과 정보산업이 경제의 주축인 지식 기반 사회에 있어 지식의 공유와 확산 및 체계적인 관리는 국가 경쟁력 향상뿐만 아니라 지속 가능한 사회 발전의 필수 전략으로 인식되고 있다. 또한, 정보기술(Information Technology: IT)과 경영의 융합이 다양한 방식으로 일어나고 있는 정보시스템(Information Systems: IS) 연구 분야에서, 연구자들이 서로 협력하여 오래된 지식을 과학적 지식 네트워크 관점의 새로운 지식으로 만들어 낼 때 비로소 지식의 진화가 일어난다. 특히, 인용과 공저, 키워드와 같은 네트워크 기반의 학제적 접목을 통해 해당 연구분야의 관심 주제와 적용된 방법론, 연구동향 등을 파악함으로써 새로운 통찰을 끌어낼 수 있다. 한편, 연구주제와 방법론, 공동저자 등의 관계를 밝혀 해당 커뮤니티의 지식체계 구조와 연구동향을 파악하려는 다양한 시도가 있었으나, 두 개 이상의 저널을 일부 기간으로 한정해서 비교한 연구가 대부분이고, IS 연구분야의 전 역사를 아우르면서 연구 동향을 살펴본 연구는 부족한 실정이다. 이에 본 연구에서는 IS 연구분야에서 지식을 밝히는 데 주도적인 역할을 하는 MIS Quarterly (Management Information Systems Quarterly: MISQ) 저널을 중심으로 창간호(1977년)부터 현재(2022년 1분기)까지 게재된 모든 논문으로부터 (1) 키워드를 추출하고, (2) 추출된 키워드를 연구주제와 연구방법론, 이론 등으로 각각 구분한 후, (3) 토픽모델링과 키워드 네트워크분석을 활용하여 IS 연구분야의 태동부터 현재까지의 변화 양상을 연대기적으로 파악해 보고자 한다. 본 연구과제를 통해 MISQ에 게재된 IS 연구의 변화 양상을 살펴봄으로써 IS 연구분야의 발전 방향을 예측하고, IS 연구자들에게 새로운 연구방향을 제시하여 미래 지향적인 연구를 진행하는 데 실질적인 도움을 줄 수 있을 것으로 기대한다.

Key Terms - MIS Quarterly, 정보시스템 연구동향, 토픽모델링, 키워드 네트워크분석, 연대기적 분석

본 논문은 연구재단 4단계 BK21 사업으로부터 지원받은 연구임.

D3.4 인터넷 커뮤니티 게시글을 활용한 청소년 정책 의제 도출

노수경
동아대학교 경영대학
rsk2032@naver.com

홍순구
동아대학교 경영대학
shong@dau.ac.kr

임지원
동아대학교
스마트거버넌스연구센터
ji1e@naver.com

struct - 본 연구의 목적은 학부모들이 인터넷 게시판에서 자녀와 관련된 문제에 대해 어떤 논의를 주로 하고 있는지를 코로나19 전후로 구분하여 파악하는 것이다. 분석을 위한 데이터는 2018년 1월에서 2021년 4월까지로 총 464,590건을 수집하였다. 전처리를 거쳐 최종 분석 대상 문서수는 코로나 이전이 57,487건이고, 코로나 이후는 36,476건이다. 게시글에서 나타난 주요 이슈를 파악하기 위해 TF-IDF, LDA 분석기법을 활용하였다. 또한 주제의 내용을 심도 있게 파악하기 위해 네트워크 분석을 실시하였다. 분석 결과, 코로나19 이전은 '교육환경', '육체건강', '정신건강', '유학', '선물', '진학', '학습 방법', '카드사용', '얼굴 화장', '입시비리', '상담'이었다. 코로나19 이후는 '교육환경', '육체건강', '정신건강', '유학', '선물', '진학', '학습방법', '공공의대', '아동학대'이다. 교육과 건강은 지속적으로 학부모들 사이에 이슈가 되고 있으며, 코로나19 이후의 주요 이슈로 '아동 학대'가 나타났다. 토픽별 분포 결과는 코로나19 이전과 이후 모두 교육(44%, 41%), 건강(25%, 28%) 순으로 나타나, 학부모들은 항상 자녀의 교육과 건강에 대해 염려하는 것으로 보인다. 본 논문의 독창성은 청소년 관련 정책 의제를 기존 연구에서는 다루지 않았던 학부모들의 일상 대화에서 도출하였다는 점이다.

Key Terms - 정책 의제 도출, 청소년 정책, 학부모, 네트워크 분석, 텍스트 마이닝, LDA

이 논문은 2018년 대한민국 교육부와 한국연구재단의 지원을 받아 수행된 연구임.
(NRF-2018S1A3A2075240)

[DAY 1]

E3 [KIISS-Paper Session]
추천시스템과 인공지능

E3.1 리조트 교차판매 예측모형 개발 및 XAI를 활용한 해석

강보람
국민대학교 비즈니스IT전문대학원
kangbor0220@kookmin.ac.kr

안현철
국민대학교 비즈니스IT전문대학원
hcahn@kookmin.ac.kr

Abstract - 국내 관광 연구 분야에서 머신러닝 기법은 수요예측을 중심으로 연구된 바 있으나 교차판매 예측에 대해서는 연구된 바가 거의 없다. 또한 넓은 의미로는 호텔과 같은 숙박업종이지만 회원제 중심으로 운영하며 숙박과 취사에 적합한 시설을 갖추고 있는 리조트 업종에 특화된 연구는 더욱이 전무한 실정이다.

실제 리조트 회사의 투숙 데이터로 다양한 머신러닝 기법을 활용하여 교차판매 예측 모형을 제안하고자 한다. 또한 설명가능한 인공지능 XAI (eXplainable AI) 기법을 적용해 교차판매에 영향을 미치는 요인이 무엇인지 해석하고 어떻게 영향을 미치는지 실증 분석을 통해 확인해 보고자 한다. 이를 통해 실무적으로 기업에서는 매출 증대를 위한 영업 전략 수립에 반영할 수 있을 것으로 기대된다.

Key Terms - 교차판매, 기계학습, 설명가능한 인공지능(eXplainable AI), SHAP

I. 서론

최근의 코로나19와 같은 전염병 뿐만 아니라 관광산업은 정치, 자연재해 등 다양한 내외부 요인에 많은 영향을 받는 산업이다 (Kuo, Chen, Tseng, Ju, & Huang, 2008 ; 권혁진과 지윤호, 2020). 최근 관광숙박업의 위기를 극복하기 위해 무엇보다 수익성 개선이 매우 중요한 상황이다. 객실 수익의 증대 방법으로 객실 수익의 구성요소가 되는 객실수, 점유율, 평균 객실료를 극대화하는 방법이 있다. 하지만 객실 판매로 인한 객실 수익은 객실 수익 자체만의 수익으로 그치는 것이 아니라 호텔 영업 수익 전반에 영향을 미치는 것으로 식음료와 부대 사업장의 수익 발생은 숙박객 증대에 따른 객실 수익에 의존하고 있다 (강현신, 2002).

새로운 고객을 창출하는 것은 기존 고객과 좋은 관계를 유지하여 지속적으로 구매하도록 하는 것보다 더 많은 비용이 든다는 점은 이미 선행 연구자들에 의해서 지적되어 왔고 여러 각도에서 연구되어 왔다 (정유경, 2003). 따라서 기존 고객과 우호적인 관계를 유지하면서, 기존 고객으로부

터 새로운 매출을 유도할 수 있는 교차판매에 대한 관심이 최근 높아지고 있다. 교차판매는 기업의 기존 고객에게 새로운 상품이나 서비스를 권유하는 과정을 말한다. 상품의 특성과 고객 프로파일의 관계를 분석하여 고객들의 개별 정보, 즉 인적사항, 라이프 스타일, 구매특성 등과 매치가 되는 다른 상품들의 구입을 권유할 수 있게 된다. 상승판매는 교차판매의 한가지 형태로써 고객의 구매 형태와 관련 있는 새로운 상품을 권유하는 경우를 의미한다(정유경, 2003). 여행 수요 자체가 축소된 코로나19와 같은 상황에서는 수익 증대를 위해 객실 점유율을 높이기 위한 공격적인 영업전략보다 어려운 여건 속에서도 찾아온 고객에게 객실 외 추가상품을 판매하여 객단가를 높이는 방향이 더 효율적인 것이다.

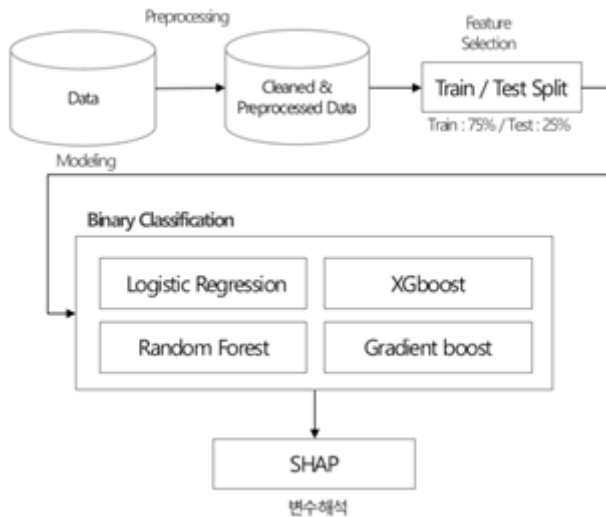
이런 가운데 타 학문 분야 및 산업 분야에서 적극적으로 도입하고 있는 머신러닝 기법은 다양한 예측 연구에서 탁월한 성과를 나타내고 있다. 컴퓨터가 데이터를 통해 모형을 개발하고 결과를 예측하는 머신러닝 기법은 타 연구 기법과 비교하였을 때, 시간과 비용은 감축시키면서 높은 예측 정확성을 보인다 (이인지, 2020). 국내 관광 연구 분야에서 머신러닝 기법은 수요예측을 중심으로 연구된 바 있으나 교차판매 예측에 대해서는 연구된 바가 거의 없다. 또한 넓은 의미로는 호텔과 같은 숙박업종이지만 회원제 중심으로 운영하며 숙박과 취사에 적합한 시설을 갖추고 있는 리조트 업종에 특화된 연구는 더욱이 전무한 실정이다.

이러한 배경에서 본 연구의 목적은 다음과 같이 정의할 수 있다. 본 연구에서는 실제 리조트 회사의 투숙 데이터로 다양한 머신러닝 기법을 활용하여 교차판매 예측 모형을 제안하고자 한다. 또한 설명 가능한 인공지능 XAI (eXplainable AI) 기법을 적용해 교차판매에 영향을 미치는 요인이 무엇인지 해석하고 어떻게 영향을 미치는지 실증 분석을 통해 확인해 보고자 한다. 이를 통해 실무적으로 기업에서는 매출 증대를 위한 영업 전략 수립에 반영할 수 있을 것으로 기대 된다.

II. 제안모형

기존의 교차판매 모델에서는 고객의 나이, 성별, 연령대 등 기본적인 개인정보를 활용하였으나 최근 개인정보 보호법이 강화되고 유출에 대한 사고로 인해 관련한 이슈를 기업에서는 더욱 엄격하게 다루고 있으며, 특히 리조트는 회원권을 보유한 개인 또는 법인이 예약하고 실제 투숙자는 개인회원의 추천인이나 법인회원의 임직원으로써 예약자와 투숙자가 상이한 경우가 많다. 따라서 방문 전에 투숙자의 정보를 알기 어렵고 예약자의 개인정보를 기반으로 교차판매 캠페인을 실행하기 적절하지 않을 수 있다.

이에 본 연구에서는 투숙자의 추가적인 개인정보 없이 상품 정보 만으로도 활용할 수 있는 교차판매 예측 모델을 제안한다. 이는 캠페인으로 활용할 수도 있겠지만 XAI 기법을 활용하여 모델을 해석함으로써 객실 외 추가적인 매출을 일으키는 영업전략을 수립하는 데에 실무적인 시사점을 줄 수 있을 것으로 기대한다. 제안모형의 전반적인 구조는 다음의 <그림1>과 같다.



<그림 1> 제안 모형

본 연구에서는 국내 H리조트의 1년치 투숙 데이터를 제공받아 분석에 사용하였다. 해당 데이터에는 투숙객의 고객 개인정보는 포함되어 있지 않으며, 객실 상품에 대한 정보와 예약에 관련한 속성만이 포함되어 있다. 분석에 사용된 데이터는 총 484,857건으로 학습용과 검증용 데이터의 비율은 75% : 25%로 하였다.

중속 변수값은 객실당 결제 정보의 교차판매 여부로서, 이 때 교차판매는 객실 외 리조트 내

식음시설이나 테마시설 등에 지출한 경우를 의미하여 객실 외 상품에 지출한 경우를 1, 객실만 이용한 경우를 0으로 값을 부여하였다. 중속변수를 예측하기 위해 활용되는 독립변수는 총 74개로서, 이 중 독립표본 t검정과 카이제곱 검정을 통해 유의한 변수로 65개를 최종적으로 선정하였다.

그 다음 로지스틱 회귀분석, 랜덤포레스트, XGBoost, GradientBoost 네가지 기법을 사용하여 예측률을 확인하고 그 중 우수한 모델을 선택하여 XAI 기법 중 하나인 SHAP를 활용하여 변수들의 중요도를 해석하고자 하였다.

III. 참고문헌

권혁진, 지윤호(2020). 코로나19에 따른 호텔고객의 전환의도 결정요인에 관한 연구. 호텔리조트연구, 19(6), .25-45.

강현신 (2002). 객실수익 극대화를 위한 추천판매 활성화 방안. 문화관광연구, 4(3), 1-15.

정유경 (2003). 연관규칙을 이용한 호텔 레스토랑 고객의 이용행태 분석. 호텔경영학연구, 12(2), 1-22

이인지 (2020). 머신러닝을 활용한 지역축제 방문객 수 예측모형 개발. 정보시스템연구, 29(3), 35-52

Kuo, H. I., C. C. Chen, W. C. Tseng, L. F. Ju & B. W. Huang(2008). Assessing impacts of SARS and Avian Flu on international tourism demand to Asia. Tourism Management, 29(5): 917-928.

E3.2 전문어의 범용 공간 매핑을 위한 비선형 벡터 정렬 방법론

김준우
국민대학교 비즈니스IT
전문대학원
britz17@kookmin.ac.kr

윤병호
국민대학교 비즈니스 IT
전문대학원
bhoyoon@kookmin.ac.kr

김남규
국민대학교 비즈니스 IT
전문대학원
ngkim@kookmin.ac.kr

Abstract - 최근 사전 학습된 언어 모델이 텍스트 분야에서 우수한 성능을 나타내면서, 사전학습 언어 모델을 적용하는 응용 분야가 활발히 연구되고 있다. 하지만 사전학습된 언어 모델은 범용 코퍼스로 학습되어 특정 도메인의 전문어를 반영하지 못한다는 한계를 지니고, 이는 파인 튜닝 시 성능 저하를 유발한다. 따라서 본 연구에서는 특정 임베딩 공간에 존재하는 벡터들을 기존 관계를 유지하면서 다른 공간으로 이동하는 벡터 정렬을 통해 전문어를 범용어 임베딩 공간으로 매핑하는 방법론을 제안한다. 구체적으로 오토인코더를 활용하여 고차원의 범용어 벡터를 저차원 벡터로 압축하고, 고차원의 전문어 벡터를 압축된 저차원 벡터로 예측하는 회귀 학습을 수행한다. 이를 통해 전문어를 범용어 공간으로 매핑하고, 범용 언어 모델의 일반화된 지식을 충분히 활용하는 전문어 벡터 값을 얻을 수 있다.

Key Terms - 워드 임베딩, 사전학습 언어모델, 벡터 정렬, 레이블 임베딩

I. 서론

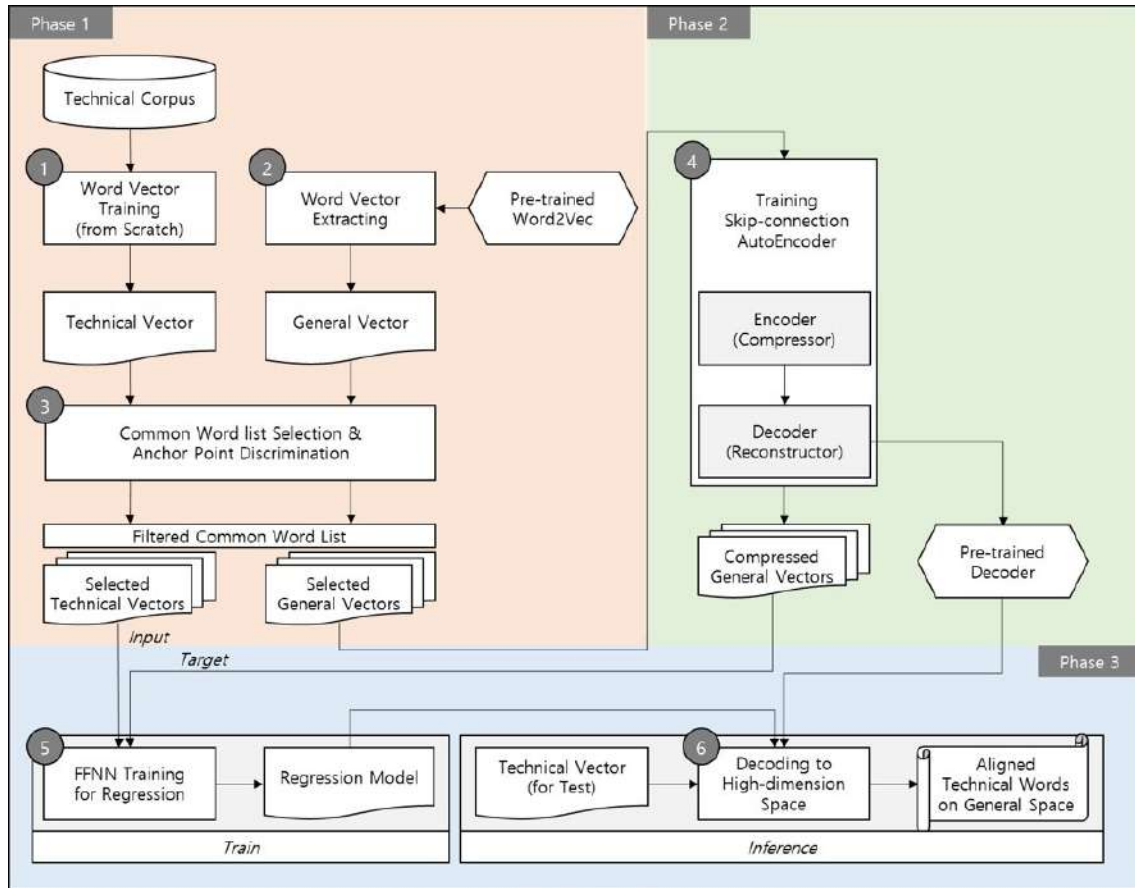
최근 워드 임베딩(Word Embedding)이 딥러닝(Deep Learning) 기반 자연어처리(Natural Language Processing) 태스크에서 우수한 성능을 나타내면서, 단어를 넘어 문서, 문장 임베딩의 연구가 활발하게 이루어지고 있다. 그중 서로 다른 언어 간의 의미적 교환을 학습하는 교차 언어 전이(Cross-lingual transfer)는 임베딩 모델의 발전과 동시에 성장한 분야로, 핵심 기술인 벡터 정렬(Vector Alignment)(Mikolov et al., 2013)을 통해 임베딩으로 표현 가능한 모든 응용에 적용될 수 있다는 유연성이 있고 그로 인해 확장성 또한 매우 높다. 특히 대용량 범용 문서로 학습된 사전 학습 언어모델을 특정 전문 도메인에 미세 조정(Fine-tuning) 하는 경우, 전문 도메인 어휘의 부재로 인한 성능 하락(Tai et al., 2020) 문제를 해결할 것으로 기대된다. 하지만 학계에서 주로 연구되어 온 선형 기반 벡터 정렬은 기본적으로 통계적 선형성을 가정하는 한계로 인해 성능 개선에 제한이 있다(Vulić et al., 2019). 본 연구에

서는 이러한 한계를 극복하기 위해 데이터의 비선형성을 효과적으로 학습하는 딥러닝 기반 벡터 정렬 방법론을 제안한다. 제안 방법론은 서로 다른 공간에서 벡터로 표현된 전문어 임베딩을 범용어 임베딩 공간으로 정렬하기 위해 오토인코더(Autoencoder)와 회귀 모델의 단계별 학습으로 이루어지며, 학습된 두 모델의 추론을 통해 범용어 임베딩 공간에 정렬된 전문어 어휘를 획득할 수 있다.

II. 제안 방법론

본 연구의 제안 방법론은 <그림 1>과 같으며, 크게 3가지 단계로 구성된다. Phase 1은 서로 다른 임베딩 공간에 존재하는 범용어와 전문어 단어 중 앵커 포인트(Anchor Point)를 선별하는 과정이며, Phase 2는 오토인코더를 통해 고차원 범용어 벡터를 저차원 잠재 벡터로 압축하는 과정이다. 최종 단계인 Phase 3은 회귀 모델 학습과 학습된 회귀 모델과 오토인코더의 디코더(Decoder)로 추론하는 단계로, 해당 과정을 통해 실질적인 벡터 정렬이 이루어진다.

본 연구는 이질적 공간에 독립적으로 존재하는 단어 벡터들을 구성하기 위해, 전문 문서로 학습된 단어 벡터를 ‘Technical Vector’로, 범용 문서로 학습된 벡터는 ‘General Vector’로 명명하여 사용한다. ‘Technical Vector’는 전문어 문서를 Word2vec으로 처음부터 학습하여 도출하고(1), ‘General Vector’는 범용 문서로 사전학습된 Word2Vec의 가중치를 사용한다(2). 다음으로 각 도메인에 등장하는 공통 단어와 전문어를 구별하여 벡터 정렬에 사용될 앵커 포인트를 선정한다(3). 이후 선별한 앵커포인트를 통해 고차원의 범용어 공간을 저차원으로 압축하는 오토인코더 학습을 진행하고(4), 그 과정에서 산출된 잠재 공간을 저차원의 범용 단어의 벡터 값으로 활용한다. Phase 3은 학습과 추론 2가지 단계로 나뉘며, 학습 단계는 전문어 공간에서 선별된 앵커포인트의 고차원 전문어 벡터 값을 저차원 범용어 벡터로 매핑하는 회귀 학습을 시행한다. 다음 추론 단계에서는 회귀 모델을 통해 고차원의 전문어 벡터를 저차원 범용어 벡터로 예측한 후, 오토인코더의



<그림 1> 제안 방법론 전체 개요

디코더를 통해 고차원의 범용어 벡터 공간으로 복원한다(6). 이러한 일련의 과정을 통해 범용어 공간에서 전문어를 확장하는 벡터 정렬 방법론을 구축할 수 있다.

III. 실험

제안 방법론의 성능을 검증하기 위해 전문도메인으로 2011년부터 2022년까지 수행된 국가 R&D 보건의료 문서 77,578건을 선정하였으며, 그중 전문어 단어와 범용어 단어와의 비교를 통해 앵커 포인트는 총 7,317개를 추출하였다. 실험을 수행한 결과, 제안 방법론인 비선형 기반 벡터 정렬이 기존 선형 기반 벡터 정렬에 비해 코사인 유사도(Cosine Similarity) 측면에서 우수한 성능을 나타냄을 확인하였다.

IV. 참고문헌

Mikolov, T., Q. V. Le, and I. Sutskever, "Exploiting Similarities Among Languages for Machine Translation," *arXiv:1309.4168*, (2013).

Vulić, I., G. Glavaš, R. Reichart, and A. Korhonen, "Do We Really Need Fully Unsupervised

Cross-lingual Embeddings?," *arXiv:1909.01638*, (2019).

Tai, W., H. T. Kung, X. L. Dong, M. Comiter, and C. F. Kuo, "exBERT: Extending Pre-trained Models with Domain-specific Vocabulary Under Constrained Training Resources," *In Findings of the Association for Computational Linguistics: EMNLP 2020*, (2020), 1433-1439.

E3.3 Scaler 종류에 따른 부도 예측 결과에 대한 영향성 분석

송찬우
국민대학교
비즈니스IT전문대학원
cksdntd2008@kookmin.ac.kr

안승규
국민대학교
비즈니스IT전문대학원
tmdrb0415@kookmin.ac.kr

박종현
국민대학교
비즈니스IT전문대학원
ppjjhh1027@kookmin.ac.kr

안현철
국민대학교
비즈니스IT전문대학원
hcahn@kookmin.ac.kr

Abstract - 머신러닝 알고리즘은 데이터의 스케일 조정에 매우 민감하며, 통상적으로 전처리 단계에서 각 특성 스케일을 조정해 데이터를 가공한다. 스케일러의 종류는 *StandardScaler*, *MinMaxScaler*, *RobustScaler*, *Normalizer* 등이 있는데 부도예측에 있어 어떤 Scaler를 사용했을 때 가장 우수한 정확도를 보이는지는 알려진 바가 없다.

이에 본 연구는 부도 예측 데이터를 통해 4가지의 Scaler를 적용하여 어떠한 것이 가장 우수한 정확도를 보여주는지 알아보하고자 한다.

Key Terms - 부도예측, *StandardScaler*, *MinMaxScaler*, *RobustScaler*, *Normalizer*

I. 서론

'Data Industry Promotion Strategy - I-KOREA 4.0 Data Field Plan, I-DATA+'(2018)이란 보고서에서는 4차 산업혁명을 견인하는 핵심 동인인 빅데이터를 통해 사회문제 해결 능력을 강화하는 것을 핵심 과제로 정했다. 또한 2018년 3월 4차산업혁명위원회의 첫 회의에서 문재인 전 대통령은 인공지능, 사물인터넷, 빅데이터를 위한 투자를 확대하여 혁신생태계를 조성할 것임을 밝히게 되면서 금융 분야에서의 빅데이터 분석에 관한 연구의 필요성이 높아지고 있다(차성재와 강정석, 2018).

그중 기업의 부도를 예측하는 것은 지속하여 연구되고 있고, 예측 정확도를 보다 높이고자 노력하고 있다.

기업의 부도는 그 기업의 경영자, 노동자 측면에만 국한되는 것이 아니라 그 기업에 직·간접적으로 연관관계를 가진 이해관계자(투자자, 금융기관, 거래 기업 등)에게도 연쇄적인 피해를 양산할 수 있다. 더 나아가 국민경제에도 심각한 타격을 미칠 수 있다(강치형과 신해수, 2015).

그러한 데이터 분석 기반 의사결정 지원 시스템을 개발하기 위해서는 데이터 전처리가 필요하다. 데이터 전처리 단계에는 *data cleaning*, *pruning*, *feature selection*, *scaling*이 존재하지만, 대부분의 부도예측 연구는 이에 집중하지 않고 다른 알고리즘을 적용하며 정확도를 높이고자 하였다(Ahsan, Md Manjurul, et al, 2021).

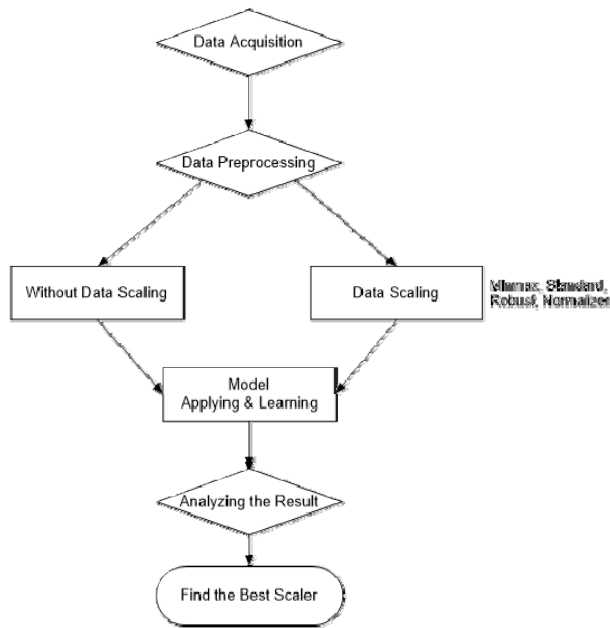
Scaling 기법 중에는 각 특성의 평균을 0, 분산을 1로 변경해주는 *StandardScaler*, 이와 유사하지만, 평균과 분산 대신 중간 값과 사분위 값을 사용하는 *RobustScaler*, 모든 특성이 정확하게 0과 1 사이에 위치하도록 변경하는 *MinMaxScaler*, 특성 벡터의 Euclidean Distance가 1이 되도록 데이터 포인트를 조정하는 *Normalizer*가 있다(Andreas C. Muller, Sarah Guido 2016).

본 연구에서는 기존 연구된 부도 예측 모델에 4가지 Scaling 기법을 적용하여 어떠한 영향을 미치는지 평가를 하는 것이 목적이다.

II. 연구 모델

본 연구에서 제안하는 모형은 <그림 1> 과 같다. 먼저 부도 예측 데이터는 2001~2007년 제조업 기업의 재무 정보를 활용한다.

부도 예측 데이터는 각 재무 비율이 모델에 미치는 영향이 다르기 때문에 데이터 전처리를 통해 편향을 줄여줄 것이다. 다음으로 상기 <그림1> 에 제시한 Scaler를 Model에 적용하여 결과를 비교해 보고 최종적으로 부도 예측에 가장 적절한 Scaler를 도출하고자 한다.



<그림 1> 제안 모형

III. 참고문헌

차성재, 강정석. (2018). 딥러닝 시계열 알고리즘 적용한 기업부도예측모형 유용성 검증. *지능정보연구*, 24(4), 1-32.

강치형, 신해수. (2015). 회원제 골프장기업의 부도예측 모형개발. *관광연구논총*, 27(4), 241-269.

Ahsan, Md Manjurul, et al. (2021) "Effect of data scaling methods on machine learning algorithms and model performance." *Technologies* 9.3: 52.

Andreas C. Muller & Sarah Guido, "Introduction to Machine Learning with Python"

E3.4 머신러닝과 SHAP 기법을 활용한 온라인교육콘텐츠 이용 결정요인 탐색

맹준영
국민대학교 비즈니스IT전문대학원
mji300@kookmin.ac.kr

안현철
국민대학교 비즈니스IT전문대학원
hcahn@kookmin.ac.kr

Abstract - 본 연구에서는 학습자들의 어떤 스마트 기기 이용 특성이 온라인교육콘텐츠 소비 행동에 영향을 미치는지 살펴보고자 한다. 구체적으로 본 연구에서는 머신러닝 접근법을 이용해 온라인교육콘텐츠의 소비여부를 예측하는 모델을 개발한 뒤, 대표적인 설명가능한 AI기법 중 하나인 SHAP을 이용해 해당 모델에서 어떤 변수들이 종속변수에 가장 크게 영향을 미치는지 살펴보고자 하였다. 이러한 본 연구는 디지털 리터러시 확보 수준에 따라 구체화된 학습자 타겟을 분류하고, 대상자에 따라 차별화된 콘텐츠 큐레이션을 진행하는 전략의 필요성을 제안함으로써, 학습자들의 온라인교육콘텐츠 소비율을 높이는 데 기여할 수 있을 것으로 기대한다.

Key Terms - 교육콘텐츠, 디지털 리터러시, 머신러닝, 온라인교육, SHAP

I. 서론

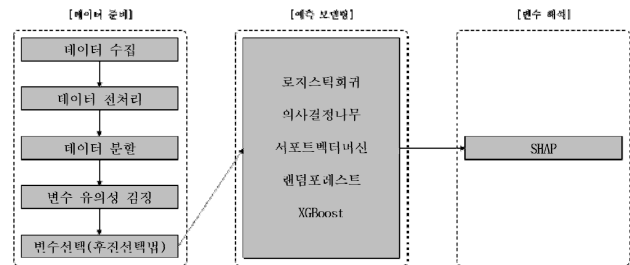
디지털 기술의 발전에 따라 교육영역에도 많은 변화를 가져왔다. 특히, 코로나 시대를 거치며, 오프라인 중심에서 온라인 중심의 교육으로 전환되었고, 그에 따라 학습에 있어서 온라인교육콘텐츠의 비중이 많은 부분을 차지하게 되었다. 디지털 기술이 보편화되면서, 고전적인 교육 방식을 통한 지식 습득보다는 디지털 콘텐츠를 통한 지식 습득이 보편화되고 있다. 디지털 콘텐츠라 함은 다양한 형태를 포함할 수 있는데, 요즘은 대개 영상이 보편화되고 있으며, 이는 최근의 콘텐츠 소비자들 사이에서 장문의 텍스트보다는 이미지를 더 선호하고, 더 나아가 이미지보다는 동영상도 더 선호하기 때문이다. 이는 방대한 양의 정보에 노출되는 현대인들이 자신의 시간을 효율적으로 소비하고 싶어하는 욕구와도 맥락을 같이 한다고 볼 수 있다(김진수, 2018). 본 연구에서는 학습자들의 스마트 기기 이용 행태를 살펴봄으로써 디지털 리터러시가 어떻게 온라인교육콘텐츠 소비 행동에 영향을 미치는지 살펴보고자 한다.

II. 연구방법 및 실증분석

1. 자료수집

분석데이터는 미디어통계포털(KISDISTAT)의 한국 미디어패널조사 2021년 데이터를 활용하였다. 본 패널조사는 동일표본을 대상으로 매년 데이터를 축적하는 설문조사이다. 가구 및 개인의 미디어 환경과 미디어 이용 행태를 추적하는 것을 목적으로 한다. 2010년부터 1년 주기로 시행해 오고 있으며, 뉴미디어 이용 현황, 휴대폰 및 스마트 기기에 대한 보유, 이용 현황, 방송통신 서비스에 대한 가입과 지출 현황 등 미디어 이용 행태에 관련된 내용으로 구성된다. 본 연구에서 활용된 2021년 관측치는 총 10,154명이었다.

2. 연구절차



<그림 1> 연구 절차

3. 독립변인 유의성 검정 및 변수선택

변수의 특성에 따라서 카이제곱검정과 t-test를 각각 적용하였으며, 이를 통해 최초 70개의 독립변수에서 시작하여 46개의 독립변수로 추리는 과정을 거쳤다. 이러한 과정에서 카이제곱검정, 독립표본 t-test 모두 95%의 신뢰수준 하에서 해석을 했으며, 유의확률이 0.05보다 작은 수준인지를 확인하였다.

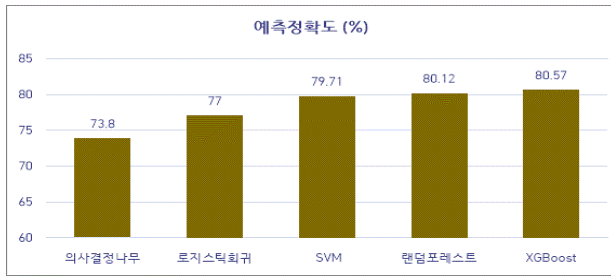
추가적인 변수선택과정에서는 로지스틱회귀분석의 후진선택법을 이용하여 독립변수를 최종 24개로 선정하였다. 로지스틱회귀분석 후진선택법 결과 추출된 유의미한 독립변수 목록은 아래와 같다.

<독립변수 24개 선택>

age, fin_edu, marriage, income1, job_type2, ott_use, ott_broad, ott_sns, ott_monthly, news_use, music_use, game_use, sns_upload, sns_likes,

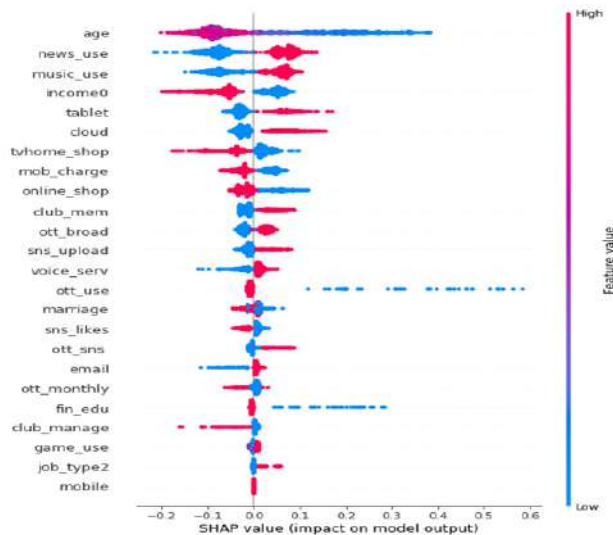
tvhome_shop, online_shop, mobile, voice_serv, tablet, mob_charge, email, cloud, club_mem, club_manage

4. 머신러닝기법 적용 및 예측모델링 결과 비교



<그림 2> 예측정확도 비교

5. SHAP 기법 적용을 통한 변수 해석



<그림 3> SHAP 기법 적용 결과

III. 결론

본 연구는 학습자의 미디어 이용 행태를 통해 온라인교육 이용 가능성을 예측하고자 했기 때문에 인구통계학적 학습자 특성을 중심으로 진행된 기존 연구와는 차별화된 접근을 취하고 있다. 높은 예측정확도를 갖는 모델을 찾는데 초점을 맞추고 있는 예측모델링에서 그치지 않고, 설명가능한 인공지능 기법 중 SHAP 기법을 이용함으로써 영향 변수를 파악하고자 했다.

또한 실증분석을 통해 온라인교육콘텐츠 소비를 촉진하기 위해서는 학습자의 디지털 리터러시 확보를 선제적으로 지원해야 하며, 양질의 콘텐츠를 제작하고 효과적인 마케팅을 하는 것도 필요하지만, 학습자를 세분화하고, 학습자별 특성에 따라 맞춤형 큐레이션을 하는 것이 온라인교육콘텐츠의 이용률을 더 높일 수 있다는 사실을 확인할 수 있었다.

IV. 참고문헌

권성호, 현승혜, “중·장년층 직장인의 디지털 리터러시에 대한 연구: 디지털 리터러시 향상을 중심으로”, 학습과학연구 제8권 제1호, 120-140, 2014

김성중, 김현진, 김현숙, 박경인, 임맹현, “학교교육을 위한 웹기반 동영상 서비스 특징 비교및수업 활용 실태 분석”, 한국교육공학회 학술대회발표자료집 2016권 2호, 2016, 139-148(10pages) 12~20.

김지현, 정재범, 조재춘, 임희석, “온라인 학습판단 시스템을 활용한 e-러닝 동영상 수업의 효과연구 : 초등학교 사회과 수업을 중심으로”, 한국융합학회논문지 제10권 제2호, 2019, pp.141-148

김진수, “유튜브 플랫폼의 변천 양상 연구”, 한국문화기술 통권 제 24호 61-91, 2018

김진희, 황두희, 이상숙, “Apriori 알고리즘을 활용한 학습자의 성별과 학교급에 따른 온라인 수업 유형 선호도 분석”, Journal of Digital Convergence Vol. 20. No.1, pp. 33-39, 2022

김해준, 박하나, 정성희, 임규연, “국내 디지털 리터러시 교육 프로그램 효과에 대한 메타분석”, 한국교육정보미디어학회 교육정보미디어연구 28권1호, 2022, 105-131(27pages)

박성익, 김연경, “온라인 학습에서 학습몰입요인, 몰입수준, 학업성취 간의 관련성 탐구”, 『열린교육연구』 제14집 제1호, 2006

E3.5 멀티모달 딥 러닝 기반 이상 상황 탐지 방법론

이동훈
 국민대학교 비즈니스IT
 전문대학원
 ldh1468@kookmin.ac.kr

김남규
 국민대학교 비즈니스 IT
 전문대학원
 ngkim@kookmin.ac.kr

Abstract - 최근 딥 러닝 기술의 발전으로 이상 탐지를 수행하기 위한 연구가 활발히 이루어지고 있다. 일반적으로 이미지 데이터의 이상 상황 탐지는 대용량 데이터로 학습된 사전학습 모델을 사용하여 이루어진다. 하지만 이러한 사전학습 모델은 이미지의 객체 클래스 분류를 학습한 모델로, 객체들이 상호 작용하여 만들어내는 복잡한 상황을 탐지해야 하는 이상 탐지에 곧바로 적용되기에는 어려움이 있다. 이에 본 연구에서는 객체 클래스 분류를 학습한 사전학습 모델을 기반으로 이미지 캡셔닝 학습을 추가적으로 수행하여, 객체 파악뿐 아니라 객체들이 만들어내는 상황까지 이해해야 하는 이상 상황 탐지에 적절한 2단계 사전학습 모델을 제안한다.

Key Terms - Deep Learning, Classification, Pre-trained Model, Image Captioning, Anomaly Detection

I. 서론

최근 컴퓨팅 기술의 발전과 클라우드 환경의 개선에 힘입어 데이터의 수집과 처리가 매우 용이하게 되었으며, 이로 인해 대량의 데이터를 학습하고 이를 바탕으로 우수한 성능을 내는 딥 러닝(Deep Learning)에 대한 관심이 높아지고 있다. 정상으로 정의된 데이터와는 상이한 값 또는 패턴을 갖는 데이터를 찾는 이상 탐지(Anomaly Detection)(Chandola et al, 2009) 분야에서도 딥 러닝 기술을 적용한 이상 탐지 알고리즘이 기존의 전통적인 이상 탐지 기법에 비해 우수한 성능을 보이고 있다. 특히 영상 데이터에 대한 이상 탐지 연구는 대부분 대용량의 이미지를 사전학습한 모델을 미세 조정(Fine-tuning)하는 방식으로 이루어지는데, 이러한 사전학습 모델은 객체의 클래스 분류 학습을 통해 구축되는 것이 일반적이다. 하지만 영상 데이터의 이상 탐지의 경우 객체들이 만들어내는 복합적인 상황을 파악해야 하기 때문에, 객체들의 클래스 분류만을 학습한 사전학습 모델을 그대로 사용하여 이상 탐지에 수행하기에는 어려움이 있다. 예를 들어 <그림 1>의 (a)와 (b)는 정상(Normal)' 상황을, 그리고 (c)는 '이

상(Abnormal)' 상황을 나타낸다. 또한 그림에서 객체 'Person' 과 'Car' 는 세 이미지에 공통적으로 등장하며, (a)에는 이들 객체 외에 'Plants' 와 'Motorcycle' 이, (b)에는 'Dog' 와 'Tree' 가, 그리고 (c)에는 'Tree' 가 추가로 등장한다. 본 예시는 객체 정보만으로는 정상 상황과 이상 상황을 구별할 수 없으므로, 여러 객체들이 만들어 내는 복합적인 상황에서 이상을 정확하게 탐지하기 위해서는 새로운 사전학습 방법이 필요함을 나타낸다.



<그림 1> 객체 인식 기반 이상 상황 탐지의 한계

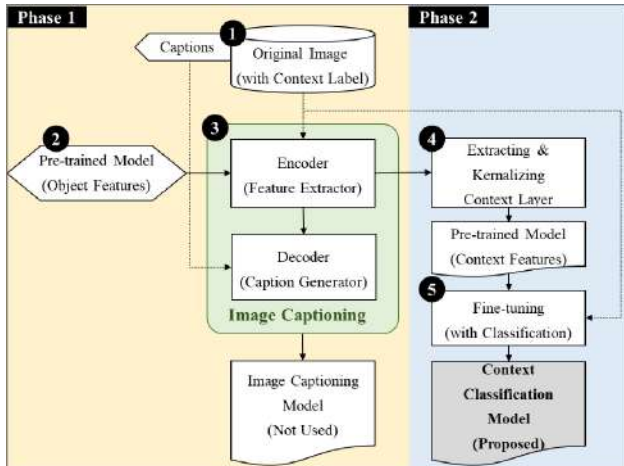
이에 본 연구에서는 딥러닝 기반 이상 상황 탐지를 위해 객체 특질 학습과 상황 특질 학습으로 구성된 2단계 사전학습 모델을 제안한다. 제안 모델의 1단계에서는 대용량의 이미지로 학습된 기존의 사전학습 모델을 통해 다량의 이미지로부터 객체의 특질을 학습하고, 2단계에서는 이미지 캡셔닝(Image Captioning)(Xu et al., 2015)에 사용되는 인코더-디코더 모델을 통해 상황 특질을 학습한다. 이후 인코더에서 객체 특질과 상황 특질을 모두 학습한 가중치를 추출하여 이를 기반으로 이상 상황 탐지 모델을 구축한다.

II. 제안 방법론

본 연구의 제안 방법론은 Phase 1의 사전학습 단계(①~③), 그리고 Phase 2에서 객체들이 만들어낸 상황을 학습한 가중치를 추출 및 활용하는 단계(④, ⑤)로 구성된다. 제안 방법론의 전체적인 과정은 아래 <그림 2>에 나타난다.

먼저 이상 상황 탐지에 적합한 이미지 데이터를 수집하고 각 이미지에 맞는 캡션을 작성하여 이미지 캡셔닝 학습을 위한 데이터 셋을 구축한다(①). 다음으로 대용량 데이터 셋을 사용하여 객체를 분류하는 학습을 한 사전학습 모델을 이미지 캡셔닝 모델의 인코더-디코더 부분의 인코더에 사용한다. 이미지 캡셔닝 학습 시에는 이미지에 대한 상황을 설명한 캡션 데이터가 함께 사용되면서, 인코더는 객체 특질과 상황 특질을 모두 학습한다(②, ③). 이후 이미지 캡셔닝에 사용되는 인코더-디코더 모델의 인코더에서 객체 특질과 상황 특질을 모두 학습한 가중치를 추출한다. 이를 대용량 데이터로 객체 분류를 학습한 사전학습 모델(②)과 결합하여 미세 조정을 진행한다(④, ⑤).

본 연구는 객체 특질뿐 아니라 상황 특질도 학습하는 2단계 사전학습 방식을 제안하고, 이를 영상 기반 이상 상황 탐지에 적용한다. 최종적으로 객체 특질과 상황 특질을 사전에 모두 학습한 이상 상황 탐지 모델이 생성된다.



<그림 2> 제안 방법론 전체 개요

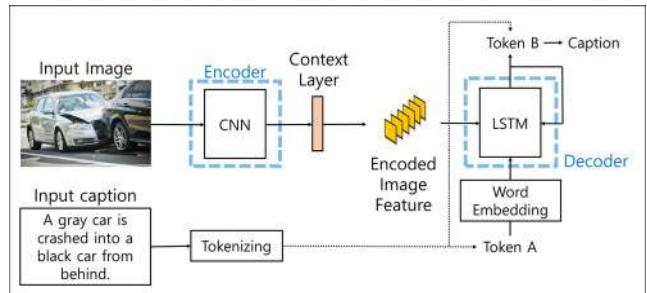
III. 실험

본 연구의 실험을 위해 G 포털사이트에서 상황 이미지를 수집하고, 해당 이미지에 맞는 캡션을 직접 작성하여 멀티모달 데이터 셋을 구축하였다. 수집한 이미지는 사람과 차가 동시에 등장하는 정상 혹은 사고 상황을 나타내며, 캡션 데이터는 각 이미지마다 5문장씩 영문으로 작성하였다. 아래 <그림 3>은 정상과 비정상 상황에 대한 이미지와 그에 대응하는 캡션의 예시이다.

데이터 분류	Abnormal	Normal
Image		
Caption	Black car has completely overturned.	There are cars parked next to people.

<그림 3> 이미지와 캡션 데이터 예

Phase 1의 사전학습 단계는 총 2단계로 이루어지는데, 1단계에서는 사전학습 모델인 Inception V3가 ImageNet 데이터로 객체를 분류하는 학습을 수행한다. 2단계에서는 1단계에서 학습한 모델을 이미지 캡셔닝 모델의 인코더 부분에 전이한 후, 특질 학습을 위한 층(Context Layer)을 새로 쌓아 학습을 진행한다. 이미지 캡셔닝의 전체적인 학습 구조는 <그림 4>와 같다.



<그림 4> 이미지 캡셔닝 학습 구조

다음으로 이미지 캡셔닝 모델의 인코더에서 객체 특질과 상황 특질을 모두 학습한 층(Context Layer)를 추출하고, 이를 분류 층이 제거된 사전학습 Inception V3 모델의 마지막에 추가하여 미세 조정을 진행하였다. 파일럿 실험 결과 본 연구의 제안 방법인 2단계 사전학습 방식을 적용한 이상 상황 탐지 모델이 일반적으로 사용되는 사전학습 방식을 적용한 이상 상황 탐지 모델보다 좋은 성능을 보임을 확인하였다.

IV. 참고문헌

Chandola, V., A. Banerjee, and V. Kumar, "Anomaly detection: A survey," *ACM computing surveys (CSUR)* 41.3 (2009): 1-58.

Xu, K., J. L. Ba, R. Kiros, K. Cho, A. Courville, R. Salakhutdinov, R. S. Zemel, and Y. Bengio, "Show, attend and tell: Neural image caption generation with visual attention," In *International conference on machine learning*, 2015, (pp. 2048-2057). PMLR.

E3.6 준지도학습 방식 속성 기반 감성분석을 이용한 다중 기준 추천시스템

박동준
 국민대학교 경영대학
 pugpug2334@kookmin.ac.kr

정여진
 국민대학교 경영대학
 ychung@kookmin.ac.kr

Abstract - 속성 기반 감성분석은 문장에서 발생하는 속성 용어에 대한 감성 극성을 결정하는 작업이다. 이러한 속성 기반 감성분석은 리뷰 기반 추천시스템에서 제품의 명시적 특성을 학습하고 제품 추천에 대한 설명력을 가지기 때문에 널리 활용되고 있다. 추천시스템 효용가치가 높은 속성 기반 감성분석도 라벨링된 데이터가 필요하다는 데이터의 제약이 존재한다. 본 논문에서는 준지도 학습 방식의 속성 기반 감성분석을 통하여 이를 해결한다. 또한 단일 기준 추천시스템보다 효과적으로 알려져 있는 다중 기준 추천시스템에 속성 기반 감성분석을 통해 나온 제품의 다양한 명시적 요소를 활용하여 제품을 추천하는 추천시스템을 모델링하고자 한다.

Key Terms - 속성 기반 감성분석, 다중 기준 추천시스템, 속성 추출, 준지도학습.

I. 서론

다양한 의견과 리뷰가 쏟아지는 온라인 플랫폼에서 소비자의 피드백과 경험을 분석하는 추천시스템은 제품과 서비스에 대한 소비자의 선호도를 학습하고 확인하는 하나의 서비스로서 제공되고 있다. 추천시스템은 단일 척도를 통하여 제품에 대한 고객의 선호도를 반영하여 추천하는 방식이 대부분이다. 이러한 단일 기준 추천시스템 방식은 기준을 지나치게 단순화하는 것 일 수 있다 [1]. 이를 해결하기 위한 방법론으로 다중 기준을 통해 소비자의 선호도를 세분화하는 추천시스템 모델이 많은 문헌에서 기존의 방식보다 좋은 예측 정확도 성능을 보여주고 있다[2,3]. 이러한 다중 기준 추천시스템도 사전에 정해진 기준에 대해서만 소비자의 평점이 매겨짐으로써 정확한 소비자의 선호도를 반영하는 것과 상황에 따라 다른 기준을 고려하거나 제 3의 요인에 의해 의사결정이 내려질 경우 단일 기준을 통하여 소비자의 선호도를 이해하는 것이 더 효과적일 수 있다[4]. 제 3의 요인에 의해 발생하는 문제에 대하여 하이브리드 필터링 방식을 통하여 단일 기준 추천시스템의 사용자 선호도와 결합하여 문제점을 방지한다.

속성 기반 감성분석은 고객의 세분화된 선호도를 이해하고 활용하는 것이 목표인 연구로서 추천시스템에서의 효용성이 있다. 하지만 기존의 ABSA에 관련된 다중 기준 추천시스템 연구들은 제품의 속성과 감성이 추출되어 있는 데이터를 활용한 지도학습 기반의 연구가 대부분이고 이러한 연구들은 데이터에 대한 제약이 존재한다[5].

본 연구에서는 고객 리뷰에서 준지도학습 방식 속성 기반 감성분석(Asspect-based Sentiment Analysis, ABSA)를 실시하여 Seed Word를 설정하여 Location, Service, Facilities, Mood, Host 등의 숙소 속성에 대한 감성을 추출하고 추천 기준으로 설정하여 다각적인 측면에서 고객의 선호도를 파악하고 하이브리드 필터링을 결합하여 정확성을 높인 하이브리드 다중 기준 추천시스템을 모델링하고자 한다.

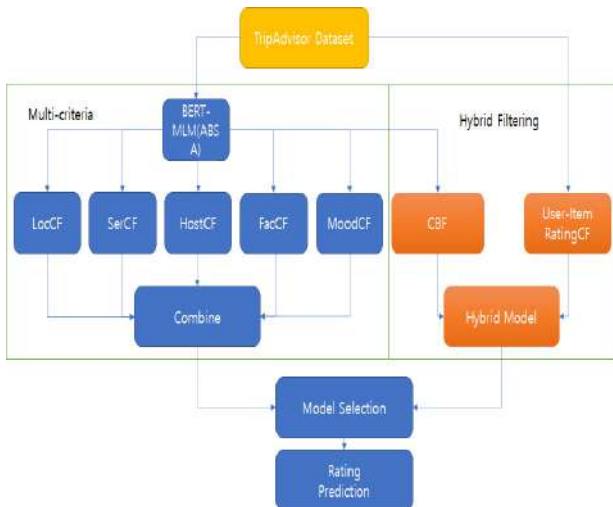
II. Figures and Tables

<표 1> Aspect Seed word

Aspect	Seed Word
Location	location, taxi, route, boston, uber, Downtown, st.
Facilities	facilities, restaurant, starbucks, aquarium, laundry
Service	checkin, airconditioner, heat, hair dryer, wifi, bed, bathroom, mattress
Host	host, worker, Anne, hostess, he, waiter
Mood	mood, place, interior, atmosphere, picturesque

<표 2> RMSE, MAE

Model	RMSE	MAE
LocCF+Hybrid Filtering	0.4313	0.4019



<그림 1> Model

III. 참고문헌

Cataldo Musto, Marco de Gemmis, Giovanni Semeraro, and Pasquale Lops. 2017. A Multi-criteria Recommender System Exploiting Aspect-based Sentiment Analysis of Users' Reviews. In *Proceedings of the Eleventh ACM Conference on Recommender Systems* (*RecSys '17*). Association for Computing Machinery, New York, NY, USA, 321–325. <https://doi.org/10.1145/3109859.3109905>

Fu, Y., Liu, B., Ge, Y., Yao, Z., & Xiong, H. (2014, April). User preference learning with multiple information fusion for restaurant recommendation. In *Proceedings of the 2014 SIAM international conference on data mining* (pp. 470-478). Society for Industrial and Applied Mathematics.

Fuchs, M., & Zanker, M. (2012, September). Multi-criteria ratings for recommender systems: an empirical analysis in the tourism domain. In *International Conference on Electronic Commerce and Web Technologies* (pp. 100-111). Springer, Berlin, Heidelberg.

Ku, Min Jung, and Hyunchul Ahn. "A Hybrid Recommender System Based on Collaborative Filtering with Selective Use of Overall and Multicriteria Ratings." *Journal of Intelligence and Information Systems*, vol. 24, no. 2, 한국지능정보시스템학회, June 2018, pp. 85-109, doi:10.13088/JIIS.2018.24.2.085.

Li, R., Chen, H., Feng, F., Ma, Z., Wang, X., & Hovy, E. (2021, August). Dual graph convolutional networks for aspect-based sentiment analysis. In *Proceedings of the 59th Annual Meeting of the*

E3.7 데이터셋 유형 분류를 통한 클래스 불균형 해소 방법 및 분류 알고리즘 추천

김정훈
국민대학교 *비즈니스IT전문대학원*
4단계 BK21 교육연구팀
jeonghun0077@kookmin.ac.kr

곽기영
국민대학교 *경영대학/비즈니스*
IT전문대학원
kykwahk@kookmin.ac.kr

국문초록

AI(Artificial Intelligence)를 다양한 산업에서 접목하기 위해 알고리즘 선택에 대한 관심이 증가하고 있다. 알고리즘 선택은 대부분 데이터 과학자의 경험에 의해 결정되는 경우가 많다. 하지만 경험이 부족한 데이터 과학자의 경우 데이터셋 특성 기반의 메타학습(meta learning)을 통해 알고리즘을 선택한다. 기존의 알고리즘 추천은 선정 과정이 블랙박스이기 때문에 어떠한 근거에 의해 도출되는지 알 수 없었다. 이에 따라 본 연구에서는 k-평균 군집분석을 활용하여 데이터셋 특성에 따라 유형을 나누고 적합한 분류 알고리즘과 클래스 불균형 해소 방법을 탐색한다. 본 연구 결과 네 가지 유형을 도출하였으며 데이터셋 유형에 따라 적합한 클래스 불균형 해소 방법과 분류 알고리즘을 추천하였다.

주제어

클래스 불균형, 메타학습, 데이터셋 유형, 군집분석, 데이터 특성

[DAY 2]

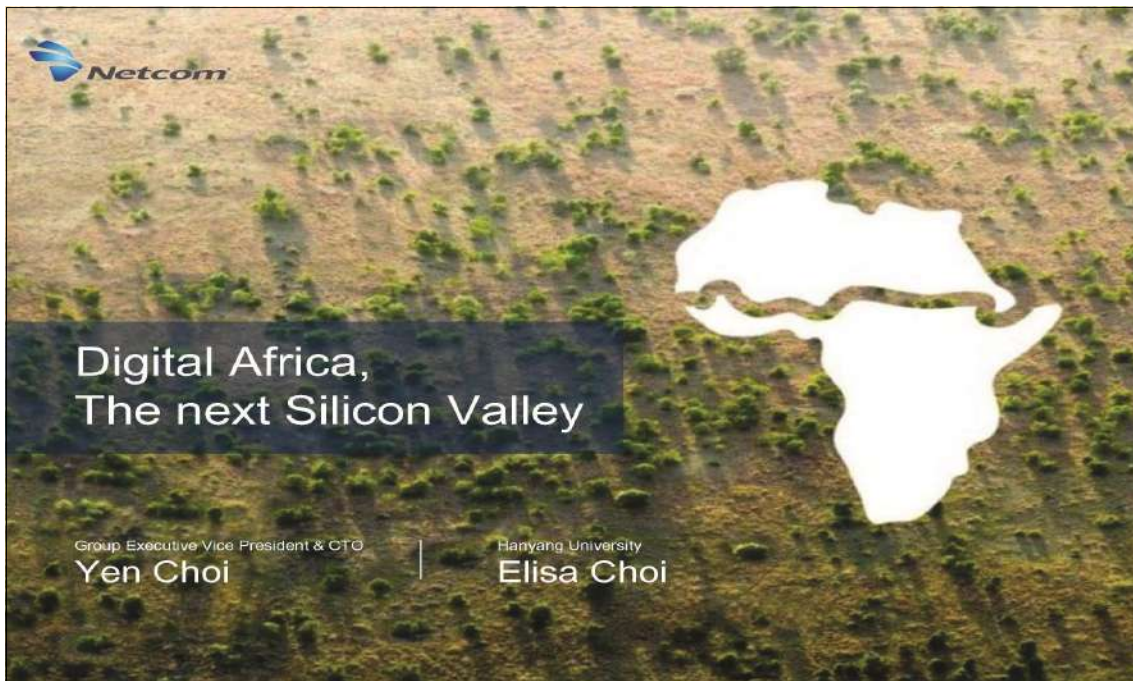
A1 [Tutorial] Tutorial (Africa Startup)

A1.1 Africa start up, entrepreneurship, market status, market demand

Yen Choi^a, Elisa Choi^b

^aGroup Executive Vice President & CTO

^bHanyangUniversity

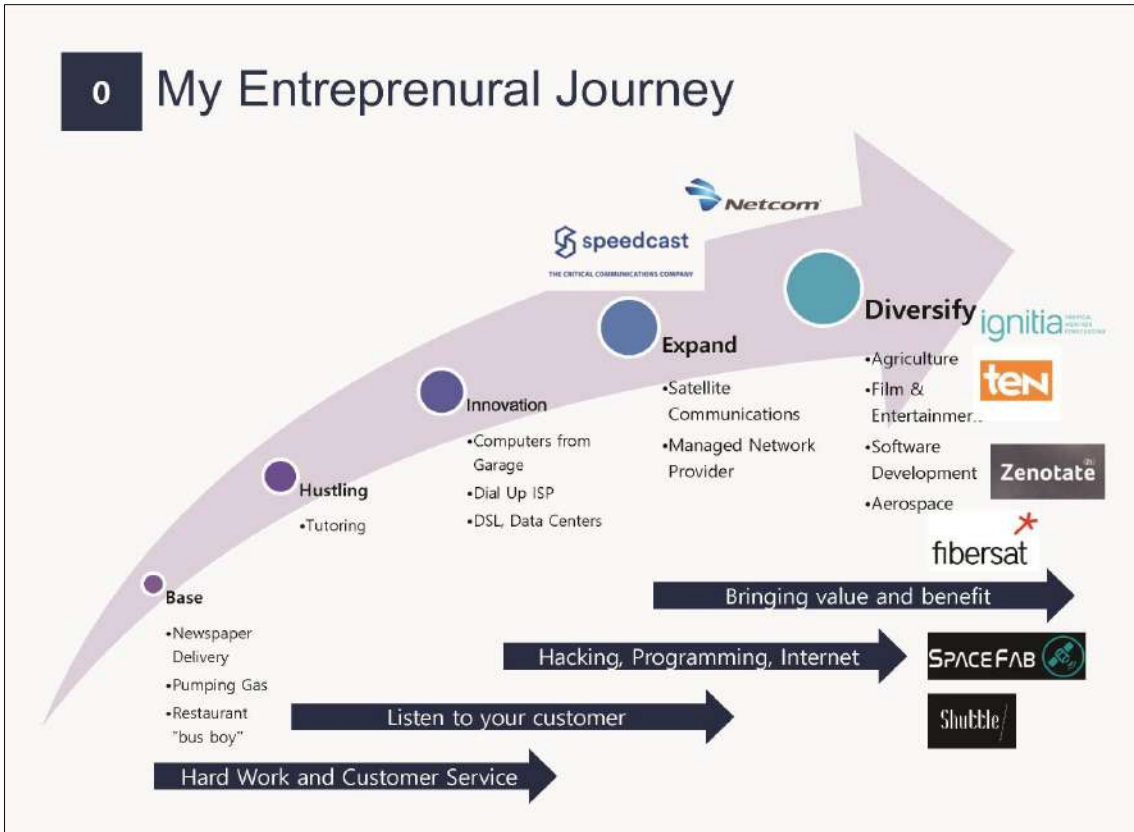


o Table of Contents

- Will fill in







0 Agri-Tech



Accurate weather forecasts helps to reduce risk and increase profits.

228,217,447
forecasts sent to date

[Learn More](#)

ignitia.se

0 Telecom



Data Security

The damage related to cybercrime is projected to hit \$6 trillion (about \$18,000 per p in the US) annually by 2021, and Nigeria is ranked number 8 globally when it comes Ransomware attacks.

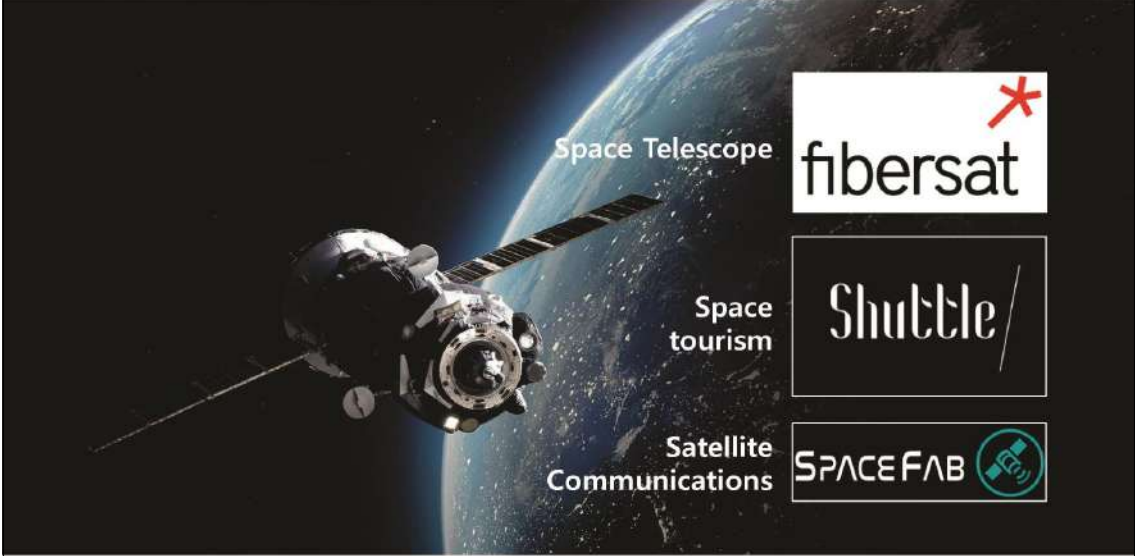
Netcom Africa

- Since 2004
- Largest Enterprise Networks and
- Managed Services Provider in Nigeria
- National Fiber Network

Cloud Adoption ERP (Enterprise Resource Planning) Unified Communications Data Security

netcomafrika.com

0 Space & more...

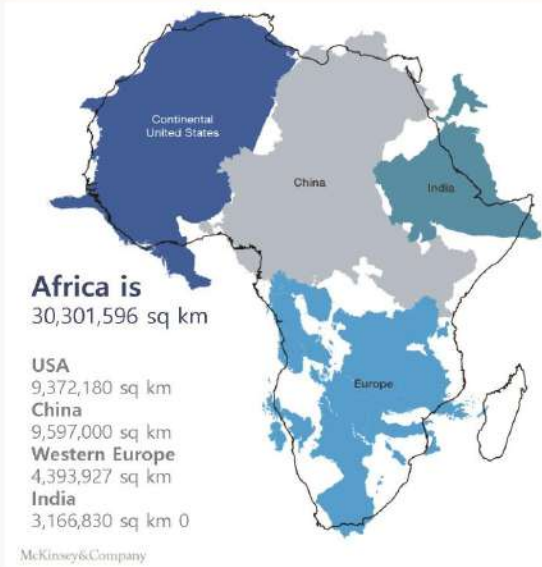


0 Films



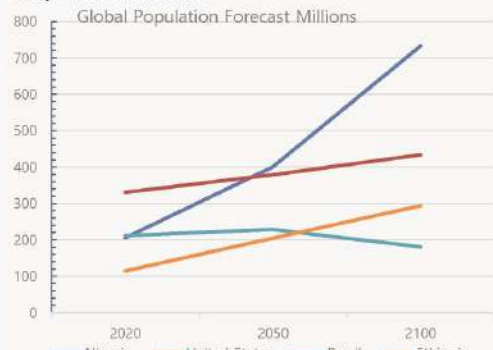
0 About Africa

The continent size



\$ GDP	Urbanization Rate
2021: \$ 2.69 trillion	2020: 47 %
\$ GDP per Capita	FDI inflow(% of GDP)
2021: \$ 2,030	2020: 2.03 %

Population leader



Source: United Nations Department of Economic & Social Affairs, June 17, 2019.

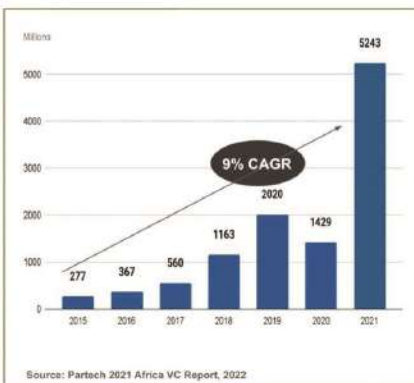
0 About Africa

The Africa VC funding gap is LARGE

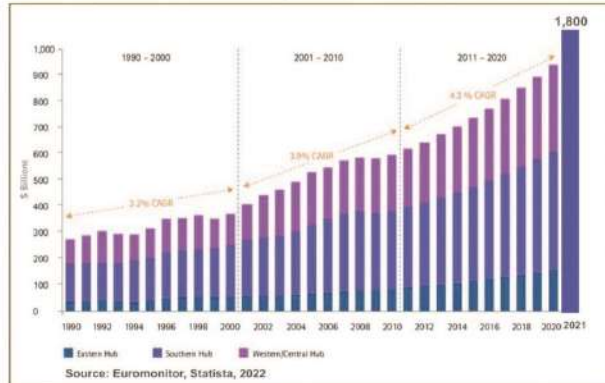
Africa is Undercapitalized

- Africa represents 0.8% of global VC funding(Global: \$620 bn./ Africa: \$5.2 bn. 2021)
- Yet Africa accounts for 17.5% of global population as of 2021(1.4bn. Ppl. out of 8 bn.)
- And 2.74% of global GDP in 2021 of \$95 trillion

Africa VC funding, 2015-2021



Sub-Saharan Africa Consumer Spending reached \$1.8 Trillion in 2021

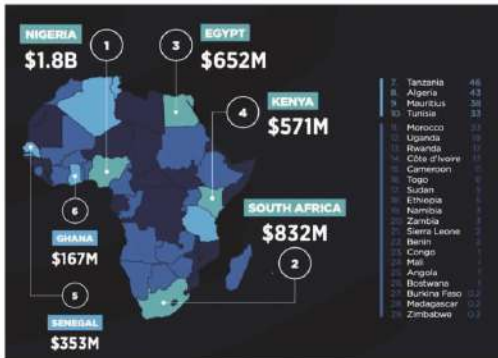


0 About Africa

Funding continues to go only a few regions & sectors

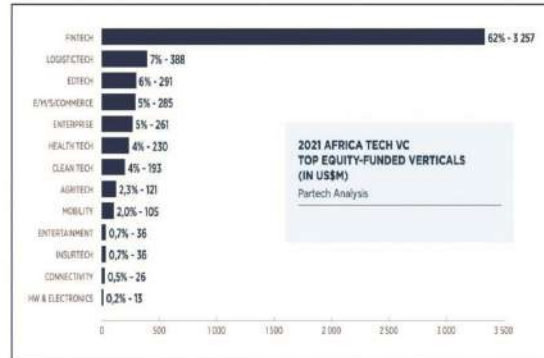
- Nigeria, and Fintech get most of the money

35% of VC funding went to Nigeria in 2021



Source: Partech 2021 Africa VC Report, 2022

62% of VC funding went to Fintech in 2021



Source: Partech 2021 Africa VC Report, 2022

0 About Africa : 4 Big tech hub in Africa

① South Africa

- Global Competitiveness Report (GCR): Ranked 60th with score of 62.4(2019)
- Global Innovation Index: Ranked 63rd(2019)

② Egypt - North

- Global Innovation Index : Ranked 92nd with a score of 27.47.
- Best universities in Africa – Scientific research carried out by scholars greatly supports the development of technology.
- Government's intentional investment in research and development in Egypt to improve the lives of her citizens.

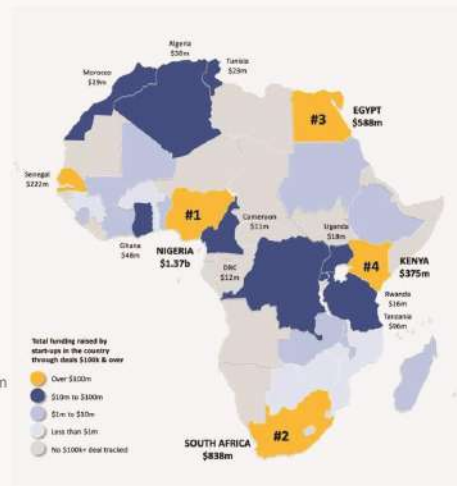
③ Nigeria - West

- Nigeria is Africa's most populous country in western region
- Nigeria is the 3rd most technologically advanced country - Significant technological discoveries and innovations with global recognition.
- Major strength: talented youths pool
- IT sector is worth mentioning - Nigeria is home to Iroko Partners, a successful web organization with over 6 million extraordinary clients from 178 unique countries, made in Nigeria INYE-1 and INYE-2 tablet PCs.

④ Kenya - East

- The top 10 most technologically advanced countries in 2022 – Ranked 4th
- Several innovative ideas have emerged from Kenya over the last couple of years, especially in the IT sector.
- Global Innovation Index: Ranked 77th with score of 31.3(2019) - 2nd in Sub-Saharan Africa

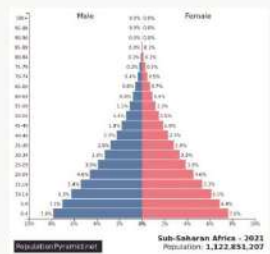
Total funding raised by start-ups in 2021



0 Potential in Africa

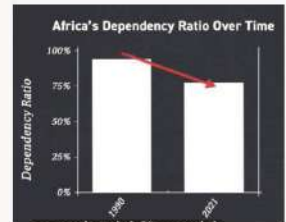
1. Rapid Urbanization

- Nigeria, Ghana, and Angola: the proportion of urban residents will increase to over 80% of their total population by 2050
 - Africa's current(2021) population 1.2 billion → projected 1.7~2.4 billion by 2030
- In large metropolitan areas, the amount of money spent on consumer goods and services is typically 79% higher than the national average.
- Better connectivity in urban areas
 - Broaden employment opportunities
 - Create larger markets for commerce
 - Driving financial and social inclusion for more people.



2. Demographic boom

- Africa will be the only continent that decreasing dependency ratio



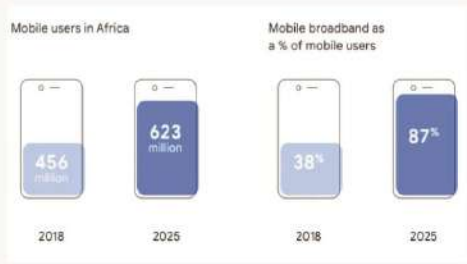
2021 dependency ratio
America: 54%
Africa: 79 %
China: 37%

- Over 350 million middle-class people(According to the African Development Bank, excluding South Africa)
- By 2030, Africa is expected : 1.7 billion consumers with total consumer expenditure of \$2.5 trillion.

0 Potential in Africa

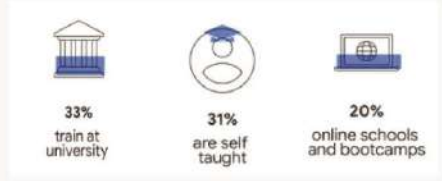
3. Internet access

- Mobile devices are the most common - means of Internet access
- Across Africa, 60% of the population is accessing the Internet through their mobile phones.
- By 2025, 167 million more people from Sub-Saharan Africa will have subscribed to mobile services : total of 623 million users
- In the next decade, the #of Internet users in Africa will grow by 11%, representing 16% of the total global amount.
- Internet economy to reach \$155Bn by 2025



4. Developer population

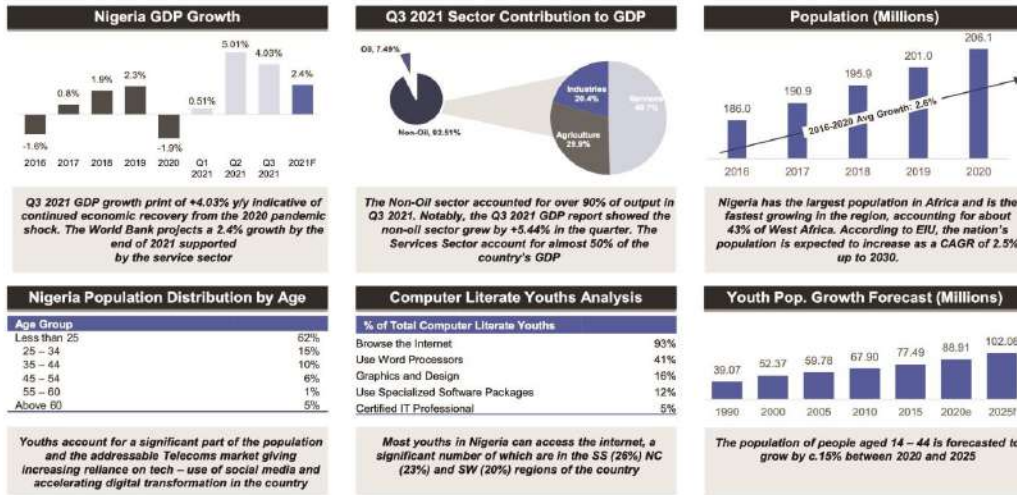
- Young and growing —hiring pipeline
 - technology ecosystem
 - talent pool
 - innovation hubs goes hand-in-hand with the rise of local developer talent - Software development
 - IT are spreading their influence and affecting
- Nearly 700k professional developers across Africa w/ more than 50% concentrated in 5 key African markets:
 - Egypt, Kenya, Morocco, Nigeria, and South Africa.
 - Rise of informal education channels,
 - Increasing gender diversity
 - More proactive government support
 - Software development is becoming more accessible to wider audiences.



0 About Nigeria

Supportive Economic Indicators & Demographics

- There is a positive outlook on Nigeria's GDP growth & economic recovery with Telecoms being a high impact sector



Source: National Bureau of Statistics, World Bank, Economist Intelligence Unit, Deloitte Research, Fitch Nigeria Telecommunications Report

0 Nigeria E-Commerce Market Overview

- Expected to register a CAGR of 12.24% during the period 2022-2027
 - ① Advanced infrastructure
 - ② High internet penetration
 - ③ Growing number of card-based payment systems
- Economy is moving toward cashless transactions, with digital payment and electronic banking
 - The development of electronic payments in Nigeria encourages payment service providers to enter the industry
 1. Citibank 2. Zenith 3. UBA 4. Fidelity
 - Make payments abroad in nations : United Kingdom, Germany, South Africa, United States.
- With a 30 percent increase in 2021, the Nigerian eCommerce market contributed to the global growth rate of 29 percent.
- The rise in fraudulent online activities= cybercrime



Legend: Cash, Cheque, Electronic Direct/ACH, Other Payment Types, Card

0 Nigeria Key Market Trend

- Penetration of Internet and Rise in online payments
- One of Africa's most developed internet economies
 - ① largest population
 - ② one of the world's youngest.
 - ③ Africa's strongest network coverage
 - ④ mobile communication infrastructure.
 - ⑤ The percentage of people who use the internet : currently above 70% Smart phone users between 25 and 40 million
- According to the National Communication Commission (NCC) the majority of internet users are shoppers,
- Mobile network coverage is currently estimated at 77%.
- 89 % of internet users purchase online, with another 24 % planning to do so in the near future.

0 Challenges in Nigeria

Table 9. Challenges of E-commerce in Nigeria

No	Challenges	Frequency	Percentage	Sign. T.Sigif.
1.	Power outage and frequent power interruption	52	6.2	1.375
2.	Insecurity	65	7.7	1.000
3.	High rate of poverty	31	3.7	0.011**
4.	High rate of illiteracy	47	5.6	0.000**
5.	Technology cost	51	6.0	0.58
6.	Lack of e-commerce infrastructure	30	3.6	1.774
7.	Reliable technology vendor	31	3.7	0.143
8.	Making business known to users	24	2.9	0.815
9.	Lack of seriousness by banks	17	2.0	0.109
10.	Authenticity and credit card threat	34	4.1	1.000
11.	Lack of privacy and confidentiality	34	4.1	0.125
12.	Lack of trust in web retailers	52	6.2	0.813
13.	Acquiring IT skilled personnel	56	6.7	0.000**
14.	Unreliable last mile delivery	22	2.6	0.092
15.	Managing change	33	3.9	0.0625
16.	Obtaining senior management support	21	2.5	0.188
17.	Reaching customers in rural areas	40	4.8	0.092
18.	Current e-commerce legislation	18	2.1	0.096
19.	Dealing with intermediaries	30	3.6	0.518
20.	Software compatibility	52	6.2	0.180
21.	Internet service provider reliability	33	3.9	0.625
22.	Web site issues	21	2.5	0.774
23.	Employee resistance towards e-commerce	24	2.9	0.549
24.	Customer service	21	2.5	0.021**
	Total	839	100	

- ① Weak infrastructure: Power & transportation
- ② Rising crime and Insecurity
- ③ High rate of poverty
- ④ Political risk: political corruption
- ⑤ Multiple taxes: by Federal, State, Local Govern. & agencies
- ⑥ Exchange risk
- ⑦ High Interest Rates
- ⑧ High Inflation

Do you think we need this ?



0 Challenges

Doing Business in Nigeria

- Cost of Living
 - Property
 - Getting things done
 - Operational costs
- Ease of doing business
 - Fake news vs reality
- Cultural norms
 - Don't Colonize, assimilate
- Networking
 - Business is about relationships
- Contracts
 - Get a good lawyer
- Get used to getting knocked out
 - Get back up

0 Perspectives on new opportunities

- Do not be afraid to play outside your comfort zone
 - All big projects start from 1 person with a vision and develops it
- Partnerships is a scalable growth strategy
 - $e=1+0.1n$
 - e=effort
 - n=number projects
- Study and become a 50% expert in 24 hours
 - Google is your friend
 - Wikipedia is your uncle

0 Failures



THE CHANCE
THAT YOU WILL
FAIL IN
SOMETHING
YOU TRY IS
ABOUT 100%.
YOU ARE
GOING TO FAIL



"IT IS EASIER
TO SOLVE
PROBLEMS
WHEN YOU
ARE USED TO
FAILING. YOU
GET SMARTER.
PREVENT AND
SOLVE



LEARN FROM
OTHERS
MISTAKES



"ANY BLOOD?
IS ANYONE
HURT?"

0 Conclusion

- What would be the conclusion

Reference

- [5 key trends in Africa's digital economy - Think with Google](#)
- [Nigeria E-commerce Market Trends, Forecast, Report 2022 - 27 \(mordorintelligence.com\)](#)
- Challenges of E-commerce in Nigeria
- [hssl.28.2.05 Okolie-Ojomo.pdf \(lu.lv\)](#)
-
- [\(PDF\) Globalization and localization: The formation of the technology innovative development \(researchgate.net\)](#)
-
- [The power of connections: Strengthening African tech ecosystems | Institute for Global Change](#)
- [South Africa, Nigeria and Kenya are the three largest eCommerce markets across Sub Saharan Africa - report | Business Insider Africa](#)

[DAY 2]

B1 [Special Session] NIA Open Data

B1.1 공공데이터 추진성과와 디지털플랫폼정부 구현을 위한 공공데이터 기본계획 방향

이용건
N/A



공공데이터 제공 운영실태 평가 개요

- ▲ 목적
 - 공공데이터 제공 운영 전반에 대한 현황을 파악하고 정책 개선에 환류하여 공공데이터 정책 성과 제고
- ▲ 근거
 - 공공데이터의 제공 및 이용 활성화에 관한 법률 (약칭: 공공데이터법) 제9조 공공데이터의 제공 운영실태 평가

공공데이터법 제9조

① 행정안전부장관은 매년 공공기관(국회·법원·헌법재판소 및 중앙선거관리위원회는 제외한다. 이하 이 조에서 같다)을 대상으로 공공데이터의 제공기반조성, 제공현황 등 제공 운영실태를 대통령령으로 정하는 바에 따라 평가하여야 한다.

2

공공데이터 제공 운영실태 평가 개요

▲ 대상

- 공공기관(국회·법원·헌법재판소 및 중앙선거관리위원회는 제외)

*법2조(정의) 1. "공공기관"이란 국가기관, 지방자치단체 및 「지능정보화 기본법」 제2조제16호에 따른 공공기관을 말한다.

2022년 평가대상
중앙행정기관 45개, 지방자치단체 243개, 공공기관 282개로 총 570개 기관

▲ 평가항목

- 5개 영역(관리체계, 개방, 활용, 품질, 기타가감점) 16개 지표

※ 품질 영역은 「공공데이터 품질관리 수준평가」 결과 반영

3

공공데이터 제공 운영실태 평가 추진경과



	2018년	2019년	2020년	2021년	2022년
평가 대상	총 287개 기관 - 중앙행정기관 44개 - 광역자치단체 17개 - 기초자치단체 226개	총 520개 기관 - 중앙행정기관 43개 - 광역자치단체 17개 - 기초자치단체 226개 - 공공기관 234개	총 535개 기관 - 중앙행정기관 43개 - 광역자치단체 17개 - 기초자치단체 226개 - 공공기관 249개	총 548개 기관 - 중앙행정기관 45개 - 광역자치단체 17개 - 기초자치단체 226개 - 공공기관 260개	총 570개 기관 - 중앙행정기관 45개 - 광역자치단체 17개 - 기초자치단체 226개 - 공공기관 282개
우수 등급	26개 기관 (9.1%)	120개 기관 (23.1%)	173개 기관 (32%)	186개 기관 (33.9%)	

4

B1.2 공공데이터 제공 운영 수준 향상을 위한 실태평가 추진성과

신명진 (N/A)

공공데이터 추진성과와 디지털 플랫폼정부 구현을 위한 공공데이터 기본계획 방향

2022. 6.
한국지능정보사회진흥원 공공데이터본부 | 이용건 수석

NIA 한국지능정보사회진흥원

공공데이터 정책추진 개요

2013.10.31일 공공데이터 제공 및 이용활성화에 관한 법률(공공데이터법)이 시행되었으며, 올해로 10년동안 꾸준히 정책을 추진하여 시간이 지나 개방수, 활용수, 이용자수, 오픈포맷 비중, 다운로드 수 등에서 대폭 증가가 이루어짐.

ㄱ 개방수	2013년 5,272개	->	2021년 67,441개
ㄱ 활용수	2013년 42개	->	2021년 2,724개
ㄱ 이용자수	2013년 23,662명	->	2021년 395,022명
ㄱ 오픈포맷 비중	2013년 8.7%	->	2021년 93.4%
ㄱ 다운로드수	2013년 13,923건	->	2021년 33,340,436건

그동안 공공데이터는 공공주도 양적 개방 등 공급자 중심의 개방, 정형데이터 중심 개방과 활용을 확대해 왔음. 이러한 공공데이터와 관련한 개방, 활용, 품질, 기반 등의 측면에서 성과와 한계에 대해 살펴보고자 함

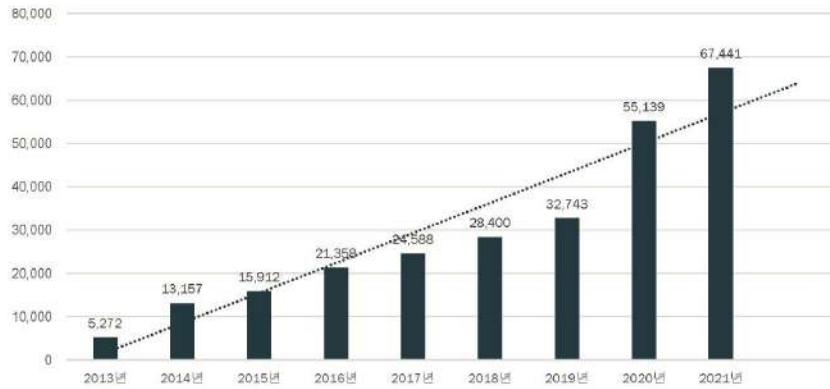
2022.5.10일 출범한 윤석열 정부에서는 '디지털 플랫폼 정부 구현'이라는 국정전략을 제시하여네거티브 방식의 공공데이터 전면 개방, 개방을 저해하는 법제도 정비, 익명화 등 기술적 조치, 공공분야 데이터 레이크 구축, 차세대 개방 포털 구축 등을 새롭게 추진하여 국민이 원하는 공공데이터를 개방, 공유, 활용 하도록 지원할 예정임

이제는 민-관 협력 중심, 품질 중심 개방, 정형 비정형 등 다양화, 민-관 협치 강화, 지역 및 사회문제해결 추진 등 새로운 방향 모색이 필요함

2

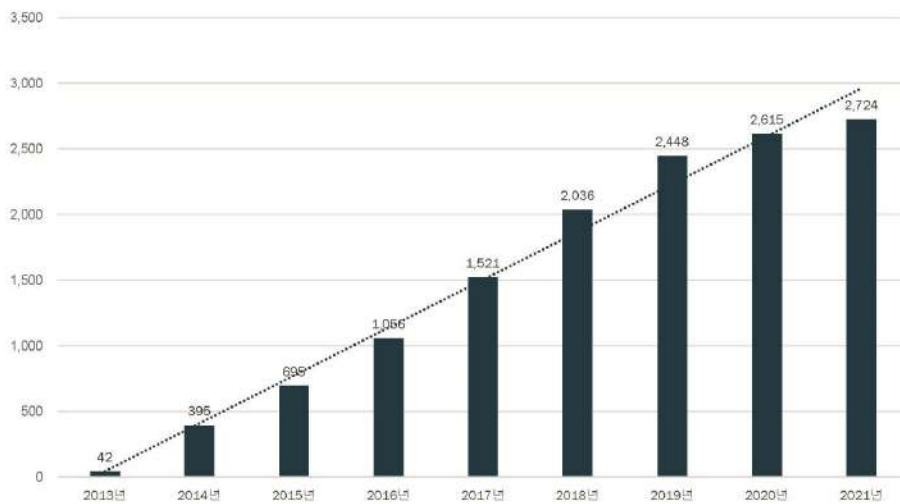
공공데이터 개방수 실적

공공데이터 개방수 현황



공공데이터 활용수 실적

활용 서비스 개발 수



B1.3 데이터 기반 행정 활성화를 위한 공공빅데이터 분석 사례

김승현 (NIA)



데이터기반행정 활성화를 위한 공공빅데이터 우수사례

한국지능정보사회진흥원, 공공빅데이터분석팀
김승현 선임 (kim@nia.or.kr)



활용우수사례 - 참조모델

1. 공공시설물 특성 기반의 최적입지 선정

▶ 다양한 공공시설물 설치를 위한 범용 모델 개발을 통한 예산 및 분석시간 절감, 선제적 수요 대처

Before	After
<p>추진 배경</p> <ul style="list-style-type: none"> ✓ 국민 편의와 안전을 위한 다양한 공공시설물 설치 증가 (공공자전거대여소, 그늘막, 이동노동자쉼터, 전기자전거전소, 택배함 등) ✓ 신규 공공시설물에 대한 모델 수요 증가 ✓ 10개이내 등 설치수가 적은 공공시설물 모델 필요 ✓ 모델 개발시 고비용·장기간 소요 등 이슈 개선 필요 <p>현황 및 문제점</p> <ul style="list-style-type: none"> • 경험기반의 입지선정으로 최적 입지 선정에 한계 • 설치 사례수가 적은 공공시설물에 대한 모델 부재 • 현재 시설물별로 모델 개발하여 고비용, 장기간 소요 • 국민의 활용성과 투입 예산의 효율성 관점의 근거 미약 	<p>수행 방안</p> <ul style="list-style-type: none"> 다양한 공공시설물에 적용 가능한 범용 모델과 변수 Pool 도출 공공시설물별 입지 특성 분석과 상관성 분석 공공시설물별 최적 설치 우선 지역 선정 최적 설치 우선 지역 모형의 개발 및 시각화 <p>개선방안</p> <ul style="list-style-type: none"> • 다양한 공공시설물에 모두 적용한 모델과 변수 Pool 도출 • 최소의 데이터를 활용하여 분석 및 확산 저항성 제거 • 기존의 각 공공시설물별 정밀분석 결과 수준의 우수 결과 도출 • 국민의 활용성과 투입 예산의 효율성 관점의 근거 마련

NIA 한국지능정보사회진흥원 2

법정부 데이터 통합관리 플랫폼 구성도

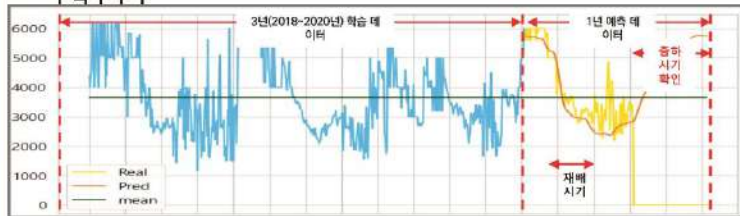


2. 지역 농작물 및 로컬푸드 활성화

농작물 수익성 검증 모델 2/2

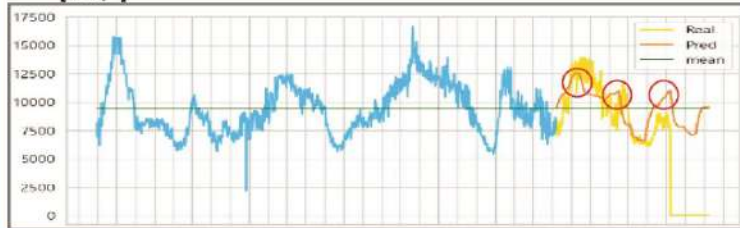
출하 적정시기 활용 방안

[옥수수]



- ◆ 옥수수의 경우 4~5월에 파종하여 9월에 수확을 함.
- ◆ 11월부터 1월까지 높은 가격대를 형성

[고추]



- ◆ 평균 가격보다 높아 지는 시기에 따라서 출하시기 확인
예 > 2월, 5월, 8월

[DAY 2]

C1 [KIISS-Paper Session]
Intelligence Service

C1.1 Human reasoning evidenced by a cortical surface-based meta-analysis

Minho Shin¹ and Hyeon-Ae Jeon^{1,2}

¹Department of Brain Sciences, Daegu Gyeongbuk Institute of Science and Technology (DGIST), Daegu 42988, Korea and ²Partner Group of the Max Planck Institute for Human Cognitive and Brain Sciences at the Department of Brain and Cognitive Sciences, DGIST, Daegu 42988, Korea

Recent advances in neuroimaging have augmented numerous findings in the human reasoning process but have yielded varying results. One possibility for this inconsistency is that reasoning is such an intricate cognitive process, involving attention, memory, executive functions, symbolic processing, and fluid intelligence, whereby various brain regions are inevitably implicated in orchestrating the process. Therefore, researchers have used meta-analyses for a better understanding of neural mechanisms of reasoning. However, previous meta-analysis techniques include weaknesses such as an inadequate representation of the cortical surface's highly folded geometry. Accordingly, we developed a new meta-analysis method called Bayesian meta-analysis of the cortical surface (BMACS). BMACS offers a fast, accurate, and accessible inference of the spatial patterns of cognitive processes from peak brain activations across studies by applying spatial point processes to the cortical surface. Using BMACS, we found that the common pattern of activations from inductive and deductive reasoning was colocalized with the multiple-demand system, indicating that reasoning is a high-level convergence of complex cognitive processes. We hope surface-based meta-analysis will be facilitated by BMACS, bringing more profound knowledge of various cognitive processes.

Key words: Bayesian meta-analysis of the cortical surface (BMACS), functional magnetic resonance imaging, inductive and deductive reasoning, integrated nested Laplace approximation (INLA), log-Gaussian Cox process

C1.2 Analysis of Influencing Factors of Consumer Purchase Intention on Cross-Border e-Commerce Platform

DengSheng Yu
Wenzhou University of Technology
E-mail: kits0820@naver.com

조승연
한양대학교 경영대학
shengj0712@gmail.com

Abstract

The rapid development of the world economy has formed the trend of global economic integration, and in this context, the cross-border e-commerce industry has been developing rapidly. At the same time, the deepening of economic globalization provides essential opportunities for the development of the cross-border e-commerce industry. It brings new changes to the global trade pattern. It allows consumers to purchase products from all over the world quickly without being restricted by time and space. Thus, it is rapidly gaining the favor of most consumers, and the cross-border shopping craze is getting higher and higher. With the rapid development of the cross-border e-commerce industry, and the emergence of platforms represented by Selling, T-mall International, Amazon, e-Bey, etc., there are differences between the platforms in terms of goods, payment, and delivery levels. As a result, consumers' willingness to use each platform varies greatly. Many scholars currently study the development status of cross-border e-commerce, the construction of logistics systems, and optimization policies. However, there is an overall lack of research on the willingness to use cross-border e-commerce platforms. At the same time, how to enhance consumers' willingness to use the platform and further broaden their market share is a pressing issue for cross-border e-commerce enterprises. This study is conducted to understand and explore the key influencing factors of consumers' willingness to use cross-border e-commerce. This study looks at the relationship between consumer characteristics and platform characteristics that influence consumers' willingness to use at the level of consumer characteristics. Also, whether there is a significant difference in the willingness to use cross-border e-commerce under different demographic variables. To test the research hypothesis, This paper uses a combination of theoretical analysis and empirical

research. Questionnaires were sent through online and offline methods. Statistical analysis software SPSS 23.0 was used to analyze the data and descriptive statistics were used to analyze the essential characteristics of respondents. The research hypotheses were also verified by analysis of Variance, reliability analysis, correlation analysis, and regression analysis. This study is expected to provide informative comments and suggestions to improve the quality of the cross-border e-commerce platform and enhance consumers' willingness to continue using it.

Keyword: Cross-Border e-Commerce Platform, Purchase Intention

Acknowledgement : Shandong Province Education Science "Thirteenth Five-Year Plan", "Shandong Province Implements Artificial Intelligence Education Research" (VZ2019004).

C1.3 온라인 가격비교 플랫폼 시장의 특성에 관한 연구

임상현
계명대학교 경영정보학전공
work.shlim@gmail.com

이충권
계명대학교 경영정보학전공
cklee@kmu.ac.kr

전지은
계명대학교 경영정보학전공
jeon.jeanie@gmail.com

국문초록

현재 운영되는 대다수의 대형 온라인 쇼핑 플랫폼은 기존의 소비자와 공급자만이 존재하던 전통적인 시장구조(단면시장, One-Sided Market)에서 완전히 벗어나 플랫폼을 중심으로한 다수의 공급자와 소비자간의 거래가 이루어지는 복잡한 구조의 양면 시장(Two-Sided Market)형태의 구조를 형성하고 있다. 이러한 형태의 시장은 소비자와 공급자간의 중개인으로써, 플랫폼 사업자가 존재하게 되고 이는 서로의 존재를 알지 못하는 소비자와 공급자간에 보이지 않는 교차 네트워크 외부성 효과라는 특별한 상호작용을 발생시키며 이러한 효과에 대한 연관 관계를 이해하기 위해 국내 최대의 포털 사이트인 네이버의 가격비교 서비스를 대상으로 양면시장만이 가지는 다양한 특성들을 살펴보고 가격 결정에 어떠한 영향을 주는지 알아보고 한다. 이를 분석하기 위하여 본 연구에서는 네이버쇼핑 가격비교 사이트 2018년 7월 1일부터 2019년 4월 1일까지의 TV제품에 대한 쇼핑관련 정보 데이터 787,179건을 수집하였고, 판매자의 입장에서 제공한 홍보 데이터와 소비자 입장에서 제품과 판매자에 대해 판단할 수 있는 제품 리뷰, 상품 스펙, 쇼핑몰 브랜드 이미지 등을 분류하고 이러한 요소들이 가격결정에 어떠한 영향을 주는지에 대해 알아보기 위해 다중 회귀 분석을 진행하였다. 그 결과 가격을 결정하는 중요한 요인으로 기술적인 스펙이 높은 제품이라고 하더라도 보편적으로 많이 유통되는 제품군이 상대적으로 가격이 저렴할 수 있고 동일한 제품이라고 할지도 브랜드 쇼핑몰보다는 판매자들끼리 보다 경쟁이 치열하다고 할 수 있는 오픈마켓에서 상대적으로 가격이 저렴해지는 것을 확인 할 수 있었다. 이러한 특성은 인터넷의 발전으로 소비자들에게 정보의 불균형에 대한 부분을 충분히 감소시켜 주었다고 하더라도 언제나 낮은 가격을 통한 판매 정책만이 존재하는 것은 아니기 때문에 다양한 관점에서 가격결정에 대한 요인을 확인 할 수 있다. 또한 판매 채널의 다각화와 보이지 않고 다양한 성향을 가진 많은 소비자의 증가로 인하여 각기 다른 형태의 네트워크 외부성 효과를 발생시키고 있음을 확인할 수 있었다.

주제어

온라인 가격비교 사이트, 양면시장, 네트워크 외부성 효과, 가격결정요인분석, 다면플랫폼

C1.4 수요예측 기반의 신제품 개발 방법론 제안: KANO와 Gaussian Process Regression 적용 모델

정두희

한동대학교 AI Convergence and Global
Entrepreneurship학부
profchung@handong.edu

양성민

한동대학교 수리통계학부
22000408@handong.ac.kr

이찬규

한동대학교 AI Convergence and Global
Entrepreneurship학부
changyu6036@handong.ac.kr

강진

한동대학교 ICT Convergence and Global
Entrepreneurship학부
i_kang@handong.ac.kr

국문초록

시장의 경쟁구도가 심화되고 제품의 수명 주기가 짧아짐에 따라 소비자의 기대와 요구에 알맞는 신제품 개발 역량이 매우 중요해지고 있다. 신제품 개발은 소비자 선호가 급변하는 경쟁적이고 복잡한 시장에서 시장 점유율을 확보할 수 있는 중요한 무기로서 회사의 경쟁력과 평판을 향상시킨다. 이러한 흐름에 따라 많은 기업은 지속가능한 경영을 위한 발판을 마련하기 위해 신제품 개발에 다양한 투자를 하지만, 현재 대부분의 신제품 개발 프로세스는 제품 출시 이후의 수요를 통해 성과가 판단되는 연역적이고 비효율적인 구조로 이루어지고 있다. 심지어 그 구조마저도 기업 내 일부 전문가의 의견으로 주도되어 소수의 주관적인 경험에 의존하는 경우가 많다. 따라서 이렇게 개발된 새로운 제품은 시장의 불확실성으로 인해 출시 후 소비자와 시장의 니즈를 충족시킬 수 있을지 불분명하다. 기업은 신제품 개발 평가 기준이 되는 판매량 예측도구가 필요함을 인지하지만, 아직까지 이것에 부합하는 틀이 없기 때문에 판매량을 극대화하는 신제품 프로파일을 식별하고 제안하는데 한계가 있다.

이 연구는 기존 신제품 개발 방법론에서 드러난 공백을 메우기 위하여 예측적 신제품 개발 방법론을 제시한다. 이는 제품의 새로운 기능이 판매량에 끼치는 영향을 미리 예측하여 수요를 극대화하는 신제품 프로파일을 귀납적으로 제안하여 신제품 개발 과정을 효과적으로 개선할 수 있다. 이 모델은 제품의 속성적(Feature) 변화정도를 의미하는 신제품 차별화 지수(Differentiation Index)를 활용하여 수요 변동지수(Demand Variation Index)를 예측한다. 예측을 위해 가우시안 프로세스 리그레션(Gaussian Process Regression) 기법을 사용하며, 이렇게 예측한 초기 판매량을 통해 판매량을 극대화하는 신제품 프로파일을 도출한다.

예측 모델 생성 중 제품 사용자의 기능별 만족도를 측정하는 KANO 모델의 결과값을 가중치로 활용하여 소비자 데이터가 반영된 완성도 높은 예측 모델을 연구에 사용한다. 이는 기존 신제품 개발 방법론에서 지적된 전문가 의존적 개발 과정을

획기적으로 해결하며 예측모델의 신뢰와 객관성을 높인다.

이 연구에서 제안하는 예측 모델은 동일 제품군에서 업그레이드가 지속적으로 일어나는 종류의 신제품에 적용되기 적합하기에 신제품이 주기적으로 출시되며, 혁신 기능에 대한 기획이 꾸준히 일어나는 스마트워치 신제품 개발 사례를 예시로 수요 예측 모델에 적용하여 본 연구의 방법론을 검증한다. 예측 모델 적용 결과, 본 연구의 예측 모델은 13%의 MAPE 예측 오차를 기록하며 스마트워치 신제품의 초기 판매량을 우수한 정확도로 예측하였다. 이후, AI 및 전자기기 전문가의 인터뷰를 통해 얻은 새로운 속성들 중 실시간 통역 기능, 진맥 측정 기능, 공기 중 바이러스 측정 기능을 각각 포함한 3가지의 새로운 신제품 시나리오를 구성하여 해당 제품의 초기수요를 예측하였다. 이를 통해 각각의 새로운 기능이 초기 수요에 미치는 영향을 예측할 수 있었고, 결과적으로 진맥 측정 기능이 0.567의 가장 높은 판매 기여도 수치를 기록하며 국내 시장에서 한의학적 접근으로 체질이나 건강 상태를 모니터링하는 제품을 출시할 때 높은 시장 호응을 얻을 수 있음을 시사했다.

본 연구는 기존의 주관적 의견에 의존하던 신제품 개발 방식을 데이터 분석 기반의 객관적인 개발 방식으로 개선한 점에서 의의를 갖는다. 또한 기존 연구와 다르게, 사용자의 요구조건을 반영하는 KANO 모델을 예측모델에 결합하여 시장의 반응을 보다 정밀하게 수요예측에 반영했다는 점도 이 연구가 지니는 차별점이다. 이 연구가 제시하는 방법론은 신제품 개발의 극초기 단계에서 제품 출시 후 판매량을 예측할 수 있는 발판이 되어 판매 성과를 극대화하는 신제품 프로파일을 도출할 수 있다는 점에서 향후 산업계에 의미 있는 기여를 할 것으로 기대한다.

주제어

예측적 신제품 개발, 수요 예측, 가우시안 프로세스 리그레션, KANO

C1.5 Boycott or Not? How do paid Advertisement Controversy in Youtuber Industry for Consumer's Boycott Intention

왕밍
순천향대학교 글로벌경영대학 경영학과
jackwang1121@sch.ac.kr

최재원
순천향대학교 글로벌경영대학 경영정보학부
jaewonchoi@sch.ac.kr

Abstract

The main purpose of this study is to explore the perceived deception, perceived risk and negative emotional factors impact on distrust, dissatisfaction, boycott intention of consumer toward product and Youtuber who failed to provide sufficient information about paid advertisements in their content which called "hidden advertisement". A total of 306 YouTube viewers from South Korea were interviewed in an online survey. As a result of the study is as follows: First, the perceived deception, perceived risk, negative emotional factors have been shown to increase the consumer's distrust and dissatisfaction. Second, we found that both consumer's distrust and dissatisfaction have positively influenced boycott intention toward YouTubers and boycott intention toward product. This study tries to identify the boycott intention of online consumer and it aims at finding out the reasons why boycotts can occur because in this issue the boycott just not only stopped at boycotting influencer or YouTuber, consumer distrust and dissatisfaction also can affect to boycott intention toward product and affect a long-term branding effort of company.

Boycott intention, Consumer distrust, Consumer dissatisfaction

Keywords: Hidden advertisement, Influencer,

C1.6 모바일 채널에서의 소비자 행동 변화 확인: 아이트래킹 접근 방식을 통해

박규홍
인하대학교 경영학과
khpark@inha.ac.kr

김동연
가톨릭대학교 경영학과
dykim88@catholic.ac.kr

Abstract - 모바일 커머스의 성장으로 인하여 채널 간 소비자 행동의 차이를 확인하는 것이 중요해지고 있다. PC와 모바일 채널 별 전자상거래 경험 시 고객의 시각적 주의 변화 추이와 제품 타입, 제품 배치 방식에 따른 시각적 주의의 분포 변화를 아이트래킹 분석을 통하여 확인하였다. 모바일 채널의 경우 PC채널에 비해 시각적주의가 급격하게 변하는 것을 확인할 수 있었고, 제품의 타입과 배치 형태에 따라 시각적 주의의 분포 경향이 변화함을 확인하였다.

Key Terms - 모바일, 시각적 주의, 아이트래킹, 전자상거래, 채널

이 논문은 2022년도 인하대학교, 가톨릭대학교의 지원에 의하여 연구되었음

I. 서론

온라인 채널의 도입은 전통적인 거래시장을 완전히 바꾸어 놓았다. 특히 전자상거래의 출현은 거래비용과 탐색비용을 줄이고 전시공간 문제와 재고문제를 해결하여 소비자들에게 더 다양한 제품을 적시에 공급할 수 있게 되었다. 스마트폰, 태블릿 등 새로운 모바일 기기의 출현은 전자 상거래를 더 소비자 친화적으로 변화시키고 시공간의 제약을 줄였으며 개인화된 서비스를 제공하는데 큰 역할을 했다. PC와 모바일 채널의 도입과 이로 인한 변화는 다양한 연구를 통해 확인되었다(Bang et al. 2013). 특히 여러 채널의 도입으로 인한 소비자의 행동 변화는 오랜기간 동안 다양한 주제와 방법론을 통해 확인되었으나 상당수의 연구는 서베이나 클릭스트림 데이터에 대한 분석연구를 통해 수행되었다. 서베이연구는 응답자의 인지적 제약이 존재하며 클릭스트림 데이터 분석의 경우 소비자의 최종선택까지의 과정 중 실제 클릭하지 않은 대안들에 대한 내용을 확인할 수 없는 단점이 있다(Fowler 1992; Ahn et al. 2018). 이에 본 연구는 아이트래킹 방법론을 활용해 고객의 의식적, 무의식적 행위를 모두 관찰하고자 한다.

II. 선행 연구

시각적 주의는 광고나 제품 선택 영역에서 활발히 연구되어 온 주제이다(Lee et al. 2015). 주의를 제품을 인지하는 첫번째 단계에서 발생하며 주의를 끌지 못하는 제품은 소비자에게 선택될 확률이 현저히 낮기 때문에 시각적 주의를 확보하는 것은 매우 중요하다. 아이트래킹 방법론은 시각적 주의를 확인하는데 가장 효과적인 연구 방법론이며 특히 전자상거래 관련 분야에서 리뷰시스템이나 광고, 상품 배치의 효과 등을 확인하는데 활발히 활용되고 있다.

상거래 분야에서 새로운 채널의 도입은 항상 커다란 변혁을 동반하였다. 온라인 채널의 출현은 파레토 법칙에서 롱테일 법칙으로의 변화를 이끌어 냈으며 최근 급성장하고 있는 모바일 채널의 출현은 디스플레이 크기 변화와 입력장치의 부재로 인하여 소비자 행동의 변화를 야기하기도 하였다(Park and Han 2010).

III. 가설 전개

사람의 인지능력은 한계가 있기 때문에 처음 입력된 자극이 가장 기억에 깊게 남고 그 이후의 자극에는 많은 에너지를 투입하기 어렵다(Raymond et al. 1992). 그렇기 때문에 많은 상황에서 대부분의 주의를 처음과 초기의 자극에 집중되고 점차 줄어들게 되며 이러한 분포를 시각화하면 알파벳 F 모양과 유사하게 나타난다(Ahn et al. 2018). PC 채널에 비해 모바일 채널의 경우 입력장치가 없고 디스플레이 크기가 작기에 더 많은 탐색비용이 필요하기에 이러한 시각적 주의의 변화가 더 급격할 것이다.

H1. 모바일 채널에서 시각적 주의의 감소는 PC 채널보다 더욱 급격히 나타날 것이다.

웹페이지 상에서 검색 결과를 나타내는 방법은 여러가지 형태가 있으나 그 중 가장 많이 활용되는 형태로는 격자형과 리스트형이 있다. 리스트형의 경우 검색엔진 사이트 등에서 가장 많이 활용되는데 가장 상위포지션이 대다수의 시각적 주의를 독차지 하는 경향이 있다(Haas and Unkel 2017). 이를 해결하기 위해 검색 사이트에서는 격

자형 (테이블형) 배치가 활용되기도 하였다. 전자상거래 분야에도 마찬가지로 배치형태와 채널에 따라 시각적 주의 분포가 달라질 것이다.

- H2. 격자형 배치에서 리스트형 배치 보다 시각적 주의를 고루 분포될 것이다.
- H3. PC 채널의 경우 배치 방법에 따른 시각적 주의의 분포 차이가 모바일 채널 보다 클 것이다.

상품을 선택할 때는 고려해야 할 요소가 많기 때문에 전자상거래에서는 상품의 특성을 고려한 소비자 행동에 대한 다양한 연구가 이루어지고 있으며 그 중 하나로 경험/탐색재로의 상품의 특성 분류가 있다(Bang et al. 2013). 경험재의 경우 제품의 리뷰나 디자인에 대해 소비자의 관심이 집중되는 경우가 많고 탐색재의 경우 제품의 성능 관련 요인에 소비자가 관심을 가지게 된다.

- H4. 탐색재의 경우 시각적 주의를 일부 상품군에 더욱 집중 될 것이다.
- H5. 모바일 채널 상에서 탐색재의 경우 시각적 주의를 PC채널에 비해 일부 상품군에 더욱 집중 될 것이다.

IV. 방법론 및 실험 디자인

PC채널과 모바일 채널을 동일한 환경에서 관측하기 위하여 모바일 아이트래킹 기기(Tobii Pro Glasses 2)를 활용하여 실험을 진행하였다. 실험은 채널(PC, 모바일), 배치(격자형, 리스트형)으로 나누어 2*2 디자인으로 구성하였으며 실험 참가자는 각자 한 그룹에 배치되어 제작된 페이지에서 총 4종류의 상품(탐색재 2종류 경험재 2종류)에 대한 구입을 하는 실험을 수행하였다. 시각적 주의를 측정하기 위해서 해당 상품에 얼마나 자주 시선이 갔는지에 대한 횟수를 기록하였다.

<표 1> 실험자의 그룹 배치

채널	PC	그룹1	그룹2
	모바일	그룹3	그룹4

V. 실험 결과

실험결과 시각적 주의의 감소패턴은 선행연구와 마찬가지로 초기 상품에 집중되고 점차 하락하는 경향을 보였으며 이는 모바일 채널에서 더욱 급격히 일어남을 확인 할 수 있었다(기울기 -0.0162 vs. -0.0201).

시각적 주의의 분포 경향을 설명하기 위해서는 불평등 지수를 나타내는데 쓰이는 지니계수를 계산하여 활용하였다.

상품 배치에 따른 차이를 확인하기 위한 분석 결과, 리스트형의 경우 격자형 보다 시각적 주

의가 특정 상품군에 더욱 집중되는 것을 확인 할 수 있었다(지니계수 0.572 vs. 0.501). 또한 PC 채널에서 그 격차가 더 큰 것을 확인 할 수 있었다.

상품의 종류에 따른 차이를 확인하기 위한 분석 결과 탐색재의 경우 경험재 보다 시각적 주의가 특정 상품군에 더욱 집중되는 것을 확인 할 수 있었다(지니계수 0.556 vs. 0.516). 또한 모바일 채널에서 그 격차가 더 큰 것을 확인 할 수 있었다.

VI. 참고문헌

Ahn, J. H., Bae, Y. S., Ju, J., and Oh, W. "Attention Adjustment, Renewal, and Equilibrium Seeking in Online Search: An Eye-Tracking Approach," *Journal of Management Information System*, Vol.35, No.4(2018) 1218-1250.

Bang, Y., Lee, D. J., Han, K., Hwang, M., and Ahn, J. H. "Channel Capabilities, Product Characteristics, and the Impacts of Mobile Channel Introduction," *Journal of Management Information Systems*, Vol.30. No.2(2013) 101-126.

Fowler Jr, F. J. "How Unclear Terms Affect Survey Data," *Public Opinion Quarterly*, Vol.56. No.2(1992), 218-231.

Haas, A., and Unkel, J. "Ranking Versus Reputation: Perception and Effects of Search Result Credibility," *Behaviour & Information Technology*, Vol.36. No.12(2017), 1285-1298.

Lee, J., Ahn, J. H., and Park, B. "The Effect of Repetition in Internet Banner Ads and the Moderating Role of Animation." *Computers in Human Behavior*, Vol.46(2015), 202-209.

Park, Y. S., and Han, S. H. "One-handed Thumb Interaction of Mobile Devices from the Input Accuracy Perspective," *International Journal of Industrial Ergonomics*, Vol.40. No.6(2010),746-756.

[DAY 2]

D1 [ICEC-Paper Session]
Machine Learning & Text Mining I

D1.1 Conducting Service Analysis Based on Online Customer Reviews - Topic Modeling

Park, K., Jo, B., Cho, S., and Ha, S. H.
Kyungpook National University
E-mail: iamkbpark@gmail.com, iambgjo@gmail.com,
sbcho@nia.or.kr, hsh@knu.ac.kr

Abstract

This study provides a framework to discover the strengths and weaknesses of services and to enhance customer satisfaction from online customer reviews, especially in the hospitality industry. Instead of using user-rating scores, a sentiment analysis is conducted to classify consumers' attitudes toward hotels based on their experiences as written in reviews. By integrating the results of sentiment analysis, polarity, with a structural topic model as a covariate, this research detects hidden dimensions in review data and distinguishes positive and negative dimensions. Furthermore, other covariates, time and hotel, are used to track dimensional trends over time and compare the outcomes of two different hotels. This study addresses a limitation in previous research that focused on discovering the service defect by strength detection and explanation of the relationship between service factors and user-rating scores of the review as a proxy of customer satisfaction.

Keywords: customer satisfaction, structural topic model, sentiment analysis

Introduction

Over the last several decades, people have revealed their opinions and emotions through social media. People are willing to share their experiences regarding products or services with others, and such information is easily accessible to prospective customers. Consequently, customer behavior when shopping or traveling has been changed dramatically and management has been required to react accordingly. User-generated text data posted on the social media has significant potential for understanding both customer and management in details and identifying new insights compared to traditional qualitative approaches such as surveys and interviews. Paradoxically, the tremendous amount of information available online not only provides new opportunities but also exposes a problem of information overload. Steering unstructured information is a substantial challenge because it requires effective methods of filtering, categorizing and prioritizing data.

In response to such demand, the purpose of this study is threefold. First, this study attempts to classify hotel review documents into binary sentimental polarity based on customer comments. Second, it aims to identify buried service dimensions from reviews, to track how dimensions have changed over time, and to combine them with the covariate of information: posting date of reviews, name of hotels, and type of polarity of reviews. Finally, by comparing the dimensions between two different hotels, this research aims to discover competitive advantages over the rival company.

Literature Review

Numerous social media platforms from various industries have allowed people to create their own content, such as reviews, comments, feedback, and articles. Participants in social media can interact by generating and sharing this user-generated contents (UGC). Previous review mining studies have proven that reviews are critical to the performance of organizations. Black and Kelley (2009) examined the proposition that when consumers read online customer reviews that include elements of a good story, they would deem those reviews to be more helpful when they decide whether to patronize hotels. Schuckert et al. (2015) reviewed articles regarding online reviews in tourism and hospitality published

in academic journals from 2004 to 2013 based on a key-word-driven search and a content analysis. Sparks et al. (2016) investigated the effect of negative customer reviews and feedback from hotels on potential customers to examine the presence of an organizational response and their aspects. Xu and Li (2016) analyzed online customer reviews of hotels to demonstrate the factors that generate either customer satisfaction or dissatisfaction regarding hotels.

Sentimental analysis elicits subjective impressions toward specific topics from the text data. Thus, a primary goal of sentiment analysis is to determine polarity of the given text data into positive, negative, or neutral states. To accomplish the goal of mining opinions, the sentiment analysis technique is often divided into two consecutive tasks: (1) identifying which text segments contain sentiments, and (2) determining the polarity and strength of those sentiments. Existing literature investigated the relationship between people's opinions and their everyday life on certain topics being discussed on the social media. O'Connor et al. (2010) compared traditional poll methods with sentiment analysis using tweet content on Twitter, discovering that the poll results were closely associated with the frequency of emotional words. Tumasjan et al. (2011) sought to examine whether messages on Twitter could reflect real world politics and even successfully predict the outcome of elections. Acknowledging the online information generated by users as a critical source of information, existing literature started to focus on using textual information in addition to the valence and number of reviews. Cantalops and Salvi (2014) examined why customers wrote reviews and how such reviews possibly impacted customers and management.

Method

The research framework aims to track the uncovered dimensions over time, evaluate the significance of the dimensions, compare its outcome to that of competitors, and identify the strengths and weaknesses of hotel businesses based on customer satisfaction. Accordingly, customer reviews from two different hotels are used in an integrated text mining framework, as illustrated in Figure 1. Each component of the framework, from data collection to comparison, is explained respectively in this section.

Data collection

Two five-star luxury hotels located in the same vicinity in Las Vegas, NV, USA, are selected for our study. The two hotels were of similar size in terms of the number of guests and sales. Comparing these two hotels (Hotel A and Hotel B for the sake of anonymity) could possibly discover competitive advantage factors to reveal invaluable new insights about customer satisfaction in the field. Customer review data are collected from a popular online review platform in the tourism industry – including accommodations, transportation, entertainment, and food and beverage. According to the structure of the online web site, a web scraper is built using the Python language to obtain review information by hotel and save it to a CSV file.

Data preprocessing

Preprocessing of the review data is one of the most important steps, performed after the extraction of the necessary information and before applying an appropriate text mining method. The preprocessing of textual information is conducted based on the organized data. For the purpose of this study, data are manipulated as having Hotel Name, Posting Date, Reviewer, User-Rating Score, Review Title, and Review Content. In the R software, the *tm* package has been used to deal with the diverse tasks for handling and preprocessing textual data.

After the text is transformed to a lower case, the SMART information retrieval system developed by Cornell University, which consists of 571 general stop-words, is applied to filter out stop-words in the review text. Punctuations and numbers are also removed because those are not informative. Part of Speech (POS) tagging using Stanford CoreNLP with the wrapper package *CleanNLP* in R is implemented. After POS tagging, all nouns collected from each review are lemmatized and attached to the original data set. Lemmatized nouns extracted with the POS tagging method can increase both cohesiveness and interpretability in terms of unifying the form of words and removing meaningless adjectives, verbs, and adverbs. The preprocessed text and additionally created information, such as the

number of words per review, are attached to the original data set and stored in a data frame, which is the primary input for sentiment analysis to classify the reviews according to polarity.

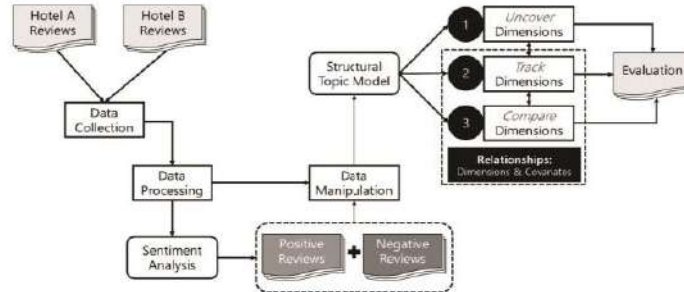


Figure 1. Research Framework

Sentiment analysis

After the review data are preprocessed, a sentiment analysis is conducted by adopting the methodology of Socher et al. (2013). Their research introduced Sentiment Tree Bank annotated parse trees containing sentiment labels for 215,154 phrases from the parse trees of 11,855 sentences. To deal with complexity for sentiment compositionality raised by elaborated sentiment labels, they proposed a neural network-based model called a recursive neural tensor network (RNTN) to capture the complex compositional effects. Together, they demonstrated that a RNTN with the Tree Bank outperformed the previous models in terms of single sentence sentiment detection and accuracy of sentiment prediction. Likewise, our study also conducts a sentiment analysis using an RNTN implemented in Stanford CoreNLP 3.7 using the wrapper package *stansent* in R to calculate the sentiment scores from the textual review data at a document level. Decimal scores between -1 and 1 are returned from the sentiment analysis and transformed into a binary class with the values 0 (negative) and 1 (positive) to classify the polarity of each review. Consequently, a new variable, *Polarity*, representing positive or negative sentiment is introduced for the subsequent analysis of a topic model.

Structural topic model

This research uses a structural topic model (STM) to uncover hidden dimensions in customer review corpora (Roberts et al. 2013) and examine the relationships with the three covariates: posting date of reviews, name of hotels, and type of polarity of reviews obtained from the sentiment analysis. Figure 2 depicts the conceptual diagram of the STM.

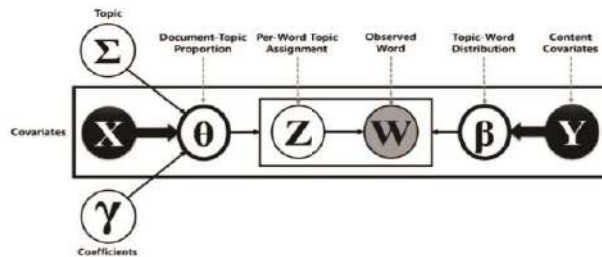


Figure 2. Conceptual Diagram of Structural Topic Model

When conducting a topic model, researchers must specify the number of topics in advance, although there is no formal method of finding an optimal number. Choosing an optimal number of topics depends on both the objective of the study and the nature of the data given for the analysis. Therefore, this research refers to the guest experience and satisfaction literature for the hospitality industry because

those service dimensions discovered could, in turn, serve as the basis for the potential number of topics. At the same time, several helpful indicators exist like log-likelihood, perplexity, and semantic coherence. To find the optimal number of topics, this study applies the *searchK* function of the package *stm* in R, which computes diagnostic properties for models with different numbers of topics, along with the indicators of semantic coherence and log-likelihood.

Analysis Results

This section depicts the descriptive statistics, demonstrates the overall results of the sentiment analysis, and discusses the results of the STM. It explains the 16 dimensions (topics) discovered and their relationships with the three covariates by using the information from positive and negative reviews classified by the sentiment analysis.

Descriptive statistics for each hotel

Using a web scraper, the review data of the two hotels, Hotel A and Hotel B, were collected from TripAdvisor. There were more than 830 million reviews from approximately 8.6 million service providers around the world (as of 2019), according to TripAdvisor's Mediaroom. Due to its popularity and volume, the reviews from TripAdvisor are considered a major source for review mining studies (Xiang et al. 2017). The web scraper collected 20,855 reviews (9,405 for Hotel A and 11,450 for Hotel B). The top three most-frequently mentioned words in the Hotel A reviews were *great* with a frequency of 6,634, *tip* (6,161), and *service* (5,425), and the top three words in the Hotel B reviews were *time* (6,978), *view* (6,099), and *check* (6,048).

Sentiment analysis for each hotel

The review information expresses users' experiences in the hotel, including five-star-rating scores (from 1 to 5) along with the review contents. User-rating scores were rescaled into the two levels of negative and positive. The four- and five-star-rated reviews were labelled as positive, where customers were satisfied with their experiences. In contrast, the one- and two-star-rated reviews were labelled as negative. Three-star-rating reviews (13) was considered neutral and discarded. After the transformation, the sample included 18,475 (88.6%) positive reviews and 2,367 (11.4%) negative reviews.

As anticipated, nearly 90 percent of reviews were positive, with several possible reasons to explain the significant difference between positive and negative distributions. Positive reviews are expected to be dominant because both hotels chosen for this study are upscale in the city, Las Vegas. Furthermore, people may submit ratings that are different from what they stated because of self-selection bias (Li and Hitt 2008). While user-rating scores were widely used to indicate customer satisfaction toward products or services, it is, however, challenging to capture which aspects of products or services need to be improved or maintained with only the rating score. In addition, a smaller number of reviews does not imply fewer complaints or compliments, and vice versa. The review impact is sometimes nothing to do with the level of stars, such that a four-star review demonstrates a greater impact than a five-star review.

Archak et al. (2011) illustrated the hidden value of using textual content because singular numerical dimensions such as the number of reviews and number of stars may not fully capture the state of the customer, although they are somewhat indicative of the polarity of the reviews. Consequently, the original rating scale posted by reviewers is unreliable as a decisive classification criterion. To address this problem, this study selected an RNTN as a sentiment analysis technique to calculate sentiment scores by using review content. The RNTN returned sentiment scores between -1 and 1 based on textual content. A score between 0 and 1 was assigned for positive polarity, and a score between -1 and 0 was assigned for negative polarity. From the sentiment analysis using the RNTN, there were 11,281 (54.1%) positive reviews and 9,561 (45.9%) negative reviews, and the distribution of positive and negative was balanced in comparison to the original user-rating scores. Consequently, a new variable, *Polarity*, representing the positive or negative polarity discovered by the sentiment analysis was added to the subsequent analysis of performing the STM for topic modeling.

Structural topic model for each hotel

Before fitting the STM, additional data preprocessing was conducted such that a word that appeared in less than five documents was removed. Very frequent and obvious words were also removed. In addition to the previous removal of general stop-words (571 words), domain-dependent stop-words were removed for customizing topic modeling at this stage. Removal of domain-specific stop-words guarantees a more transparent fit for the STM model while maintaining comparable analysis quality. After cleaning and manipulating data set, the processed corpus maintained 20,842 documents, but the number of terms decreased to 19,693.

Figure 3 depicts the two luxury hotels, Hotel A and Hotel B, had different distributions of dimension proportions. Whereas some dimensions, such as topics 2, 4, 12, and 16, had similar percentages, others indicated differences in the proportions, which revealed the different characteristics of each hotel. For example, Topic 8 was a dominant dimension of Hotel A (14.46%), but it was the least significant dimension in Hotel B (1.71%). Similarly, Topic 11 was barely mentioned in Hotel A, but was responsible for nearly 10% of the reviews regarding Hotel B. These specific results suggest that several topics, such as 8 and 11, could be the key dimensions that distinguish business situations.

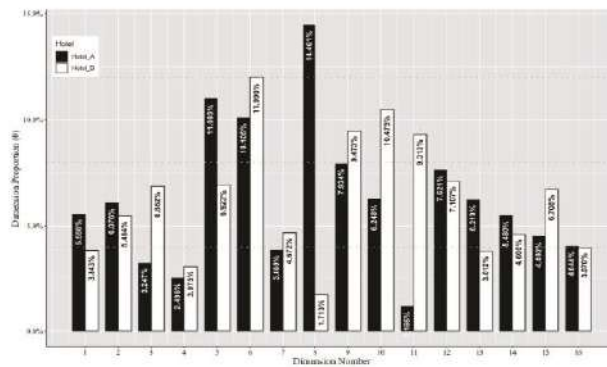


Figure 3. Distribution of Dimension Proportions for Each Hotel

Based on the research of Guo et al. (2017), descriptive labels were initially explored and attached to the 16 dimensions. Before finalizing the labeling of dimensions, cross-validation is often helpful to avoid subjective interpretation of dimensions and increase validity and reliability. Cross validation was conducted by three people, those working in other hotels, and the top 30 keywords for each dimension were provided. Candidate labels were fulfilled by the workers, further examined, and aggregated for consistency to name the dimensions. Table 1 describes the dimensions discovered from the reviews for both hotels.

The dimensions identified by the STM revealed interesting insights. Dimensions such as *Ambience*, *Experience*, and *Homeliness* expressed customers’ feelings or impressions about their experiences. They were related to the services indirectly offered by the hotels. The dimensions *Communication* and *Guest Service* were likely associated with hotel management continuously engaging with customers throughout their stays. Furthermore, the dimensions of *Pool*, *Suite*, *Bathroom*, *Wedding*, *Location*, and *Amenity* were expected to be the principal dimensions of the hotels because they represent core products offered to customers; moreover, it is no surprise to uncover them in the hotel industry. The same was true for the dimensions of *Dining*, *Style & Decor*, and *Room View*. The STM successfully identified them as proposed in the previous hospitality literature (Xu and Li 2016), which supports the effectiveness of topic modeling analysis in identifying key dimensions, ensuring the greater confidence in the performance of the model. In contrast, *Casino* and *Smoking* were credible location-specific dimensions, considering the hotels were located in Las Vegas. These dimensions are unique because they are not identical to those uncovered in other studies. The dimension of *Transportation* existed because the public transportation system in Las Vegas was conveniently offered to travelers, and most

of the hotels were located in close proximity. Most of the nearby hotels or attractions were within walking distance, and it took approximately 10-20 minutes by taxi from the airport to the main central strip, where the majority of hotels were located.

Table 1. Summary of 16 Topics with Most Probable Words and Proportions (Θ)

Label	#	Θ	word1	word2	word3	word4	word5
<i>Dining</i>	1	0.0461	menu	steak	Café	steakhouse	pizza
<i>Pool</i>	2	0.0574	sun	pool	Shade	cabana	lounger
<i>Suite</i>	3	0.0523	prestige	egg	Cocktail	Tea	hors
<i>Smoking</i>	4	0.0281	spa	Smoke	Smoking	Smell	canyon
<i>Ambience</i>	5	0.0876	detail	class	Experience	expectation	attention
<i>Experience</i>	6	0.1114	entertainment	property	Choice	restaurant	place
<i>Casino</i>	7	0.0431	slot	love	Play	Poker	game
<i>Style & Deco</i>	8	0.0746	view	floor	Buffer	Golf	encore
<i>Homeliness</i>	9	0.0878	year	wife	Trip	Time	vacation
<i>Bathroom</i>	10	0.0857	shower	toilet	Tub	Vanity	sink
<i>Room View</i>	11	0.0564	bella	island	Treasure	Canal	airport
<i>Communication</i>	12	0.0734	manager	credit	Bill	apology	call
<i>Wedding</i>	13	0.049	wedding	weekend	Party	Club	girl
<i>Location</i>	14	0.05	mall	fashion	Street	Bus	bellagio
<i>Guest Service</i>	15	0.0571	front	car	Elevator	parking	guard
<i>Amenity</i>	16	0.04	center	internet	Fee	convention	fitness

Effect of Polarity on Dimensions

Figure 4 depicts the dimensional trends with Polarity information. A solid line represents the dimensional trend for the negative polarity, whereas a dashed line represents the dimensional trend for the positive polarity. For the dimensions of *Communication*, *Guest Service*, *Bathroom*, *Amenity*, and *Suite*, the negative polarity had a larger proportion than the positive polarity. Negativity prevailed in these dimensions. Negative emotional services could be a weakness for businesses. There were 113 hotels with more than 150,000 hotel rooms available in Las Vegas as of 2019. Finding service defects and improving the quality of services were essential for surviving and growing in such a highly competitive market. There were serious problems with the dimension *Communication*, where the difference between negative and positive proportions was most significant. Given that customers continued to write negative reviews about this dimension, both hotels should make changes in their services to attract customers and maintain their reputations as luxury hotels.

In contrast, the dimensions of *Experience*, *Ambience*, *Style & Deco*, *Homeliness*, and *Room View* have evolved with the stronger positive polarity. Positive emotions prevailed in these dimensions and proved to be the main strengths of both hotels, where customers have posted more positive reviews over time. Customers were generally satisfied with their experiences and the physical characteristics of the hotels. Moreover, the hotels exemplified beautiful style and decorations. The golf club, city, and main strip in Las Vegas were renowned for excellent views, especially at night.

For the remaining dimensions, such as *Dining*, *Pool*, *Smoking*, *Casino*, *Wedding*, and *Location*, there was little difference in the proportion between negative and positive polarities, indicating a similar number of positive and negative reviews. By carefully monitoring and improving these dimensions, management could increase positive reputation over negative reputation.

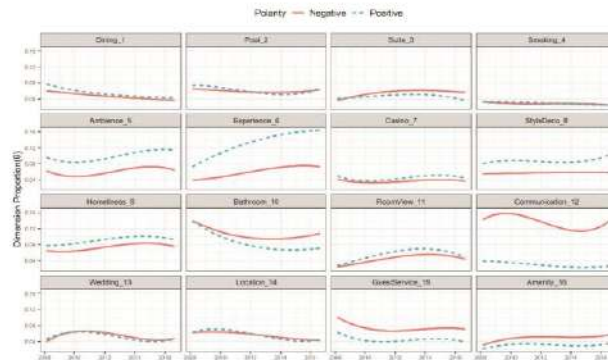


Figure 4. Dimensional Trends of Polarity Information

Effect of Hotel on Dimensions

To investigate which dimensions are strengths or weaknesses against competitors, the effect of a covariate, hotel, on dimensions can be used as an indicator of competitive advantage, which is one of the main contributions of our research. To compare the effects of different hotels on dimensions, the dimensional proportions for each hotel were calculated. Figure 5 summarizes the dimensional trends and illustrates how the dimensional proportions of each hotel and the dimensional gap between the two hotels have changed over time. The trends of Hotel A are drawn in a solid line and the trends of Hotel B in a dashed line.

The dimensions of *Communication*, *Amenity*, *Guest Service*, *Bathroom*, and *Suite* were predominantly negative, as depicted in the previous figure 4. *Communication* and *Amenity* were problems for both hotels, which could harm their reputation because these two dimensions were mentioned at the same frequency in the reviews. Hotel B had a competitive disadvantage on the dimensions of *Guest Service*, *Bathroom*, and *Suite*, because it had many more negative reviews than its competitor. Hotel B revealed its weakness for these three dimensions, which should be addressed. Likewise, the dimensions of *Style & Deco* and *Ambience* were strengths of Hotel A over Hotel B. These dimensions conferred on Hotel A competitive advantage because the hotel gained many more positive reviews than Hotel B. In contrast, Hotel B had a competitive advantage for *Experience*, *Homeliness*, and *Room View*. For the remaining dimensions of *Dining*, *Pool*, *Smoking*, *Casino*, *Wedding*, and *Location*, this study could not determine which company had a competitive advantage on which dimensions, because these six dimensions exhibited little difference concerning the proportion between negative and positive polarities.

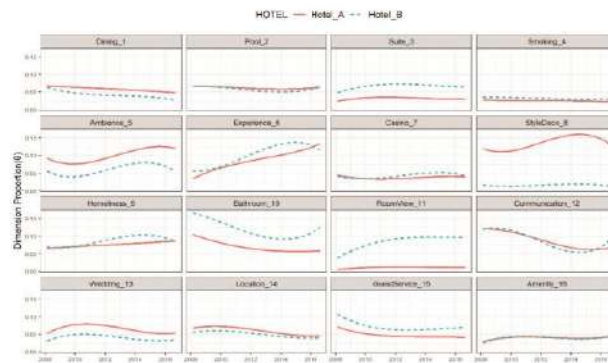


Figure 5. Dimensional Trends for Hotel Information

Conclusion

This study proposed an integrated text mining framework to discover hidden dimensions together with the prevalence of each dimension over time, for different polarities, for different hotels, from publicly available customer reviews online. A sentiment analysis was conducted as an objective measure instead of adopting the original rating scores submitted by users, and then lowered the risk of subjectivity from human judgment. The RNTN technique produced sentimental scores to classify the polarity of a review. Negative statements usually reflect customer complaints, which generally signal the weakness of services or products. Positive statements can be service strengths. Subsequently, a structural topic model was applied to discover several dimensions constituting the meta-information (covariate) *a priori* to capture its effect on dimensions. Each customer review was represented as a probabilistic distribution over a set of dimensions (topics), which this research interpreted as service dimensions of the hotels. This study incorporated the three covariates—posting date, name of hotels, and type of polarity—into the structural topic model to identify the relationship between dimensions and covariates, which could provide multiple aspects of dimensions.

References

- Archak, N., Ghose, A., and Ipeirotis, P. G. 2011. "Deriving the Pricing Power of Product Features by Mining Consumer Reviews," *Management Science* (57:8), pp. 1485-1509.
- Black, H. G., and Kelley, S. W. 2009. "A Storytelling Perspective on Online Customer Reviews Reporting Service Failure and Recovery," *Journal of Travel & Tourism Marketing* (26:2), pp. 169-179.
- Cantalops, A. S., and Salvi, F. 2014. "New Consumer Behavior: A Review of Research on eWOM and Hotels," *International Journal of Hospitality Management* (36), pp. 41-51.
- Guo, Y., Barnes, S. J., Jia, Q. 2017. "Mining Meaning from Online Ratings and Reviews: Tourist Satisfaction Analysis Using Latent Dirichlet Allocation," *Tourism Management* (59), pp. 467-483.
- Li, X., Hitt, L. M. 2008. "Self-Selection and Information Role of Online Product Reviews," *Information Systems Research* (19:4), pp. 456-474.
- O'Connor, B., Balasubramanyan, R., Routledge, B. R., and Smith, N. A. 2010. "From Tweets to Polls: Linking Text Sentiment to Public Opinion Time Series," in *Proceedings of the Fourth International AAAI Conference on Web and Social Media*, pp. 122-129.
- Roberts, M. E., Stewart, B.M., Tingley, D., and Airoidi, E. M. 2013. "The Structural Topic Model and Applied Social Science," in *Advances in Neural Information Processing Systems Workshop on Topic Models: Computation, Application, and Evaluation*, pp. 1-20.
- Schuckert, M., Liu, X., and Law, R. 2015. "Hospitality and Tourism Online Reviews: Recent Trends and Future Directions," *Journal of Travel & Tourism Marketing* (32:5), pp. 608-621.
- Socher, R., Perelygin, A., Wu, J. Y., Chuang, J., Manning, C. D., Ng, A. Y., and Potts, C. 2013. "Recursive Deep Models for Semantic Compositionality Over a Sentiment Treebank," in *Proceedings of the Conference on Empirical Methods in Natural Language Processing*, pp. 1631-1642.
- Sparks, B. A., So, K. K. F., and Bradley, G. L. 2016. "Responding to Negative Online Reviews: The Effects of Hotel Responses on Customer Inferences of Trust and Concern," *Tourism Management* (53), pp. 74-85.
- Tumasjan, A., Sprenger, T. O., Sandner, P. G., and Welpe, I. M. 2011. "Election Forecasts with Twitter How 140 Characters Reflect the Political Landscape," *Social Science Computer Review* (29:4), pp. 402-418.
- Xiang, Z., Du, Q., Ma, Y., and Fan, W. 2017. "A Comparative Analysis of Major Online Review Platforms: Implications for Social Media Analytics in Hospitality and Tourism," *Tourism Management* (58), pp. 51-65.
- Xu, X., and Li, Y. 2016. "The Antecedents of Customer Satisfaction and Dissatisfaction Toward Various Types of Hotels: A Text Mining Approach," *International Journal of Hospitality Management* (55), pp. 57-69.

D1.2 Exploring Voice Assistant Users' Goals: A Goal Hierarchy Approach

Han, Seoungmin^a, Jung, Yoonhyuk^b, and Hong, Woonki^c

^a School of Media & Communication, Korea University

E-mail: han9102@korea.ac.kr

^b School of Media & Communications, Korea University

E-mail: beyond@korea.ac.kr

^c School of Management, Konkuk University

E-mail: woonki@konkuk.ac.kr

Abstract

This study uses a goal hierarchy approach to deepen our understanding of the goals of using voice assistant services. A means-end chain analysis is applied to examine data collected from laddering interviews with 30 voice assistant users. The analysis provided knowledge of the hierarchical goal structure of using a voice assistant. This study delivers a specific explanation of user behavior on voice assistant services by providing knowledge of how the use of voice assistant services relates to their specific goals. The results show diverse types of goals, and particularly reveal the high centrality for 'productivity' and 'reducing loneliness' which each represents functional and social purposes for using a voice assistant. This study improves our understanding of user adoption of voice assistant services by disclosing the goal structure.

Keywords: Voice assistant services, goal hierarchy approach, means-end chain analysis

Introduction

As the information technology (IT) industry has shown tremendous growth, individuals are exposed to a variety of new technologies that facilitate the improvement of personalized services (Jung et al., 2017). IT users especially have a broader range of personalized experiences, characterized by rich user experience, user self-configuration, and openness (Germonprez et al., 2007). Given that individually tailored IT services have become embedded in everyday life, there is a timely call for more research on experiential computing about the ordinary use of IT and related technology. "The nature and consequences of the digital mediation of everyday experiences" are recognized as an emerging area of information systems (IS) research, arguing for a need to understand IT influence on human life (Yoo, 2010).

Recently, a Voice Assistant Service (VAS) equipped with artificial intelligence (AI) technology has become popular in daily life. Presuming that AI denotes the ability of algorithms to imitate intelligent human behavior, dealing with problem-solving and learning (Syam & Sharma, 2018), a VAS is conceived as a type of voice-enabled AI that refers to a general level of intelligence presented by digital interfaces (Gomes & Preto, 2017). Also, these voice assistant technologies have been developed on smartphones. According to media richness, voice assistant interfaces provide users with richer experience, including instant feedback, convenience, and personalized services (Levy & Gvili, 2015), compared to traditional touch interfaces (Anandarajan et al., 2010). In this sense, many individuals use VAS in the form of mobile applications and these devices allow users to connect IT devices at home with voice and without having to touch the device directly.

Although prior research revealed that user adoption of smart speakers and VAS in various aspects, there is still a puzzle as to why users constantly use VAS, or what they think about VAS bringing to them in their daily life. Therefore, the study aims to identify the reasons for using voice assistants. This study focuses specifically on what characteristics or functions users use their voice assistants for and for what purpose. These investigations allow us to understand the nature of motivation of voice assistant users, and to observe why they continue to use voice assistant technology. In addition, this study can inform what features of voice assistants are critical in the adoption and usage behaviors.

Theoretical Background

The Attribute of Voice Assistant Services and Literatures

Along with the development of AI systems, users can interact with machines. Modern machines can understand the natural human language and respond to users' requirements. Also, voice assistant systems not only conduct unilaterally accepted orders but also can communicate by responding to users' specific commands. This development of VAS has attracted more researchers' attention, and thus research on VAS is actively underway.

Studies that focused on VAS function were conducted variously. Nasirian et al. (2017) researched that user utilize VAS in their life. López et al. (2017) conducted the testing of the popular personal assistant software for usability in terms of naturality and correctness. Zhang et al. (2018), Lei et al. (2018), and Moorthy & Vu (2014, 2015) explored the side effect of VAS to find an enhanced way to use this service. The existing studies have focused on identifying the characteristics of VAS, but there is little research about why users use VAS and what feature induce people to use this service. Therefore, this study aims at what characteristics make users use VAS and seek deeper factors why they use VAS and what feature induce them to use it.

Means-End Chain Analysis

The main purpose of this research is to structure the users' goals for the use of voice assistant services. This research use means-end chain analysis to achieve the purpose, which stems from the foundation framework of goal hierarchy theory. A goal is the desired outcome of an action (Locke & Latham, 1990). Many researchers argue that goals exist within a hierarchical system that lies between the superordinate and subordinate goals, furthermore, each goal is a means to achieve its superordinate goal (Kruglanski et al., 2002; Newell & Simon, 1972; Pervin, 1989). This research's method, means-end chain analysis stems from the concept of a hierarchical goal system. The analysis suggests that attributes of a product or service represent how consumers achieve benefits and important personal values (Gutman, 1982; Olson & Reynolds, 1983). This analysis supposes that consumer knowledge is hierarchically organized by levels of abstraction (Reynolds & Whitlark, 1995), and focuses on a product or service's meanings at three levels of abstraction: attributes, consequences, and values.

In the means-end chain approach, attributes are depicted as the perceptible or observable properties of a product or service (Klenosky, 2002). Consequences refer to the practical benefits accrued to the consumers, achieved by the attributes, and values that represent abstract and encompassing objects that guide a wide range of attitudes and behaviors (Klenosky, 2002). A chain from attribute–consequence–value is rendered as a hierarchical map, which consists of nodes and links between the means-end elements.

The means-end chain approach consists of three steps: laddering interview, content analysis, and generation of a hierarchy goal map. The first step of the means-end chain approach is to conduct a semi-structured laddering interview for eliciting means-end concepts and to further explain their interrelationships from concrete attributes to highly abstract values (Gutman, 1982). In this respect, the interview ultimately addresses the question "Why is it important to you?". It can be conducted either by face-to-face or online communications. The second step, content analysis, is to synthesize and analyze interviewees' responses for clarifying the meaning of the given answers concerning the means-end model (Fleiss et al., 2013). In this procedure, a multi-coder approach is needed to establish

the reliability of the records. The last step is to produce and display a hierarchical goal map. It is generated based on an implication matrix that enumerates the number of times a code is mentioned as a means and an end. In the hierarchical structure, the means-end elements are typically classified into three pre-specified levels of attributes, consequences, and values. However, as stated above, the alternative approach based on the network theory argues that the abstractness of each element can be employed to locate the element in the hierarchical goal map, facilitating efforts to clarify the relationship between means-end associations. This alternative approach is also known for its advantage in being adaptable to a wider variety of contexts and situations (Pieters et al., 1995).

Methodology

Participants

This research gathered 30 participants who had used a voice assistant service. This study recruited participants by announcing on local online channels who wanted to participate in our research interview. The participants volunteered for our research. So, this researcher conducted interviews with people who approved this process online. This study was posted in the local community to recruit participants for the experiment. Our participants' age was mainly 20s to 30s because major users who use voice assistant services are those who often use a smartphone or live in their own space. These users are also less resistant to new technologies and tend to try. All the respondents have used voice assistant technology, the frequency of using voice recognition interfaces was once a month (36.7%), once a week (16.7%), 2-3 times a week (26.7%), almost daily (20%).

Laddering Interview

Participants conducted paper-pencil laddering interviews which asked them to describe their voice assistant service usage. After the demographic survey, they respond to whether they used voice assistant services or not. In the first step, the laddering interview, participants were asked to take notes on the following responses. 1. "What characteristics, attributes, and features do you use the voice assistant interface for?", 2. "What do you use the characteristics, attributes, features? Why do you use the characteristics, attributes, features?", 3. "Why are the reasons are given above important to you?", 4. "How much do you think the reasons mentioned above relate to the statement below?". In the fourth question, the researcher conducted a semi-structured interview. This method can seek the three levels of abstraction: attributions, consequences, and values which enable to find the user's means-end chain.

Content Analysis

The content analysis is the coding process for the interviewees' responses to the interview questions. This study adopted a multi-coder approach which can reduce the coder's subjective view. This approach can increase the reliability of coding results by comparing data and checking inter-coder reliability. By generating codes from an open coding process with two coders, Cohen's Kappa, which shows an acceptable level of inter-rater reliability (Fleiss, 1981) was 0.86. Table 1 shows examples of the list of codes and their example.

Table 1. Codes and Examples

Codes (topics)	Examples
A1. Search	Search route, weather, curious information
A2. Order	Have shopping, Order food
A3. Command	Volume up a smart TV, Turn off the light in the kitchen
A4. Multitasking	Use voice assistant while other activities
A5. Interactivity	Using "rap for me", Communication with VAS

G1. Acquiring Information	Obtaining useful information
G2. Curiosity	Resolve the wondering question
G3. Saving time	Save time with VAS
G4. Increasing Efficiency	The efficiency increased by skipping various processes.
G5. Killing time	To pass time, kill time
G6. Following Trends(<i>removed</i>)	Learning about contemporary issues
G7. Communication with others	Feel communication with others using VAS
G8. Relieving loneliness	Feel like I'm with someone
G9. Productivity	Improving the efficiency of tasks
G10. Enjoyment	Having fun, feeling pleasure
G11. Psychological stability	Feeling comfortable, achieving mental calm

Hierarchical Goal Map

The final step in the means-end chain approach involved the generation of the relational structure of users' voice assistant usage goals. The response to the first question became an initiating point that elicited higher-level goals, and responses to the second question corresponded to both the goal of the answer to the first question and the means to attain the goal reflected in the response to the next probing question. All relations were summarized in an implication matrix, which depicts the number of times each topic led to each other topic in the responses (Klenosky, 2002). The factors which show low abstractness scores are regarded as means, others that show high abstractness scores are regarded as ends.

The centrality of each factor was also generated for informative analysis, which is the degree that which the factors have a central role in the structure (Knoke & Burt, 1983). Centrality was calculated by dividing the ratio of in-degree to out-degree of a particular element by the sum of all active linkages (180 in the current study) in the implication matrix. With this implication matrix, the researcher generated the hierarchical goal map. In this stage, the important point was to determine what linkages were to be included in the map. Because the inclusion of all linkages can decrease a map's usefulness and informativeness, we did not embrace all linkages and decided to employ a cutoff level (Gutman & Reynolds, 1988). Considering the balance between complexity and interpretability and Gengler & Reynolds' (1995) recommendation of a cutoff level including at least two-thirds of all relations, we selected a cutoff level of five which indicates that the relations are counted at least five times, so that only the relations with five or greater from the implication matrix were included in the map (see Figure. 1). This cutoff level of five represented 68.9% of the active linkages, which corresponds to a measure of variance (Gengler & Reynolds, 1995).

Table 2. Implication Matrix

Topics	G1	G2	G3	G4	G5	G6	G7	G8	G9	G10	G11	out-degrees
A1	17	7	2	1		2		2			1	0
A2		1	6	4	1		1					0
A3				5	1							0
A4			4	9								0
A5		2			9		8	3		1		0
G1			2			2	1		8	3	2	18
G2							1			6	1	8

G3				8					4			12
G4									13	3	8	24
G5								2	1	5	1	9
G6									2			2
G7								9	1		3	13
G8											7	7
G9												0
G10												0
G11												0
In-degrees	0	0	2	8	0	2	2	11	29	17	22	93
abstractness	0	0	.14	.25	0	0.5	.13	.61	1	1	1	
Centrality	.1	.04	.08	.18	.05	.02	.08	.10	.16	.09	.12	

*In-degrees: The number of times the topic serves as the object or end of linkages with other topics
 *Out-degrees: The number of times the topic serves as the source or origin(means) of linkages with other topics
 *Abstractness = (In-degrees) / (In-degrees + Out-degrees)
 *Centrality = (In-degree + Out-degree) / the sum of all active linkages

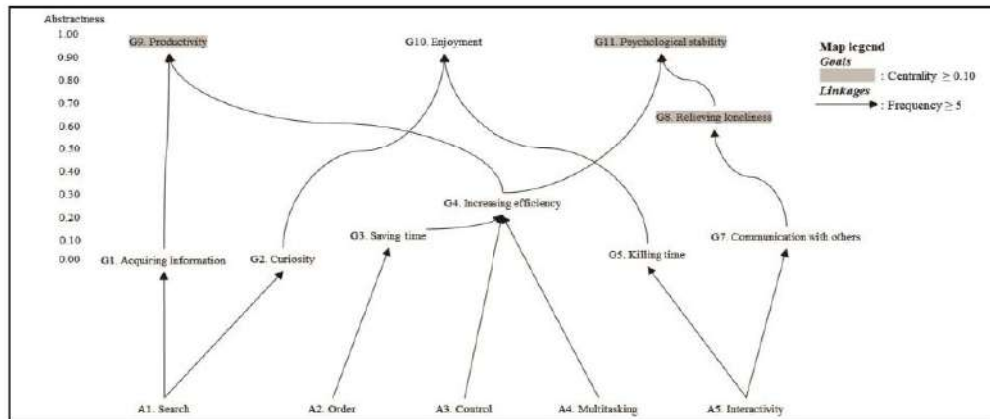


Figure 1. Goal Hierarchy Map

Results

The means-end chain analysis showed that Voice assistant usage consists of four main activities: Searching, Order, Control, Multitasking, and doing Interactivity are the most dominant activities, almost all respondents mentioned in the interviews. Many respondents searched (A1) through voice assistant service, mainly to obtain information and solve their curiosity. Among them, information acquisition was often done mainly for the weather and distance, and such information was often searched for school or work, and it was said to be related to productivity (G9). They responded that the weather and road conditions information they learned while preparing for work guarantees a pleasant way to work or school, and this process would improve their productivity. Furthermore, in the case of obtaining information for curiosity, most of the time, it was for the pleasure of searching the conversation topic with others (G10). Some respondents who responded their usage as order (A2), use voice assistant because of saving time. They can register groceries or daily supplies using their voice assistant service, and this registration makes them easily order these products. So, the

respondents who use the order function said they save their time(G3) with voice assistant services. In the case of command (A3), respondents said it would be used to play music and control home devices, while most respondents said saving time (G3) and increased efficiency (G4). Most of the time savings were said to be for increasing efficiency, so most commands through voice assistant were for increased efficiency. Through this increase in efficiency, respondents sought productivity (G9) and psychological stability (G11). This command (A3) is like multitasking (A4) in the case of increasing efficiency, which is used when not doing anything else but only wanting to change the house environment, but multitasking is used when driving or doing housework. In the case of interactivity (A5), it was simply using the various enjoying features of Voice Assistant for time killing (G5) or trying to relieve loneliness by talking to a smartphone or smart speaker with their conversation function (G8).

Discussion

A means-end chain analysis showed an efficient role in clarifying VAS users' goal structure. The hierarchical goal map suggests the summarized version of this analysis, which offer a quick and deep understanding of VAS users' goal structure. This research suggests what factor makes users use the VAS service by their purpose.

This work is significant as the first to understand the purpose of using VAS based on means-end chain analysis. There was prior research that seek at users' purpose or intention to use based on artificial intelligence technology or social media (Benson et al., 2019), but there was no research confirming the goal for using VAS based on artificial intelligence technology based on attributions, consequences, and values. This study adopted the means-end chain theory to reveal the dynamics of how VAS usage and goals are arranged. This study is expected to present necessary basic data in a follow-up study on various VAS usage behaviors.

The reason for using VAS in general, users have a superficial idea that they use VAS because it is more convenient than manipulating their devices, it is also important to note that through this study, the functionality of convenience increases efficiency beyond this, and through this, people feel productivity and psychological stability. It is also noteworthy that in terms of relieving loneliness, users felt that interactivity with VAS was an object that could form a parasocial interaction by considering it as a hypothetical object. Parasocial interaction refers to the relationship between the media and the user, in which the user considers the personality of the media to be the same as that of the people in society (Rubln et al. 1985). Based on this study and previous work, interactivity through VAS can satisfy the relational purpose with parasocial interaction. It differentiates VA usage apart from simple 'usefulness' in that VAS is a supported object for increasing user efficiency and providing information, but it can be interpreted as being considered having relational interaction with VAS.

In this research, we used the MECA to understand VAS users' motivation for their use. This research shows the investigating and widespread examination of VAS, an emerging service in the IoT developing environment. Since it is obvious that the use of VAS improved users' quality of life, this study showed the whole process using means-end chain analysis. Therefore, it is anticipated to service providers can seek the improve their service through users' using motivation.

References

- Anandarajan, M., Zaman, M., Dai, Q., and Arinze, B. 2010. "Generation Y Adoption of Instant Messaging: An Examination of the Impact of Social Usefulness and Media Richness on Use Richness," *IEEE Transactions on Professional Communication* (53:2), pp. 132–143.
- Benson, V., Hand, C., and Hartshorne, R. 2019. "How Compulsive Use of Social Media Affects Performance: Insights from the UK by Purpose of Use," *Behaviour and Information Technology* (38:6), pp. 549–563.
- Moorthy, A. E., and Vu, K.-P. L. 2014. "Voice Activated Personal Assistant: Acceptability of Use in the Public Space," *Lecture Notes in Computer Science*, pp. 324–334.

- Moorthy, A. E., and Vu, K. P. L. 2015. "Privacy Concerns for Use of Voice Activated Personal Assistant in the Public Space," *International Journal of Human-Computer Interaction* (31:4), pp. 307–335.
- Fleiss, J. L. 1981. "Balanced incomplete block designs for inter-rater reliability studies," *Applied Psychological Measurement* (5:1), pp. 105–112.
- Fleiss, J. L., Levin, B., and Paik, M. C. 2013. *Statistical Methods for Rates and Proportions*, John Wiley & Sons.
- Gengler, C. E., and Reynolds, T. J. 1995. "Consumer Understanding and Advertising Strategy: Analysis and Strategic Translation of Laddering Data," *Journal of Advertising Research* (35:4), pp.19-34.
- Germonprez, M., Hovorka, D., and Collopy, F. 2007. "A Theory of Tailorable Technology Design," *Journal of the Association for Information Systems*, Association for Information Systems, pp. 351–367.
- Gomes, C. C., and Preto, S. 2017. "Artificial Intelligence and Interaction Design for a Positive Emotional User Experience," *Intelligent Human Systems Integration*, Springer International Publishing, pp. 62–68.
- Gutman, J. 1982. "A Means-End Chain Model Based on Consumer Categorization Processes," *Journal of Marketing*, p. 60.
- Gutman, J., and Reynolds, T. J. 1988. "Laddering Theory-Analysis and Interpretation," *Journal of Advertising Research* (28:1), pp. 11-31
- Jung, Y., Pawlowski, S. D., and Kim, H. W. 2017. "Exploring Associations between Young Adults' Facebook Use and Psychological Well-Being: A Goal Hierarchy Approach," *International Journal of Information Management* (37:1), pp. 1391–1404.
- Klenosky, D. 2002. "The 'Pull' of Tourism Destinations: A Means-End Investigation," *Journal of Travel Research* (40), pp. 385–395
- Knobe, D., and Burt, R. S. 1983. "Prominence," *Applied Network Analysis*, pp. 195-222.
- Kruglanski, A. W., Shah, J. Y., Pierro, A., and Mannetti, L. 2002. "When Similarity Breeds Content: Need for Closure and the Allure of Homogeneous and Self-Resembling Groups," *Journal of Personality and Social Psychology* (83:3), pp. 648–662.
- Lei, X., Tu, G.-H., Liu, A. X., Li, C.-Y., and Xie, T. 2018. "The Insecurity of Home Digital Voice Assistants - Vulnerabilities, Attacks and Countermeasures," *2018 IEEE Conference on Communications and Network Security (CNS)*, Presented at the 2018 IEEE Conference on Communications and Network Security (CNS), IEEE.
- Levy, S., and Gvili, Y. 2015. "How Credible Is E-Word of Mouth across Digital-Marketing Channels? The Roles of Social Capital, Information Richness, and Interactivity," *Journal of Advertising Research* (55:1), World Advertising Research Center, pp. 95–109.
- Locke, E. A., and Latham, G. P. 1990. *A Theory of Goal Setting & Task Performance*, Englewood Cliffs, NJ: Prentice Hall.
- López, G., Quesada, L., and Guerrero, L. A. 2017. "Alexa vs. Siri vs. Cortana vs. Google Assistant: A Comparison of Speech-Based Natural User Interfaces," *Advances in Intelligent Systems and Computing*, pp. 241–250
- Nasirian, F., Ahmadian, M., and Lee, O.-K. D. 2017. "AI-Based Voice Assistant Systems: Evaluating from the Interaction and Trust Perspectives," *Proceedings of the Twenty-third Americas Conference on Information Systems (AMCIS)*, Boston.
- Newell, A., and Simon, H. A. 1972. *Human Problem Solving* (Vol. 104, No. 9), Englewood Cliffs, NJ: Prentice-Hall.
- Olson, J. C., and Reynolds, T. J. 1983. Understanding consumers' cognitive structures: Implications for advertising strategy. *Advertising and Consumer Psychology*, L. Percy and A. Woodside (eds.), Lexington, MA : Lexington Books, pp. 77-90

- Pervin, L. A. 1989. "Persons, Situations, Interactions: The History of a Controversy and a Discussion of Theoretical Models," *Academy of Management Review*, Academy of Management, pp. 350–360.
- Pieters, R., Baumgartner, H., and Allen, D. 1995. "A Means-End Chain Approach to Consumer Goal Structures," *International Journal of Research in Marketing* (12:3), pp. 227–244.
- Reynolds, T. J., and Whitlark, D. B. (1995). "Applying Laddering Data to Communications Strategy and Advertising Practice," *Journal of Advertising Research*, (35), pp. 9-16.
- Rubln, A. M., Perse, E. M., and Powell, R. A. 1985. "Loneliness, Parasocial Interaction, and Local Television News Viewing," *Human Communication Research* (Vol. 12), pp. 155-180.
- Syam, N., and Sharma, A. 2018. "Waiting for a Sales Renaissance in the Fourth Industrial Revolution: Machine Learning and Artificial Intelligence in Sales Research and Practice," *Industrial Marketing Management* (69), pp. 135–146.
- Yoo. 2010. "Computing in Everyday Life: A Call for Research on Experiential Computing," *MIS Quarterly* (34:2), p. 213-231.
- Zhang, X., Zhou, X., Lin, M., and Sun, J. 2018. "ShuffleNet: An Extremely Efficient Convolutional Neural Network for Mobile Devices," *2018 IEEE/CVF Conference on Computer Vision and Pattern Recognition*, Presented at the 2018 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), IEEE.

D1.3 What do Chinese Airbnb green users focus on? -A study on the emotional characteristics of online reviews based on multi-factor interaction

Wang, J.Y.^a and Wang, C.^a

^a Management College, Ocean University of China
E-mail: wangjuying@ouc.edu.cn

Abstract

In the context of the sharing economy, shared accommodation represented by Airbnb has been widely studied. The study obtains the review data of Airbnb green users in three representative cities of Beijing, Shanghai, and Hong Kong from Inside Airbnb. Ten topics of user reviews are extracted through the Latent Dirichlet Allocation model, and an index system including human, geographic, housing, and environment is constructed. This research uses the sentiment dictionary to calculate the sentiment value of green user reviews, then verifies the interaction effect between each element through multiple regression analysis, and on this basis, uses the Analytic Network Process model to measure the weight of each element. The overall emotional characteristics of green users in Airbnb under the influence of multi-factor interaction are obtained by comprehensive calculation of emotional value and element weight. And the spatial characteristic analysis of the emotional characteristics of green users in Airbnb in three places is carried out. The results show that in Airbnb, green users have a more pronounced emotional tendency towards human and geographical factors during consumption, followed by housing factors, and show lower tendencies towards environmental factors. The research provides a new perspective for optimizing the Airbnb scoring system and promoting the coordinated development of shared accommodation subjects.

Keywords: Green users, Airbnb, Emotional characteristics, Multi-factor interaction, Online reviews, Latent Dirichlet Allocation model

Introduction

The boom in tourism has boosted the travel accommodation market. In recent years, shared accommodation represented by Airbnb has been favored by travel consumers due to its shareability and affordability. After entering the Chinese market in 2015, Airbnb caused a boom in the shared accommodation market in China. Influenced by the traditional Chinese cultural concept of "home", travelers are more likely to choose Airbnb, which can provide them with personalized services and a sense of home experience (Chen et al., 2020). However, given the long chain of resource access transfer in domestic shared accommodation, the high value of shared houses, and the strong privacy of accommodation, the trust barrier among Airbnb entities is relatively high (Wang et al., 2019). As a result, China's shared accommodation market is currently in a situation of great development potential but in short supply.

In the post-epidemic era, green consumption has gradually become a life attitude of consumers. Although some scholars have questioned the shareability of Airbnb (Demir and Emekli, 2021). However, domestic Airbnb hosts usually share their second and later homes, and this reuse of underutilized assets proves that Airbnb is still a part of the sharing economy in China.

Some studies have argued that participation in the sharing economy is itself a green consumption behavior (Curtis and Lehner, 2019). This view is still open to debate, as greenness and sustainability are not the main motivation for users to participate in the sharing economy at this stage (Bocker and Meelen, 2017). Online reviews are the foundation of a trusting relationship between hosts and tenants. In analyzing user experience through online reviews, researchers generally found that factors such as service, location, price, and facilities affect user experience (Kiatkawsin, 2020, Luo and Tang, 2019, Cheng et al., 2019). However, most existing studies analyze the entire Airbnb user base, and do not consider the experience differences caused by user types. The study by Serrano et al. (2021) indicates that green users are part of the Airbnb user base. Therefore, to guide more travelers to green consumption, reduce the trust barriers among shared accommodation entities, and thus promote the development of the domestic shared accommodation market, it is necessary to study the emotional characteristics of the green user groups in Airbnb.

When analyzing the emotional characteristics of users, researchers often find the emotional tendencies of users by calculating the sentiment value of reviews (Yakubu et al., 2021). Some studies use supervised machine learning models such as deep learning to train labeled samples to predict users' emotional tendencies (Liu et al., 2021). These studies can accurately assess the emotional characteristics of individual consumers. However, when measuring the overall emotional characteristics of users, existing research ignores the interaction effect between different factors that affect user experience, and the difference in the proportion of different factors in reviews will cause deviations in users' overall emotional tendencies. To achieve an accurate analysis of user emotional characteristics, the research must consider the influence of the interaction between factors. Analytic Network Process (ANP) model fully considers the interaction between factors, and provides a method for calculating weights (Lin, 2022), which can effectively eliminate the influence of weight bias on the overall emotional tendency.

In addition, scholars have already analyzed the current state of Airbnb in China, but mostly focused on exploring one city. However, China has a huge territory and different consumption habits in different regions. At present, there is still a lack of comparative analysis of spatial characteristics of Airbnb customer experience in different provinces and cities. Therefore, this paper selects Beijing, Shanghai, and Hong Kong as the city representatives in the northern, southern, and special

administrative regions of China, to obtain online consumer reviews of Airbnb users in the three cities. Based on text sentiment analysis and the ANP model, this paper analyzes the emotional characteristics of green users in Airbnb under the influence of multi-factor interaction.

Literature Review and Research Hypothesis

Green users and green consumer behavior

Green users are those who demonstrate green consumption behaviors such as being pro-environment and pro-social in their consumption (Hosta and Zabkar, 2021). With changes in the social environment, green consumption has gradually shown a trend, and users or organizations with green consumption behaviors can usually show greater advantages in competition (Banyte et al., 2020). Möller and Herm (2021) surveyed consumers' perceptions of green and non-green user entrepreneurs, and the results show that consumers who identify with green user entrepreneurs have strong green values. Consumers with such green values will show more green consumption behaviors in the process of consumption (Choi and Johnson, 2019).

Online reviews and text analysis

Extracting topic keywords that affect user experience from online reviews is a general method for text processing, and Latent Dirichlet Allocation (LDA) model is a common method. (Ahani et al. 2021).

Calculating the sentiment value of reviews to observe the user's sentiment tendency is another research focus of text analysis (Yakubu et al., 2021). It is worth noting that the emotional tendencies of a single user can be evaluated by sentiment values. When evaluating the overall user's sentiment tendency, factors such as the different proportion of different feature words in the reviews and the interaction between different factors affecting the user experience may bias the results. Based on this, the following research hypothesis is proposed:

H1: Topic factors in online reviews have a significant impact on green user emotional tendencies.

H2: There is an interaction effect between topic factors in online reviews that combine to influence green user emotional tendencies.

Data, Methods, and Models

Data acquisition and data preprocessing

The data for this article comes from Inside Airbnb, which provides review information in many cities around the world. The study takes Beijing as the main research object and obtains 1,376,647 review data online. According to Hurley et al. (2013), green users are those who use words related to sustainable lifestyles. Biswas et al. (2015) found that in the consumption process, the word "green" is often considered to be synonymous with sustainability. In some studies on sustainable consumption behavior, it is found that users who use words such as "green" and "clean" in comments are more inclined to make sustainable consumption behaviors (Wang and Yu, 2021, Serrano et al., 2021, Wang et al., 2019). Therefore, this paper selects reviews with these words in the sentences to identify green users in Airbnb and conduct research.

Text classification

To explore the topic classification of review data more intuitively, this study uses the Latent Dirichlet Allocation (LDA) model to classify the text. LDA model belongs to unsupervised machine learning. In the classification process, the number of topics is determined based on the topic consistency score (Chi et al., 2021), and it is finally found that the model fits best when the score is 10.

The results of the LDA model are shown in Figure 1. It can be concluded that the topics involved in the online reviews of green users in Airbnb include traffic conditions, geographical location,

hygiene conditions, surrounding environment, quality-price ratio, space area, housing facilities, service attitude, housing experience, and room style.



Figure 1 Results of the LDA Model

Indicator system

Referring to previous studies (Villeneuve and O'Brien 2020, Kiatkawsin et al., 2020, Luo and Tang, 2019, Cheng et al. 2019), combined with the classification results of the LDA model, the summarized 10 characteristic elements were further refined to obtain four dimensions of green user experience. Table 1 shows the index system of green user emotional tendency.

Table 1 Index system of green user emotion tendency

Target layer	Criteria layer	Element layer	Indicator layer
Green User Emotional Tendency	Internal factors	Housing factors	quality-price ratio
			space area
			supporting facilities
		room style	
		service attitude	
	External factors	Human Factors	housing experience
			external environment
		Environmental factors	internal hygiene
			traffic situation
			Geographical factors

Multivariate statistical analysis

In order to verify the influence of geographical, environmental, human, and housing factors on the green user experience, and to test whether there is an interaction effect between the factors, this study conducts a multiple regression analysis. Among all review data, 22580 reviews were randomly selected. The constructed econometric model is:

$$GUET = \alpha_0 + \beta_1 GE + \beta_2 HU + \beta_3 EN + \beta_4 HO + \beta_5 GE * HU + \beta_6 GE * EN + \beta_7 GE * HO + \beta_8 HU * EN + \beta_9 HU * HO + \beta_{10} EN * HO + \beta_{11} GA + \beta_{12} LR + \epsilon$$

Referring to the research of Lawani et al. (2018), the sentiment value of each review obtained by sentiment analysis is used as a standard to measure the green user's sentiment tendency (GUET). Referring to the research of Chi et al. (2019), the number of words of a certain element in user reviews can reflect the user's inclination to this element. Therefore, this paper counts the word frequency related to each element in the review and uses it as the measurement standard of the independent variable. Furthermore, the length of the reviews and the words related to green life appearing in the reviews may affect the results. Therefore, the length of the reviews (LR) and the green attitude (GA) are included as control variables, measured by the frequency of related words.

Analytic Network Process

The Analytic Network Process (ANP) model comprehensively takes into account the correlation within the indicators. According to the design principle, the model includes two layers: control layer

and network layer. The control layer is a simple hierarchical analysis model, and the network layer

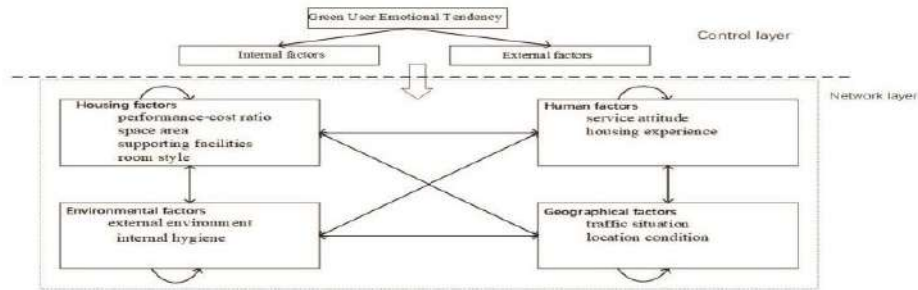


Figure 2 Analytic Network Process Model of GUET

mainly includes the element layer and the index layer. Figure 2 reflects the ANP model of green user emotional tendency.

Results

Multiple regression results

Table 2 Hierarchical multiple regression results

Dependent variable	GUET								
	model 1	model 2	model 3	model 4	model 5	model 7	model 8	model 9	model 10
Control variables									
<i>GA</i>	0.374***	0.213***	0.291***	0.382***	0.276***	0.290***	0.207***	0.272***	0.206***
<i>LR</i>	0.151***	0.077***	0.121***	0.139***	0.100***	0.115***	0.082***	0.095***	0.079***
independent variable									
<i>GE</i>		0.007	0.065***	0.126***	0.052**				0.805**
<i>EN</i>		0.712***	0.839***			0.852***	0.780***		0.813***
<i>HU</i>		0.096***		0.264***		0.202***		0.188***	0.162***
<i>HO</i>		0.737***			0.825***		0.795***	0.841***	0.769***
interactive term									
<i>GE*EN</i>			-0.043**						-0.046***
<i>GE*HU</i>				-0.079***					-0.047***
<i>GE*HO</i>					0.011***				0.025*
<i>EN*HU</i>						-0.062***			-0.037***
<i>EN*HO</i>							-0.055***		-0.046***
<i>HU*HO</i>								-0.027**	-0.003
Constant	1.318***	0.616***	1.014	1.389	1.002***	0.958***	0.601***	0.948***	0.531***

* $p < 0.050$, ** $p < 0.010$, *** $p < 0.001$

In this paper, the hierarchical multiple regression method is used for regression, and the results are shown in Table 2. Model 1 shows that both the green attitude and the length of the comment sentence have a significant positive impact on the emotional tendency of green users ($\beta=0.374$, $p < 0.001$; $\beta=0.151$, $p < 0.001$). Models 2-9 show that both independent variables and interaction terms have a significant impact on the emotional tendencies of green users. Model 10 presents the overall impact of independent variables and interaction terms on green user's emotional tendencies. The results show that there is an interaction effect among the factors that affect the green users' emotional tendencies, both hypothesis 1 and hypothesis 2 are valid. And interaction effects need to be taken into account when calculating the overall emotional characteristics of green users.

Comparison of emotional characteristics of green users

Based on the sentiment value of feature words and the weights of each index layer, the study measures the overall emotional characteristics of green users in Airbnb in Beijing, Shanghai, and Hong Kong. The spatial features are compared in Table 3.

Table 3 Comparison of emotional characteristics of green users in Beijing, Shanghai and Hong Kong

	Housing factors	Human Factors	Environmental factors	Geographical factors
Beijing	0.036	1.256	0.017	0.162
Shanghai	0.033	1.018	0.007	0.300
Hong Kong	0.015	0.057	0.007	1.450

Through the comparison of spatial characteristics, the emotional tendencies of Airbnb green users in the three places are generally consistent. Human factors and geographic factors are the main factors affecting the consumer experience, followed by housing factors. Human factors are the primary factor influencing the green user experience of Airbnb in Beijing and Shanghai, followed by geographic factors. In Hong Kong, the geographical factor is in the first place, followed by the human factor. One possible explanation is that the group of renters who choose Airbnb in Hong Kong is mostly composed of travelers who have undergone long journeys, and this group will first consider the convenience of transportation and the location to soothe their fatigue during long trips when renting a room. It should be noted that in the comparison of the emotional characteristics of green users in the three places, environmental factors are always in the last position.

Implication

Theoretical implications

Uncovering the emotional characteristics of green users in Airbnb is an important aspect to promote the growth of the shared accommodation market. By constructing an evaluation index system influenced by multi-factor interaction, this paper analyzes the emotional characteristics of green users' online reviews in Airbnb. And deeply understands users' emotional tendencies in different dimensions, which fills the gap in the analysis of emotional characteristics under the influence of multi-factor interaction.

In order to effectively solve the influence of the weight of factors affecting user experience on the results. On the basis of calculating the sentiment value of reviews, this paper obtains the weight of each element by ANP, and integrates the sentiment value and weight to obtain the emotional characteristics of green users. It provides a new idea for the related research of text analysis.

Practical implications

The sharing economy is an important support for sustainable development, and attracting more consumers to participate in the sharing economy is a key part of promoting social development. Although the economic model of shared accommodation is better than traditional budget hotels (Nie et al., 2020). However, in the era of fast consumption, the market environment is changing rapidly, and the Airbnb platform must continuously improve user satisfaction and corporate competitiveness. This paper proposes a method to measure the overall emotional characteristics of green users under the influence of multi-factor interaction. Based on this, Airbnb platform managers can formulate new user rating strategies, optimize the scoring algorithm, and assign different weights to topics related to user experience in reviews, so as to accurately analyze the development direction of the platform.

According to the research in this paper, green users in Airbnb pay more attention to human factors and geographic factors in their housing experience, followed by housing factors, and have the lowest emotional inclination towards environmental factors. To guide more users to green

consumption, Airbnb should strengthen its publicity on the environment, highlighting the sharing, affordability, and environmental protection of the listings. In addition, the platform can introduce a crowdsourcing mechanism to guide tenants to put forward specific needs before choosing a listing, and allow hosts to review these needs and provide personalized listing matching services. Provide appropriate economic incentives to hosts who are satisfied with their users and have excellent service attitudes to promote the virtuous cycle development of the Airbnb market, and can also effectively avoid offline transactions between hosts and tenants.

Conclusion

The Airbnb platform, hosts, and tenants act as a community of interests in the shared accommodation chain. Exploring the emotional characteristics of green users under the influence of multi-factor interaction can help the platform quickly identify users' emotional tendencies in different dimensions and formulate appropriate market development strategies. The scoring algorithm should be optimized according to user online reviews, and the reviews of different dimensions should be given matching weights, so that accurate user scores can provide a reference for hosts when releasing listing information and tenants when choosing listings. By which the coordinated development of shared accommodation subjects could be realized.

References

- Ahani, A., Nilashi, M., Zogaan, W.A., Samad, S., Aljehane, N.O., Alhargan, A., Mohd, S., Ahmadi, H., and Sanzogni, L. 2021. "Evaluating medical travelers' satisfaction through online review analysis," *Journal of Hospitality and Tourism Management* (48), pp.519-537.
- Banytė, J., Šalčiuvienė, L., Dovalienė, A., Piligrimienė, Ž., and Sroka, W. 2020. "Sustainable Consumption Behavior at Home and in the Workplace: Avenues for Innovative Solutions," *Sustainability* (12), 6564.
- Biswas, A., and Roy, M. 2015. "Green products: an exploratory study on the consumer behaviour in emerging economies of the East," *Journal of Cleaner Production* (87), pp.463-468.
- Böcker, L., and Meelen, T. 2017. "Sharing for people, planet or profit? Analysing motivations for intended sharing economy participation," *Environmental Innovation and Societal Transitions* (23), pp.28-39.
- Chen, B., Feng, Y., Sun, J., and Yan, J. 2020. "Motivation Analysis of Online Green Users: Evidence From Chinese "Ant Forest"," *Frontiers in Psychology* (11).
- Cheng, M., and Jin, X. 2019. "What do Airbnb users care about? An analysis of online review comments," *International Journal of Hospitality Management* (76), pp.58-70.
- Chi, M., Liu, S., Lu, X., and Luo, B. 2019. "A study of the mechanism influencing hosts' willingness to sustain participation on shared accommodation platforms: a perspective of platform network effects," *Nankai Management Review* (22), pp.103-113.
- Chi, M., Pan M., and Wang, W. 2021. "A cross-platform comparative study of shared accommodation and hotel user review texts: an LDA-based thematic social network and sentiment analysis," *Library Intelligence Works* (65), pp. 107-116.
- Choi, D., and Johnson, K.K.P. 2019. "Influences of environmental and hedonic motivations on intention to purchase green products: An extension of the theory of planned behavior," *Sustainable Production and Consumption* (18), pp.145-155.
- Curtis, S.K., and Lehner, M. 2019. "Defining the Sharing Economy for Sustainability," *Sustainability* (11), 567.

- Demir, E., and Emekli, G. 2021 "Is Airbnb no longer a sharing economy platform? Evidence from Europe's top 10 Airbnb destinations," *International journal of tourism and hospitality research* (32), pp.470-488
- Hosta, M., and Zabkar, V. 2021. "Antecedents of Environmentally and Socially Responsible Sustainable Consumer Behavior," *Journal of Business Ethics* (171), pp.273-293.
- Hurley P J. A Concise Introduction to Logic, 9Th Edition, 2013
- Kiatkawsin, K., Sutherland, I., and Kim, J. 2020. "A Comparative Automated Text Analysis of Airbnb Reviews in Hong Kong and Singapore Using Latent Dirichlet Allocation," *Sustainability* (12), 6673.
- Lin, W.C. 2022. "Maritime Environment Assessment and Management Using through Balanced Scorecard by Using DEMATEL and ANP Technique," *International Journal of Environmental Research and Public Health* (19), pp.2873.
- Liu, Y., Meng, L.K., Bao, J.G., and Zhao, C.D. 2021. "A Comparative Study of Sentiment Computing Methods: Will Machine Learning Be Overwhelming?" *Nankai Business Review* (24 -05), pp.63-74.
- Luo, Y., and Tang, R.L. 2019. "Understanding hidden dimensions in textual reviews on Airbnb: An application of modified latent aspect rating analysis (LARA)," *International Journal of Hospitality Management* (80), pp.144-154.
- Möller, J., and Herm, S. 2020. "Perceptions of Green User Entrepreneurs' Performance—Is Sustainability an Asset or a Liability for Innovators?" *Sustainability* (13), 3580.
- Nie, R., Tian, Z., Wang, J., and Chin, K.S. 2020. "Hotel selection driven by online textual reviews: Applying a semantic partitioned sentiment dictionary and evidence theory," *International Journal of Hospitality Management* (88), 102495.
- Serrano, L., Ariza-Montes, A., Nader, M., Sianes, A., and Law, R. 2021. "Exploring preferences and sustainable attitudes of Airbnb green users in the review comments and ratings: a text mining approach," *Journal of Sustainable Tourism* (29), pp.1134-1152.
- Villeneuve, H., and O'Brien, W. 2020. "Listen to the guests: Text-mining Airbnb reviews to explore indoor environmental quality," *Building and Environment* (169).
- Wang, J., and Yu, X. 2021. "The Driving Path of Customer Sustainable Consumption Behaviors in the Context of the Sharing Economy—Based on the Interaction Effect of Customer Signal, Service Provider Signal, and Platform Signal," *Sustainability* (13), pp.3826.
- Wang, Y., Xiang, D., Yang, Z., and Ma, S.S. 2019. "Unraveling customer sustainable consumption behaviors in sharing economy: A socio-economic approach based on social exchange theory," *Journal of Cleaner Production* (208), pp.869-879.
- Yakubu, H., Kwong, C.K., and Lee, C.K.M. 2021. "A multigene genetic programming-based fuzzy regression approach for modelling customer satisfaction based on online reviews," *Soft Computing* (25), pp.5395-5410.
- Yu, M., Cheng, M., Yu, Z., Tan, J., and Li, Z. 2020. "Investigating Airbnb listings' amenities relative to hotels," *Current Issues in Tourism*, pp.1-18.

D1.4 AI Generating and Detecting Manipulated Online Customers Reviews

Chernyaeva, O. ^a, Hong, T.H. ^b, Park, Y.K. ^c, Kim, Y.H. ^d and Ren, G. ^e

^a Business School, Pusan National University, Busan, Korea

E-mail: missleka@pusan.ac.kr

^b Business School, Pusan National University, Busan, Korea

E-mail: hongth@pusan.ac.kr

^c Business School, George Washington University, US

E-mail: ykpark@gwu.edu

^d Business School, Pusan National University, Busan, Korea

E-mail: kimyh@pusan.ac.kr

^e School of Management, Hefei University of Technology, China

E-mail: rengang123@gmail.com

Abstract

Since customers increasingly rely on online reviews from online platforms for information about products or services. The reliability of reviews becomes crucial. However, manipulated reviews give an untruthful picture of product quality, impede reviews' usefulness, and have an impact on customers' decision-making. Therefore, the detection of manipulated reviews has received widespread research attention. One of the main problems in detecting manipulated reviews is the difficulties with obtaining manipulated reviews and an insufficient number of manipulated reviews. In this research, we address the generation and detection of manipulated reviews by using AI. The aim of our research is to improve the detection of manipulated reviews by filling the lack of manipulated reviews with generated reviews.

Keywords: Manipulated Reviews, Manipulated Reviews Detection, Text Generation, Machine Learning, Deep Learning, Sentiment Analysis, Emotion Analysis.

Introduction

Online customer reviews have become one of the most influential factors in customer purchase behavior. Also, online reviews have shown that nowadays the amount of available online reviews grows at an exponential rate. Based on reviews written by previous customers about 85% of customers make their final purchase decisions (Eslami et al., 2018). Since in online platforms customers can in real-time access and share opinions about products or services (Dwivedi et al., 2020), utilizing online reviews written in e-commerce helps customers make better decisions such as search and purchase processes (Cheng and Ho, 2015).

According to a study by Salminen et al. (2022), online customers, reviews are one of the most trusted sources of information for sharing personal past purchase experience. Due to the development of online shopping promotion on online platforms such as Yelp.com or Amazon.com online customer reviews (OCRs) have become an important part of companies' marketing strategy too. However fraudulent companies or sellers strategically manipulate reviews in an effort to influence customers' purchase decisions. Furthermore, previous studies have investigated how marketers can strategically manipulate customers' perceptions and opinions of products or services through online communication channels such as online reviews of retail sites (Mayzlin et al., 2014). Posting an untruthful review or a review without an accounting of a real customer's experience can be considered as manipulation (Tian et al.,

2020). Hu et al. (2011) state that "unethical users manipulate online reviews, they can either post reviews with a high numeric rating or manipulate the textual statements posted in the review." Therefore, manipulation of online reviews can occur when online vendors or agencies hired by them produce customers' reviews by posing as real customers.

To detect manipulated reviews, ordinary researchers face the problem of lack of data, such as detailed information about the reviewer, posting frequency, geolocation, and information about the seller. Only the owners of the online platforms themselves have the opportunity to receive information and create a manipulated review filtering algorithm. For example, Yelp.com has an automated filtering model based on AI. In 2021, Yelp.com announced that about 22% of 19.6 million reviews were not recommended by automated recommendation software. Automated recommendation software was designed to detect reviews that are conflicts of interest, manipulated, low quality, or less reliable. In other words, we can call not recommended reviews - manipulated reviews. However, even having a dataset with non-recommended reviews, their number is not enough to build an accurate model for detecting manipulated reviews based on publicly available textual information. Therefore, the purpose of this research is the generation of reviews based on non-recommended reviews dataset and the creation of a model with the best capability to detect manipulated reviews.

Literature Review

Manipulated Reviews

Manipulation in the traditional business fields or manipulation with news or tweets is not a new area of research (Majumdar et al., 2007). However, review manipulation is one of the new and crucial issues in the e-commerce service area. According to the study by Hu et al. (2012), there are 10.3% of products' online reviews are manipulated on the online retail sites. However, until recently even big online vendors, such as Yelp.com, Amazon.com, and TripAdvisor.com rarely discussed how online retail sites should fight OCRs manipulations. Since there is no one agreed upon conceptual determination of products or services, OCRs manipulation vendors can mandate appropriate legal action. Vendors never disclose the use of unethical users who create fraud reviews because these unethical users can take advantage of this knowledge (Chen and Lin, 2013). But online reviews still remain important and play a main role in the purchase decision process. As previously mentioned, a significant number of consumers read online reviews before buying a product or service on the Internet. Online reviews have a direct impact on the purchase decision making, which ultimately will affect the sale of products and services (Cao et al., 2011).

Consequently, vendors or brands compete over reputation. Not all companies can collect the best online reviews and be rated the highest. Some vendors develop strategies to control customer opinion (Gössling et al., 2016) when they seek to expand the online customer base or when the customer base is threatened by online evaluations. This strategy to control customer opinion with the attempt to influence a vendor's reputation and new attract customers take various forms, including improved services, but also manipulation (Banerjee and Chua, 2014). According to Anderson and Simester (2014) and Filieri (2015) "fake reviews" were identified as one form of manipulation. Despite confidential content control algorithms, which are able to identify and specify forms of manipulation, review or rating manipulations have even appeared on big platforms such as Amazon.com and TripAdvisor.com. In October 2015, the serviced apartments chain, Meriton, was offering customers to change their ratings on the travel site TripAdvisor (Jacob, 2011). TripAdvisor investigated if manipulation had been committed or not. Clearly, a method for the identification of the existence of manipulation in OCRs is critically important.

Manipulated Reviews Creation

According to a study by Salminen et al. (2022), there are two main ways to create manipulated reviews. The first way is a human-generated way when sellers pay people who never saw said products or used services to write "authentic appearing" reviews. The second way is a computer-generated way by using AI text-generation algorithms to automate the fake review creation. However, we believe that even people who actually bought or used a product, but initially had no intention of writing a review, can be motivated or manipulated to write a review under the influence of a gift or extra service. Unfortunately, this kind of manipulation is very difficult to detect, since even the reviewer himself would find it difficult to assess the veracity of his review.

Before the first way of creating manipulated reviews - the human-generated way used to be more common in a "market of fakes" (He et al., 2021). However, the development of AI technologies and progress in natural language processing (NLP) and deep learning (DL) incentivized the automation of text generation with generative language models. Nowadays manipulated reviews could be generated by AI technologies faster and cheaper than human-generated manipulated reviews.

Manipulated Reviews Detection

Since there are a lot of theories and methods to detect products with manipulated online reviews (Tsikerdekis and Zeadally, 2014), researchers are motivated to develop and study more sophisticated methods. The studies related to manipulation detection techniques can be generally classified into three research techniques: Machine learning is a subset of artificial intelligence (AI). Machine learning algorithms widely use sample data (training data) based on a mathematical model in order to predict or classify. In Non-machine learning cases, this research does not have training data to provide a statistical model, therefore this study cannot calculate the accuracy of the model (Shmueli et al., 2011). There are supervised learning-based manipulation detection techniques, and unsupervised learning-based manipulation detection techniques.

Supervised learning-based manipulation detection techniques and unsupervised learning-based manipulation detection techniques are built based on the principles of design science, machine learning techniques, and verbal and nonverbal features to detect manipulation (Nunamaker et al., 2016). In literature about OCRs manipulation detection supervised learning is the most common method used for OCRs manipulation detection and examines labeled data's learning. However, providing Supervised learning labeled data is required in order to train a classifier, which presents a challenge in the field of review manipulation detection. In other words, in the case of detecting products with manipulated online reviews, the main condition for carrying out Supervised learning methods is the availability of a dataset with fake online reviews (Lim et al., 2010). Therefore, if there is no dataset with fake online reviews, detection through Supervised learning methods is not possible (Crawford et al., 2015).

Supervised learning in the case of OCRs manipulation detection classifies online customers reviews into two categories: manipulated and unmanipulated reviews. The main and most common Supervised learning methods are Logistic Regression, Naive Bayes, SVM, and Random Forest. In the study by Ott et al. (2011) 400 fake high Star Rating (5 stars) reviews of positive sentiment for a set of hotels were created by a group of people. The resulting dataset consisted of 800 reviews with 400 fake reviews and 400 truthful reviews. SVM classifiers and Naive Bayes were trained and examined by using 5-fold nested cross-validation, "the best classification model achieved an accuracy of 89.8 % and was using bigram and LIWC features with an SVM classifier" (Ott et al., 2011).

On the other hand, unlabeled data is used in the process of unsupervised learning to find unnoticed relationships between data independent of a class attribute. Clustering is an instance of Unsupervised learning. It is based on a type of similar function as it groups instances of unlabeled data. Yet due to the difficulty of creating accurately labeled datasets of manipulated OCRs, Supervised learning applications are difficult. However, unsupervised learning does not require labeled data. The semantic language model for detecting manipulated reviews was developed and integrated into a novel Unsupervised text mining model by Lau et al. (2011), and the model was compared with supervised learning methods.

Lau et al. (2011) study provides an example of Unsupervised learning-based manipulation detection techniques. Lau et al. (2011) introduced the method for calculating the degree of manipulation based on the duplicate detection results by estimating the overlap of semantic contents amongst OCRs through the Semantic Language Model (SLM). The final dataset contained 54,618 reviews, and 6% of reviews were spam. According to the results of the study, a text mining-based computational model and a semantic language model can be considered an effective method for detecting manipulated reviews. The study's results also show that unsupervised methods are able to achieve a great detection rate of duplicated OCRs. A review was labeled "manipulated" if it had great similarity with another case. "Model" measures the likeness between cases through semantic analysis. In the mentioned study, a particular dataset gathered manipulated and non-manipulated OCRs from the two ends of the likeness spectrum while ignoring data in the middle. Therefore, this research needs to provide further investigation on how the Semantic Language Model and other unsupervised methods, execute datasets that have OCRs manipulation. The datasets must differ from other cases, and the cases with genuine reviews must differ from other similar genuine reviews.

Research Framework and The Future Research Plans

As shown in Figure 1, our research framework consists of five parts: data collection, generating reviews, preprocessing reviews, additional analysis, and prediction model.

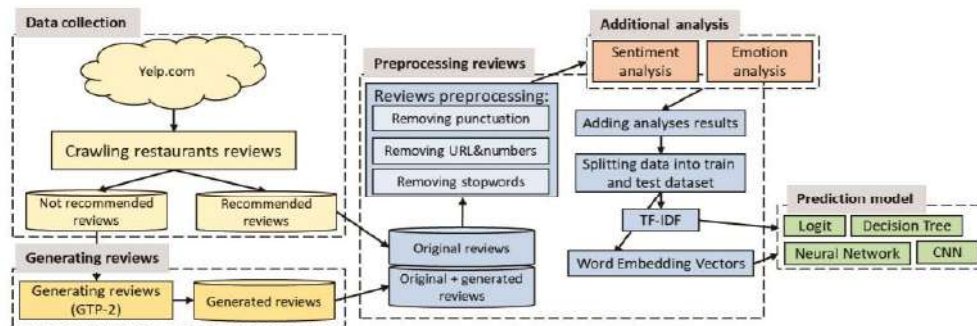


Figure 1. Research Framework for Generating and Detecting Manipulated OCRs

Firstly, in the data collection step, we plan to collect review data from Yel.com. For target data, we have chosen the top restaurants in New York, United States. Next, we plan to generate manipulated reviews based on not recommended reviews set from Yelp.com for each of chosen restaurants. After we plan construct two review datasets with manipulated and not-manipulated reviews, preprocessing procedures are applied to the review datasets. Preprocessing procedures are as follows. First, we will divide reviews into single words. Second, we will remove stopwords such as website links, numbers, symbols, and punctuation because stopwords hinder the reliability of experiment results and make it hard to interpret the results (Aggarwal and Zhai, 2012).

In addition, analyses of both sentiment and emotion analysis, we plan to provide through Python using the lexicon-based method. We will use the SentiWordNet package. SentiWordNet is a resource, which contains an opinion lexicon extracted from the WordNet database (Ohana and Tierney, 2009). In the WordNet database, each term is associated with numerical scores indicating positive, neutral, and negative sentiment scores. SentiWordNet was made publicly available for research purposes of text content in English. For emotion analysis, we will use the text2emotion package. Text2emotion is the python package that was developed by (Diaz et al 2018) to recognize the emotions embedded in the text data such as Happy, Angry, Sad, Surprise, and Fear. The advantage of this dictionary over others is that text2emotion considers the search for similar words if a term is not found in the dictionary.

In this research, detection of the manipulated review was divided into two ways: the traditional machine learning prediction models and the deep learning prediction model (CNN). In the case of machine learning prediction models (Logit, Decision Tree, Neural Network) for text preprocessing we compute the term frequency-inverse document frequency (TF-IDF) for each word in each review to prioritize the important words specific to each news. In the case of the deep learning prediction model, we start with the word embedding model (Mikolov et al., 2013, aka word2vec), which is based on an idea: words with similar meanings tend to occur with similar neighbors. To operationalize this idea, the embedding model summarizes the contextual information of each word by predicting its surrounding context words using convolutional neural networks (CNN).

Acknowledgements

his work was supported under the framework of international cooperation program managed by the National Research Foundation of Korea (2020K2A9A2A1110432911, FY2021).

References

- Aggarwal, C.C. and Zhai, C., 2012. An introduction to text mining. In *Mining text data* (pp. 1-10). Springer, Boston, MA.
- Anderson, E. T., & Simester, D. I. (2014). Reviews without a purchase: Low ratings, loyal customers, and deception. *Journal of Marketing Research*, 51(3), 249-269.
- Banerjee, S., Bhattacharyya, S., & Bose, I. (2017). Whose online reviews to trust? Understanding reviewer trustworthiness and its impact on business. *Decision Support Systems*, 96, 17-26
- Cao, Q., Duan, W., & Gan, Q. (2011). Exploring determinants of voting for the "helpfulness" of online user reviews: A text mining approach. *Decision Support Systems*, 50(2), 511-521.
- Chen, L.S. and Lin, J.Y., 2013, July. A study on review manipulation classification using decision tree. In *2013 10th international conference on service systems and service management* (pp. 680-685). IEEE.
- Cheng, Y. H., & Ho, H. Y. 2015. "Social influence's impact on reader perceptions of online reviews," *Journal of Business Research* (68:4), pp. 883-887.
- Crawford, M., Khoshgoftaar, T. M., Prusa, J. D., Richter, A. N., & Al Najada, H. (2015). Survey of review spam detection using machine learning techniques. *Journal of Big Data*, 2(1), 23.
- Diaz, S.S., Shaik, J.M.M. and Santofimio, J.C.G., 2018, November. Intelligent execution of behaviors in a nao robot exposed to audiovisual stimulus. In *2018 IEEE 2nd Colombian Conference on Robotics and Automation (CCRA)* (pp. 1-6). IEEE.
- Dwivedi, Yogesh K., Ismagilova, Elvira, Laurie Hughes, D., Carlson, Jamie, Filieri, Raffaele, Jacobson, Jenna, Jain, Varsha, Karjaluoto, Heikki, Kefi, Hajer, Krishen, Anjala S., Kumar, Vikram, Rahman, Mohammad M., Raman, Ramakrishnan, Rauschnabel, Philipp A., Rowley, Jennifer, Salo, Jari, Tran, Gina A., Wang, Yichuan, 2020. Setting the future of digital and social media marketing research: perspectives and research propositions. *Int. J. Inf. Manag.* 102168. <https://doi.org/10.1016/j.ijinfomgt.2020.102168>. July 2020.
- Eslami, S. P., & Ghasemaghahi, M. (2018). Effects of online review positiveness and review score inconsistency on sales: A comparison by product involvement. *Journal of Retailing and Consumer Services*, 45, 74-80.
- Filieri, R. (2015). What makes online reviews helpful? A diagnosticity-adoption framework to explain informational and normative influences in e-WOM. *Journal of Business Research*, 68(6), 1261-1270.
- Gössling, S., Hall, C. M., & Andersson, A. C. (2018). The manager's dilemma: a conceptualization of online review manipulation strategies. *Current Issues in Tourism*, 21(5), 484-503.
- He, Sherry, Hollenbeck, Brett, Proserpio, Davide, 2021. The Market for Fake Reviews.
- Hu, N., Bose, I., Koh, N. S., & Liu, L. (2012). Manipulation of online reviews: An analysis of ratings, readability, and sentiments. *Decision support systems*, 52(3), 674-684.

- Hu, N., Liu, L., & Sambamurthy, V. (2011). Fraud detection in online consumer reviews. *Decision Support Systems*, 50(3), 614-626.
- Jacob, Weisberg, Te'eni, Dov, Arnan, Limor, 2011. Past Purchase and Intention to
- Lau, R. Y., Liao, S. Y., Kwok, R. C. W., Xu, K., Xia, Y., & Li, Y. (2012). Text mining and probabilistic language modeling for online review spam detection. *ACM Transactions on Management Information Systems (TMIS)*, 2(4), 1-30.
- Lim, E. P., Nguyen, V. A., Jindal, N., Liu, B., & Lauw, H. W. (2010, October). Detecting product review spammers using rating behaviors. In *Proceedings of the 19th ACM international conference on Information and knowledge management* (pp. 939-948).
- Majumdar, S., Kulkarni, D., & Ravishankar, C. V. (2007, May). Addressing click fraud in content delivery systems. In *IEEE INFOCOM 2007-26th IEEE International Conference on Computer Communications* (pp. 240-248). IEEE.
- Mayzlin D., Dover Y., Chevalier J., (2014) "Promotional reviews: an empirical investigation of online review manipulation", *American Economic Review* 104 (8) 2421-2455.
- Mikolov, T., Le, Q.V. and Sutskever, I., 2013. Exploiting similarities among languages for machine translation. arXiv preprint arXiv:1309.4168.
- Nunamaker Jr, J. F., Burgoon, J. K., & Giboney, J. S. (2016). Information systems for deception detection.
- Ohana, B. and Tierney, B., 2009. Sentiment classification of reviews using SentiWordNet. *Proceedings of IT&T*.
- Ott, M., Choi, Y., Cardie, C., & Hancock, J. T. (2011). Finding deceptive opinion spam by any stretch of the imagination. arXiv preprint arXiv:1107.4557.
- Purchase in E-Commerce: the Mediation of Social Presence and Trust. *Internet research*, 2011.
- Salminen, J., Kandpal, C., Kamel, A. M., Jung, S. G., & Jansen, B. J. (2022). Creating and detecting fake reviews of online products. *Journal of Retailing and Consumer Services*, 64, 102771.
- Shmueli, G., Patel, N. R., & Bruce, P. C. (2011). *Data mining for business intelligence: Concepts, techniques, and applications in Microsoft Office Excel with XLMiner*. John Wiley and Sons.
- Social Science Research Network, Rochester, NY. <https://doi.org/10.2139/ssrn.3664992>.
- Tian, K., Shao, M., Wang, Y., Guan, J. and Zhou, S., 2016. "Boosting compound-protein interaction prediction by deep learning," *Methods*, 110, pp.64-72.
- Tsikerdekis, M., & Zeadally, S. (2014). Online deception in social media. *Communications of the ACM*, 57(9), 72-80.
- Yelp.com's report: <https://trust.yelp.com/trust-and-safety-report/>

D1.5 Exploring the Echo Chamber Effect of ASMR Marketing Content on User: A Text-mining Perspective

Wang, M.^a, Tran, H. C.^b and Choi, J. W.^c

^a Department of Business Administration, Soonchunhyang University
E-mail: jackwang1121@sch.ac.kr

^b Department of Business Administration, Soonchunhyang University
E-mail: hyunjoon193@sch.ac.kr

^c Department of Business Administration, Soonchunhyang University
E-mail: jaewonchoi@sch.ac.kr

Abstract

Recently, social media content is growing strongly, among them Autonomous sensory meridian response (ASMR) became one of the most trending contents on YouTube. This study aims to explore the echo chamber effect of ASMR marketing content on online users. First, we applied sentiment analysis and topic modeling to uncover the user's attitude toward three types of ASMR content such as mukbang, tourism and sponsor content. Then we used social network analysis and multilayer perceptron to explore the difference in communication effect of each ASMR content field. Through the result sentiment analysis and topic modeling, we found online users have better attitudes and responses towards ASMR tourism content than ASMR mukbang and ASMR sponsor content. The results of social network analysis and multilayer perceptron show the ASMR Mukbang has the best communication effect among them, next is ASMR sponsor content, and ASMR tourism content has a weaker communication effect than others.

Keywords: ASMR marketing content, multilayer perceptron, social network analysis, text-mining,

Introduction

Recently, as the video content market has grown rapidly, the video platform is attracting attention as a new information search service (Lee, 2018). Autonomous Sensory Meridian Response (ASMR) is one of the hottest content made by YouTube content creators, who called ASMRtist. The meaning of ASMR can be understood as follows: 'autonomous' stands for the self-governing nature of the phenomenon which means that people cannot influence when it appears as a response to external stimuli, 'sensory' expresses that ASMR concerns the human senses, 'meridian' refers to a climax, and 'response' describes an experience triggered by some kind of stimuli (Polito, 2017). ASMR refers to a pleasant tingling sensation experience that leads from the head and move towards the neck, back stem, or spine, which is felt to a specific sound stimulus (Kim, 2018). ASMR was created with the aim of creating a sense of relaxation for viewers by using triggers (Chae et al., 2021). ASMR trigger can be made by the act of whispering, ear cleaning, chewing crispy food, the sound of cooking, the sound of the mouth, the sound of scratching or tapping something with a fingernail, the sound of a hand or brushstroke, the sound of crumpling paper, etc (Kim, 2018). Brands benefit from ASMR because it immediately captures the focus of viewers, even those who aren't actively watching the screen, some swear the audio helps them relax or fall asleep. With the rapid development of ASMR as well as the benefits it brings, many

brands have started to make promotional videos using ASMR. Not only that, a lot of brands have also started to cooperate with ASMRtist to carry out product promotion activities or sponsorships.

In recent years, many brands from many different fields have started to apply ASMR to their advertising such as McDonald's, KFC, Apple, IKEA, Toyota, Pepsi, Superbowl, Applebee, Lush cosmetic, L'YNN, etc. For examples, Apple applies ASMR to iPhone camera feature promotional videos, IKEA with the "Oddly IKEA Campaign" advertising which became "One of the Most Satisfying Ads Ever", and Superbowl's ASMR ads also had huge number of views. ASMR videos are largely the domain of influencers, and they're banking billions of video views with long engagement times from viewers that take the content seriously. Previously, ASMRtists or ASMR content creators mainly focused on role-play content and eating broadcast (mukbang), but now ASMR has been widely applied to more types of content such as product review-unboxing, beauty, makeup, fashion, or even in the field of tourism. Like traditional YouTube content, the contents that apply ASMR have received great attention from online users. YouTube reported that relaxation videos (including ASMR) have increased by 70 percent.

Previous studies of ASMR marketing content focused on consider the ways to use ASMR-technology in modern advertising and marketing exploring the effectiveness of ASMR advertising in the field of fashion or low-tourism (Chae et al., 2021), comparing the effect of ASMR advertisement with traditional advertisement (Lee and Kim, 2019) through the survey methods. The existing research on ASMR marketing are mainly used the survey methods for research. In this study, we mainly focus on text mining to analyze the effect of ASMR marketing content on online users. This study aims to explore the echo chamber effect of ASMR marketing content on online users. More specifically, the purpose of this study is to uncover users' attitudes towards ASMR marketing content based on YouTube online reviews. We also aim to explore and compare the communication effects of ASMR content in the field of ASMR mukbang(eating broadcast), ASMR tourism, and ASMR sponsor content. The research questions of this thesis study are as follows:

RQ1: What difference are in user attitude from types of ASMR content?

RQ2: what antecedence of the ASMR content affects users of ASMR service?

RQ3: How ASMR marketing content has to communicate effects on subscribing network on YouTube?

Theoretical Background

Echo chamber effect

According to Oxford Learner's Dictionary, the echo chamber refers to "situations in which beliefs are amplified or reinforced by communication and repetition inside a closed system and insulated from rebuttal". The echo chamber effect occurs online when a harmonious group of people amalgamates and develop tunnel vision, so participants in online discussions may find their opinions constantly echoed back to them, which reinforces their individual belief systems due to the declining exposure to others' opinions (Mutz, 2013). Their individual belief systems are what culminates into a confirmation bias regarding a variety of subjects (Zimmer et al., 2019). When an individual wants something to be true, they often will only gather the information that supports their existing beliefs and disregard any statements they find that are contradictory or speak negatively upon their beliefs.

Echo chambers have been shown to exist in various forms of online media such as blogs (Gilbert et al., 2009), forums (Edwards, 2013), and social media sites like Facebook, Twitter, or YouTube (Barberá et al., 2015). By participating in an echo chamber, people are able to seek out information that reinforces their existing views without encountering opposing views (Barberá et al., 2015). The term is a metaphor based on an acoustic echo chamber, in which sounds reverberate in a hollow enclosure, another emerging term for this echoing and homogenizing effect within social media communities on the Internet is cultural tribalism (Dwyer, 2007).

The echo chamber effect is mainly achieved through online social communities, but the same phenomenon can also occur in offline communities. Online social communities become fragmented by

echo chambers when like-minded people group together and members hear arguments in one specific direction with no counterargument addressed (Stark et al., 2020). In social media platforms, echo chambers are more likely to be found when the topic is more political in nature compared to topics that are seen as more neutral (Barberá et al., 2015). In the social media context, the debate around echo chambers is fundamental to understanding social media's influence on information consumption and public opinion formation (Cinelle et al., 2021). Most of the previous studies on echo chamber effects have focused on the political point. In this study, we base our definitions of the echo chamber effect and determine that YouTube content such as ASMR can influence viewers' information consumption (user attitude, response, etc) and communication formation.

Research Methodology

Research Framework

This study was based on the theory of echo chamber effect and social capital to find out the users' attitudes towards ASMR marketing contents based on YouTube online reviews. We also aim to explore and compare the communication effects of ASMR contents in the field of ASMR mukbang, ASMR tourism, and ASMR sponsor content. The research method selected three fields of ASMR content such as ASMR mukbang, ASMR tourism, and ASMR sponsor content. This study mainly uses text-mining for analysis. First, we applied sentiment analysis and ANOVA analysis to uncover and compare the user's attitude toward three types of ASMR content. Next, we used Latent Dirichlet Allocation (LDA) to extract the user perception toward these ASMR contents. Then we used centrality measures in social network analysis to uncover the communication effect of each ASMR content type and compared it by using ANOVA analysis. Last, neural network analysis - multilayer perceptron was conducted to confirm the continuity of the communication effect of these ASMR contents in the future. The research framework of this study is as follows:

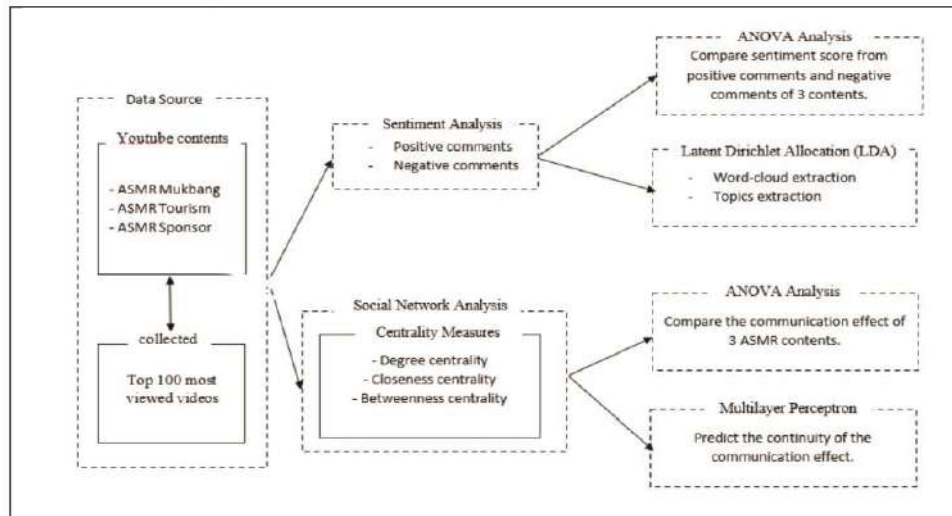


Figure 1. Research Framework

Data Collection

Youtube is the largest video platform and is widely used in the field of digital marketing with a variety of advertising videos from brands or influencers. On YouTube, there is a lot of content and a variety of genres, especially ASMR content is growing stronger and more popular. So, this research focused on YouTube comments for analysis. In this study, we divided ASMR marketing content into three types

such as ASMR Mukbang, ASMR Tourism, and ASMR Sponsor content. We crawled video information and text comments from the top 100 most viewed videos from each ASMR content type. A total of 829,427 text comments from 300 videos were collected. After crawled data, we pre-processed data for sentiment analysis, topic modelling by deleting the emoticons and just keep English comments. For social network analysis, the comment data of each video content was changed into a matrix and an edge list, and the data was refined to a level that could confirm the connection relationship. The information about collected and pre-processed data are as Table 1:

Inserting a table in the text can work well. You may want to adjust the vertical spacing of the text in the tables. (In Word, use Format | Paragraph... and then the Line and Page Breaks tab. Generally, text in each field of a table will look better if it has equal amounts of spacing above and below it, as in Table 1.)

Table 1. The information about collected data

Content type (top 100 most viewed videos)	Collected comments	Pre-processed comments
ASMR Mukbang	362,735	235,453
ASMR Sponsor	276,479	216,533
ASMR Tourism	190,213	148,408

Analysis result

Sentiment Analysis

In this study, we used sentiment analysis - support vector machine algorithms to classify the comments of ASMR marketing content into two groups that are positive comments and negative comments. The negative comments group contains comments with sentiment scores from 0 to 0.45 while the Positive comments group contains comments that have sentiment scores from 0.45 to 1. After deleted non-English comments and emoticons, a total of 600,394 comments from ASMR Mukbang, ASMR Tourism, and ASMR Sponsor content were used to applied sentiment analysis. The research has shown in Table 2 as follows:

Table 2. The comparison between positive and negative comments

Content	Comments	Positive comments	Negative comments
ASMR Mukbang	235,453	187,031 (79.4%)	48,422 (20.6%)
ASMR Sponsor	216,533	166,379 (76.83%)	50,174 (23.17%)
ASMR Tourism	148,408	120,235 (81.01%)	28,173 (18.99%)

As shown in Table 2, after using the support vector machines method, the comments about ASMR mukbang, ASMR tourism, and ASMR sponsor contents crawled from YouTube were divided into two groups of positive and negative comments. Among it, there were 187,031 (79.4%) positive comments and 48,422 (20.6%) negative comments pertaining to ASMR mukbang content; 166,379 (76.83%) positive comments and 50,174 (23.17%) negative comments regarding ASMR sponsor content; and 120,235 (81.01%) positive comments and 28,173 (18.99%) negative comments about ASMR tourism content. Based on the ratio between positive comments and negative comments, we can see that among

the 3 types of content, ASMR tourism content has the highest rate of positive comments. That means users have a better attitude towards ASMR tourism content than ASMR mukbang content and ASMR Sponsor content.

Topic modeling

In this study, we based on the results of sentiment classification to extract the topics mentioned by users in the positive comments group and negative comments group of each ASMR content.

ASMR Mukbang content

To analyze the positive and negative topics of user's comments toward ASMR mukbang content, this study conducted topic modeling based on text mining. In this study, we perform topic modeling multiple times with the results from 3 to 10 topics and then get the results without duplicate topics. After comparing the results, we chose to extract 5 topics from positive comments and extract 3 topics from negative comments. We get most 10 frequency keywords and these words co-occurrence (also called probability) from each topic, the word co-occurrence means that the amount of the word co-occurrence relation comes from a full corpus which contains many documents or texts. The topic modeling result of ASMR mukbang's positive comments and negative comments have shown in Table 3 and Table 4.

Table 3. The separated positive topics of ASMR Mukbang

Positive comment	Topic-1 Satisfaction	Topic-2 ASMR trigger	Topic-3 Food/request	Topic-4 influencer	Topic-5 enjoyment
1st	eat 0.032	asmr 0.041	chocolate 0.036	cute 0.017	watch 0.028
2nd	look 0.028	good 0.039	food 0.025	mouth 0.015	know 0.017
3rd	yummy 0.020	like 0.038	want 0.022	think 0.014	people 0.013
4th	sound 0.020	video 0.032	race 0.020	say 0.012	hello 0.013
5th	zach 0.020	hungry 0.030	girl 0.019	jelly 0.011	come 0.011
6th	satisfy 0.016	early 0.023	cream 0.017	yeah 0.010	like 0.009
7th	love 0.016	tingle 0.017	nice 0.016	like 0.010	make 0.009
8th	start 0.015	trigger 0.016	like 0.016	drink 0.010	want 0.008
9th	food 0.015	best 0.014	comment 0.015	mukbang 0.010	subscribe 0.008
10th	delicious 0.014	hunnibe 0.011	favorite 0.015	hear 0.009	enjoy 0.008

Table 4. The separated negative topics of ASMR Mukbang

Negative comment	Topic 1 sound	Topic 2 Viewing experience	Topic 3 Emotional response
1st	food 0.027	hungry 0.058	know 0.027

2nd	noisy 0.024	feel 0.024	hate 0.020
3rd	eat 0.018	make 0.021	video 0.016
4th	look 0.014	watch 0.020	sorry 0.015
5th	loud 0.013	wish 0.020	say 0.013
6th	thing 0.012	mouth 0.015	don't 0.013
7th	talk 0.012	awful 0.013	wanna 0.012
8th	need 0.011	asmr 0.012	mean 0.011
9th	sound 0.010	eat 0.011	people 0.011
10th	gonna 0.010	want 0.010	comment 0.010

In the positive comment of ASMR mukbang content, we found five different topics from the results of topic modeling. Topics include satisfaction, ASMR trigger, food, influencer, and enjoyment. In topic 1, words such as “eat”, “look”, “yummy”, “sound”, “satisfy”, “love”, “start”, “food”, “delicious”, etc were extracted. Especially, the words such as “yummy”, “satisfy”, “love” were extracted with high probability, so we confirm that topic 1 is related to “Satisfaction”. In topic 2, keywords such as “ASMR”, “good”, “like”, “video”, “hungry”, “early”, “tingle”, “trigger”, “best”, “Hunnibe” were extracted. It was confirm that topic 2 is related to “ASMR trigger”. Topic 3 is related to “Food” because the keywords such as “chocolate”, “food”, “want”, “rice”, “cream”, “nice”, “like”, “comment”, favorite”, etc were extracted with high probability. In topic 4, keywords such as “cute”, “mouth”, “think”, “say”, “jelly”, “drink”, “mukbang”, “hear” were extracted. After check the word-cloud of this topic, we confirm that topic 4 is related to “Mukbang influencer”. And topic 5 were extracted with the words such as “watch”, “know”, “people”, “hello”, “come”, “like”, “make”, “want”, “subscribe”, “enjoy”. So, we suggest that this topic is related to “Enjoyment”.

In the negative comments of ASMR mukbang content, we found three different topics from the results of topic modeling. Topics include sound, viewing experience, and emotional response toward ASMR mukbang content. In topic 1, words such as “food”, “noisy”, “eat”, “look”, “loud”, “thing”, “talk”, “need”, “sound”, “gonna” were extracted. After checked the original data and word-cloud, we confirm that this topic is related to the “Sound”. It is complaints of viewers about ASMR triggers those influencers create, as it is somewhat louder or noisier than standard ASMR triggers. Topic 2 is related to viewing experience of viewers toward ASMR mukbang content with some keywords such as “hungry”, “feel”, “make”, “watch”, “wish”, “mouth”, “awful”, “ASMR”, “eat”, “want”. And topic 3 is related to “Emotional response” because the keywords that shows the user’s emotion such as “hate”, “know”, “video”, “sorry”, “say”, “don’t”, “wanna”, “mean”, “people”, “comment” were extracted.

ASMR sponsor content

To analyze the positive and negative topics of user’s comments toward ASMR sponsor content, this study conducted topic modeling based on text mining. In this study, we perform topic modeling multiple times with the results from 3 to 10 topics and then get the results without duplicate topics. After comparing the results, we chose to extract 5 topics from positive comments and extract 3 topics from negative comments. We get most 10 frequency keywords and these words co-occurrence (also called probability) from each topic, the word co-occurrence means that the amount of the word co-occurrence

relation comes from a full corpus which contains many documents or texts. The topic modeling result of ASMR sponsor's positive comments and negative comments have shown in Table 5 and Table 6 as follows:

Table 5. The separated positive topics of ASMR sponsor

Positive comment	Topic-1 influencer	Topic 2 Perceived sponsorship	Topic-3 Emotional response	Topic-4 interest	Topic-5 ASMR trigger
1st	gibi 0.030	like 0.048	thank 0.037	right 0.017	love 0.062
2nd	asmr 0.029	advertise 0.035	nice 0.026	girl 0.014	relax 0.032
3rd	video 0.028	good 0.029	cute 0.015	work 0.013	video 0.023
4th	best 0.020	amazing 0.026	awesome 0.013	favorite 0.013	comment 0.020
5th	time 0.019	look 0.020	cool 0.012	makeup 0.012	beautiful 0.020
6th	watch 0.019	sound 0.018	whisper 0.011	upload 0.011	tingle 0.016
7th	satisfy 0.017	nice 0.016	video 0.010	know 0.011	listen 0.012
8th	love 0.014	hair 0.014	ikea 0.010	perfect 0.011	voice 0.011
9th	wait 0.013	think 0.014	camera 0.010	money 0.011	tap 0.011
10th	great 0.012	product 0.013	like 0.010	gucci 0.010	thank 0.010

Table 6. The separated negative topics of ASMR sponsor

Negative comment	Topic 1 Emotional response	Topic 2 ASMR trigger	Topic 3 Perceived sponsorship
1st	want 0.023	ASMR 0.045	look 0.024
2nd	know 0.019	Gibi 0.034	need 0.019
3rd	look 0.018	watch 0.032	feel 0.018
4th	feel 0.016	relax 0.027	know 0.016
5th	sound 0.015	time 0.017	makeup 0.016
6th	comment 0.014	think 0.013	don't 0.015
7th	hear 0.013	weird 0.013	sound 0.012

8th	don't 0.012	go 0.011	hate 0.011
9th	like 0.010	sorry 0.011	product 0.011
10th	think 0.010	hear 0.010	advertise 0.010

In the positive comment of ASMR tourism content, we found five different topics from the results of topic modeling. These topics are talking about influencer, perceived sponsorship, emotional response, interest, and ASMR trigger. In topic 1, words such as "gibi", "ASMR", "video", "best", "time", "watch", "satisfy", "love", "wait", "great" were extracted. Especially, the words such as "gibi" (influencer's name), "ASMR", were extracted with high probability, so we confirm that topic 1 is related to emotional response to influencer. Topic 2 was confirmed to be related to "perceived sponsorship" because the keywords such as "like", "advertise", "good", "amazing", "look", "nice", "hair", "think", "product" were extracted, by the appearance of "advertise" and "product" keywords, we suggest that topic 2 is related to "perceived sponsorship". In topic 3, keywords such as "thank", "nice", "cute", "awesome", "cool", "whisper", "video", "ikea", "camera", "like" were extracted, through the word-cloud we suggest that this topic is related to "emotional response". Topic 4 was extracted with the keywords such as "right", "work", "favorite", "makeup", "upload", "know", "perfect", "gucci", etc, so we confirm that this topic is related to "interest" while viewing ASMR content. And topic 5 is talking about "ASMR trigger" because the keyword such as "love", "relax", "video", "comment", "beautiful", "tingle", "listen", "voice", "tap", "thank" etc were extracted.

In the negative comments of ASMR sponsor content, we found three different topics from the results of topic modeling. These topics named emotional response, ASMR trigger, and perceived sponsorship. In topic 1, keywords such as "want", "know", "look", "feel", "sound", "comment", "hear", "don't", "like", "think" were extracted. Through the word-cloud, we suggest that this topic is related to "emotional response". Topic 2 was confirmed to be related to "ASMR trigger" because the keywords such as "ASMR", "Gibi" (influencer's name), "watch", "relax", "time", "think", "weird", "go", "sorry", "hear" were extracted. And topic final topic in negative comments of ASMR sponsor content is about "perceived sponsorship" because the keyword such as "look", "need", "feel", "know", "makeup", "don't", "sound", "hate", "product", "advertise" were extracted.

ASMR Tourism content

With the aim to analyze the positive and negative topics of user's comments toward ASMR sponsor content, this study conducted topic modeling based on text mining. In this study, we perform topic modeling multiple times with the results from 3 to 10 topics and then get the results without duplicate topics. After comparing the results, we chose to extract 5 topics from positive comments and extract 3 topics from negative comments. We get most 10 frequency keywords and these words co-occurrence (also called probability) from each topic, the word co-occurrence means that the amount of the word co-occurrence relation comes from a full corpus which contains many documents or texts. The topic modeling result of ASMR sponsor's positive comments and negative comments have shown in Table 7 and Table 8.

Table 5. The separated positive topics of ASMR tourism

Positive comment	Topic-1 Response to channel	Topic 2 Influencer's creative	Topic-3 Place/ background	Topic-4 Content quality	Topic-5 Trip – travel
1st	asmr 0.022	beautiful 0.051	cute 0.018	good 0.026	welcome 0.031
2nd	awesome 0.021	Amazing 0.042	perfect 0.018	watch 0.016	best 0.026

3rd	cool 0.018	Relax 0.026	great 0.017	time 0.013	travel 0.025
4th	vlog 0.018	Like 0.022	say 0.014	work 0.013	girl 0.020
5th	tingle 0.015	Voice 0.018	exciting 0.013	quaility 0.013	miss 0.019
6th	favorite 0.015	Nice 0.018	music 0.012	pretty 0.012	wanna 0.015
7th	hope 0.013	Absolute 0.015	english 0.009	wonder 0.011	series 0.013
8th	look 0.013	creative 0.013	moon 0.009	make 0.010	brilliant 0.012
9th	like 0.012	Incredible 0.011	masterpiece 0.008	life 0.010	book 0.011
10th	channel 0.012	Sound 0.010	background 0.008	night 0.010	accent 0.010

Table 6. The separated negative topics of ASMR tourism

Negative comment	Topic 1 trip	Topic 2 place	Topic 3 Emotional response
1st	miss 0.023	look 0.019	asmr 0.021
2nd	need 0.015	live 0.015	feel 0.016
3rd	hour 0.013	think 0.014	watch 0.013
4th	year 0.012	wanna 0.014	relax 0.012
5th	go 0.012	place 0.012	thank 0.012
6th	trip 0.011	beautiful 0.012	hate 0.011
7th	wish 0.010	know 0.012	work 0.010
8th	wait 0.009	make 0.011	sound 0.008
9th	away 0.009	comment 0.010	tingle 0.008
10th	time 0.009	want 0.010	sorry 0.008

In the positive comment of ASMR tourism content, we found five different topics from the results of topic modeling. Topics include response to channel, influencer's creative, place/background, content quality, and trip-travel. In topic 1, words such as "ASMR", "awesome", "cool", "vlog", "tingle", "favorite", "hope", "look", "like", "channel" were extracted. Especially, the words such as "ASMR", "awesome", "cool", "favorite" were extracted with high probability, so we confirm that topic 1 is related to emotional response to channel and ASMR trigger. Topic 2 was confirmed to related to "influencer's

creative” because the keywords such as “amazing”, “beautiful”, “relax”, “like”, “voice”, “nice”, “absolute”, “creative”, “incredible”, “sound” were extracted, that are the keywords related to the viewer’s praise for the influencer’s creativity. In topic 3, keywords such as “cute”, “perfect”, “great”, “say”, “exciting”, “music”, “english”, “moon”, “masterpiece”, “background” were extracted, through the word-cloud we suggest that this topic is related to “place/background”. Topic 4 is talking about the “content quality” because the keyword such as “good”, “watch”, “time”, “work”, “quality”, “pretty”, “wonder”, “make”, “life”, “night” was extracted. And topic 5 were extracted with the keywords such as “welcome”, “best”, “travel”, “miss”, “wanna”, “series”, “brilliant”, “booking”, “accent” etc, so we confirm that this topic is related to “trip/travel”.

In the negative comments of ASMR tourism content, we found three different topics from the results of topic modeling. these topics named as: trip/travel, place, and emotional response. In topic 1, words such as “miss”, “travel”, “hour”, “year”, “go”, “trip”, “wish”, “wait”, “away”, “time” were extracted. After checked the original data and word-cloud, we confirm that this topic is related to the “trip/travel”. But this topic is not exactly about the negative comments, because these keywords express the regret as well as the desire to experience travel as video content. Topic 2 also expressed a desire to visit the places mentioned in the video with the keywords such as “look”, “live”, “think”, “wanna”, “place”, “beautiful”, “know”, “make”, “comment”, “want”. So, we suggest that this topic is related to “place”. Topic 3 is about the negative emotional response toward ASMR trigger in the video with the keywords such as “ASMR”, “feel”, “watch”, “relax”, “thank”, “hate”, “work”, “sound”, “tingle”, “sorry”.

Comparison of Social Network analysis

Social network means that social members build a network through interaction, and in order to understand specific social phenomena, individual interaction results must be analyzed. In social networks, it is composed of a node, which means a connection entity, and an edge, which means a connection relationship. Nodes can be seen as members of society, and edges can be seen as relationships between individuals and individuals.

Centrality analysis includes degree centrality, closeness centrality, and betweenness centrality (Freeman, 1978). The connection degree centrality is the calculation of the total number of connections connected to a specific node, and the closeness centrality is the average distance between a specific node and other nodes (Freeman, 1978). Through degree centrality we can find the interaction degree of users and content creator (influencer), and closeness centrality shows how lively the discussion is in users’ comments. Betweenness centrality is a measure of a node that plays an intermediary role between a node and a node, and it calculates the frequency at which a specific node is located at the shortest distance between two other nodes (Freeman, 1978), it means that when the betweenness centrality is higher, that means it have more intermediary conversations between each other. We analyzed the degree centrality, closeness centrality, and betweenness centrality of the relationship between the 300 video dates of ASMR content. The result of centrality analysis has shown as follows:

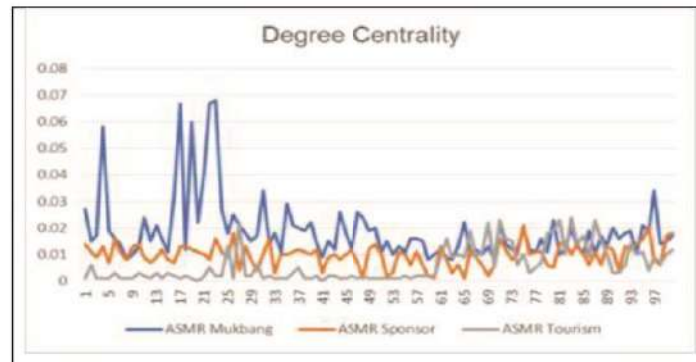


Figure 2. Comparison of Degree Centrality

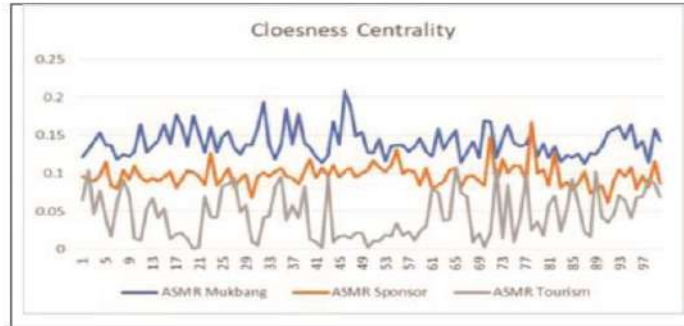


Figure 3. Comparison of Closeness Centrality

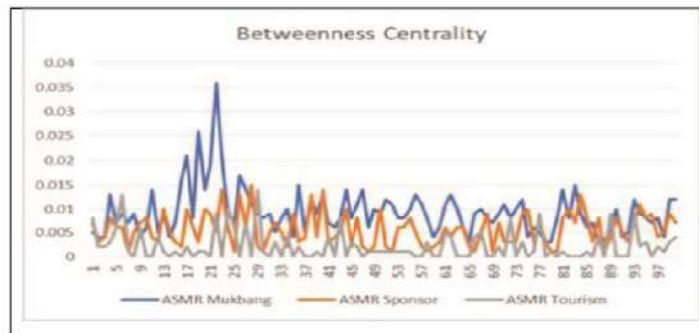


Figure 4. Comparison Betweenness Centrality

Social network means that social members build a network through interaction, and in order to understand specific social phenomena, individual interaction results must be analyzed. In social networks, it is composed of a node, which means a connection entity, and an edge, based on the chart of centrality analysis result, extracted above, ASMR mukbang content has the best communication effect among three types of ASMR content. But the results of comparing the communication effect between ASMR sponsor content and ASMR tourism content have not been clearly shown. So, the statistical analysis methods were applied to compare the difference of communication effect between three types of ASMR content. ANOVA analysis was conducted by classifying ASMR mukbang, ASMR sponsor, and ASMR tourism content into three independent groups to confirm the difference in its communication effect. The result has shown as table7:

Table 7. Comparison of Centrality measures in social network analysis - ANOVA

ANOVA		N	Mean	F	p-value
Degree Centrality	ASMR Mukbang	100	0.01900	63.150	0.000*
	ASMR Sponsor	100	0.00986		
	ASMR Tourism	100	0.00614		

	Total	300	0.01167		
Closeness Centrality	ASMR Mukbang	100	0.14118	458.034	0.000*
	ASMR Sponsor	100	0.09754		
	ASMR Tourism	100	0.04489		
	Total	300	0.09454		
Betweenness Centrality	ASMR Mukbang	100	0.00935	82.958	0.000*
	ASMR Sponsor	100	0.00560		
	ASMR Tourism	100	0.00217		
	Total	300	0.00571		

After comparing centrality's mean by using ANOVA analysis, this study also used Duncan's test - "post-hoc test to estimate particular differences between pairs of means and very liberal in terms of T type" to test the differences in communication effect of three types of ASMR content. The research has shown in Table 8 as follows:

Table 8. The result of Ad-hoc test

Duncan	Type	N	Subset for alpha = 0.05		
			1	2	3
Degree centrality	ASMR Tourism	100	.00614		
	ASMR Sponsor	100		.00986	
	ASMR Mukbang	100			.01900
	Sig.		1.000	1.000	1.000
Closeness centrality	ASMR Tourism	100	.04489		
	ASMR Sponsor	100		.09754	
	ASMR Mukbang	100			.14118
	Sig.		1.000	1.000	1.000
Betweenness centrality	ASMR Tourism	100	.00217		
	ASMR Sponsor	100		.00560	
	ASMR Mukbang	100			.00935
	Sig.		1.000	1.000	1.000

The result showed that ASMR mukbang content has the most powerful communication effect among three types of ASMR content with the high average of degree centrality (0.01900), closeness centrality (0.14118), and betweenness centrality's mean (0.00935). ASMR sponsor content ranked second but the centrality's mean scores are clearly low compare to ASMR mukbang content (degree centrality – 0.00986, closeness centrality – 0.09754, betweenness centrality – 0.00560). ASMR tourism content ranked last with centrality's mean scores of 0.00614 (degree centrality), 0.04489 (closeness centrality), and 0.00217 (betweenness centrality). Based on this, we can confirm that there is a difference in communication effect between the 3 types of ASMR content, among them ASMR mukbang content has the best performance in communication effect, next is ASMR sponsor content, and the last one is ASMR Tourism content.

Artificial Neural network analysis — Multilayer perceptron

Artificial neural network analysis – Multilayer perceptron was conducted to confirm the communication effect through the three centrality indicators of each ASMR content type and it also uses to predict the success in communication effect of these ASMR contents in the future. For the neural network analysis – multilayer perceptron, we imported a total of 300 data from the results of centrality measures in social network analysis from 3 ASMR content type, including 150 test data and 150 training data. In Artificial neural network analysis, precision means the fraction of retrieved documents, recall measures the fraction of the relevant documents that are successfully retrieved, AUC represents the degree or measure of separability (Zhang, 2011). ROC Curves is representing the classification performance of the classifier for the training and test data sets. The classification performance for each label is measured by the area under the ROC curve, the larger the AUC of a specific label, the greater the probability that the label's classification prediction will be correct (Hand, 2009). The result of Artificial neural network analysis – Multilayer perceptron has shown as follows:

Table 9. Summarized accuracy of data sets

Data	# of Total instances	Correctly Classified Instances	Incorrectly Classified Instances	Cohen's kappa coefficient
Test	150	134 (89.33%)	16 (10.67%)	0.84
Training	150	130 (86.67%)	20 (13.33%)	0.8

Table 10. The result of ANN

Data	Class	Precision	Recall	AUC (Area Under ROC Curve)
Test data	MB (ASMR Mukbang)	0.8899	0.96	0.9814
	PS (ASMR Sponsor)	0.9773	0.86	0.9739
	TR (ASMR Tourism)	0.8269	0.86	0.9128
	Weighted Average	0.8977	0.8933	0.956
Training data	MB (ASMR Mukbang)	0.9787	0.92	0.9901
	PS (ASMR Sponsor)	0.9487	0.74	0.9621
	TR (ASMR Tourism)	0.7344	0.94	0.9447
	Weighted Average	0.8873	0.8667	0.9656

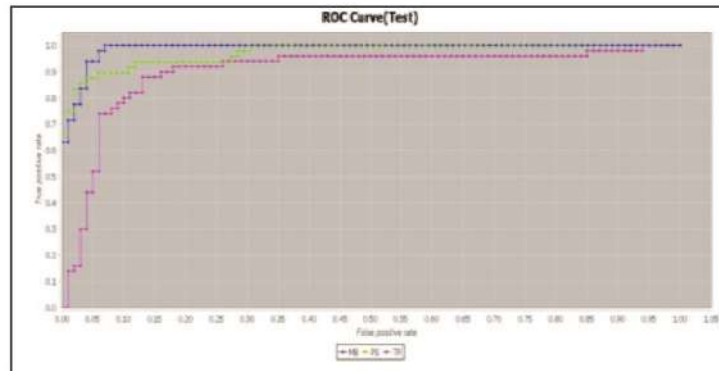


Figure 5. ROC Curve of training data

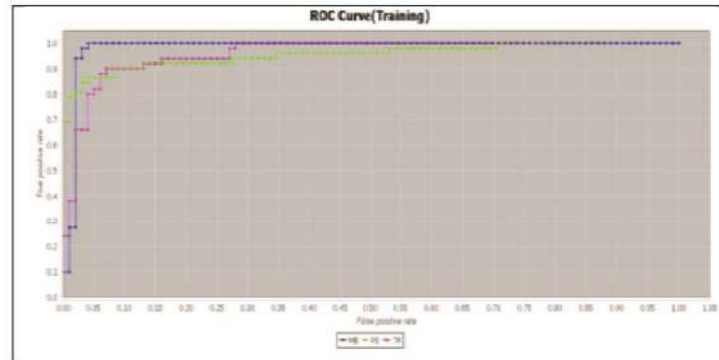


Figure 6. ROC Curve of test data

Table 9 showed that Cohen's kappa coefficients of test data and training data are all over 0.8, which means that both the test data and the training data have high reliability for neural network analysis. The result of multilayer perceptron in Table 10 showed that, the indicators such as precision, recall, AUC are all close to 1, which proves that all 3 possess good communication effect modeling and the result also predicted that three types of ASMR content all will have good performance in terms of communication effect in the future.

Conclusion

Discussion

With the purpose to uncover the echo chamber effect of ASMR marketing content on online user based on user attitude toward 3 types of ASMR content such as ASMR mukbang, ASMR sponsor, and ASMR tourism content and to explore the difference in communication effect between those ASMR content. This study used 4 text-mining methods and 1 statistical analysis method to analyze the results. The research methods including sentiment analysis, topic modeling (LDA), social network analysis, multilayer perceptron, and ANOVA analysis. Through the analysis results, the findings of this study can summarize as follows:

First, by using sentiment analysis, we compare the user attitude towards three types of ASMR marketing content (ASMR Mukbang, ASMR Sponsor, and ASMR Tourism) by divide comments into 2 groups of

positive comments and negative comments. Through the comparison of sentiment score, we found that viewers have a better attitude toward ASMR Tourism content than ASMR Mukbang and ASMR Sponsor content. Second, Five topics from positive comments and three topics from negative comments of each ASMR content type were extracted. The result shows that, in the positive comments group, viewers mostly focused on the ASMR trigger, influencer's creativity, content quality, which confirms that these ASMR content gave them a good viewing experience. And in the negative comments group, viewers show their negative emotional response toward content or ASMR trigger with keywords such as "don't like", "dislike", "hate", "weird", etc. Third, this study compared the difference of communication effect between 3 types of ASMR marketing contents by using social network analysis and ANOVA analysis. The result shows that among three content types, ASMR Mukbang content has the best communication effect, the second is the ASMR sponsor content, and the last is ASMR tourism content. Last, Multilayer perceptron was conducted to predict the success of each ASMR content type in terms of communication effect. The result shows that 3 types of ASMR content have good communication modeling, which means 3 types of ASMR content have a good communication effect, but ASMR mukbang content has the best effectiveness in the viewers' communication process.

Theoretical & Practical Implications

Theoretical Implication:

First, while other research on ASMR content used overview or survey method for research, this study explored the echo chamber effect of ASMR marketing content toward online users by using text-mining methods for analysis. Based on the result, we found that all three types of ASMR have a good echo chamber effect on user. In the field of user's information consumption ASMR Tourism content has the most powerful effectiveness. And in the field of user's public opinion formation ASMR Mukbang content has the most effectiveness.

Second, while many previous studies mainly used survey method to explore the echo chamber effect of a certain problem such as political issues. In this study, we base our definitions of the echo chamber effect and determine that YouTube content such as ASMR can influence viewers' information consumption (user attitude, response, etc) and communication formation through the sentiment analysis, topic modeling and social network analysis.

Third, this study was intended to demonstrate the relational dimension of the social capital theory through the centrality measure in social network analysis and artificial neural network analysis. In previous studies, social capital theory has been confirmed through survey methods, but this study proposed and verified a methodology to measure relational capital through centrality measure in social network analysis to explore the communication effectiveness of social media content creators.

Theoretical Implication:

From a practical perspective, the user's attitude and perception toward ASMR content were explored. Moreover, this study also compared the communication effect of three ASMR content types. It possible to confirm that three types of ASMR marketing content all have good communication effects. Among them, ASMR Tourism content has a better viewer's attitude, and ASMR Mukbang content has a better communication effect than others.

Based on the analysis results, this study provides information on the advertising effectiveness of using ASMR for companies. We divide ASMR content into 3 categories and analyze the viewer's response, attitude and content creator's communication effectiveness. This research helps companies come up with appropriate advertising strategies in each field as well as target different customers. As a marketing strategy, this study also provided information to establish an efficient advertising strategy by using ASMR contents. While ASMR tourism content receives a good attitude from viewers and ASMR mukbang content has the strongest word of mouth effect, ASMR Sponsor content balances those two factors with good audience attitudes and effective word of mouth effect.

Finally, through the structure of social networks formed by the interaction between content creators and viewers, the company can establish a suitable strategy to test user's interaction, so that the company can improve ads performance in terms of word of mouth or communication effect.

Future Study

First, this study only used English comments on YouTube for research. It would be more interesting if future research use comments data from many different languages and combine comparisons with the cultural differences of viewers.

Second, this study mainly focused on three types of ASMR content as ASMR Mukbang, ASMR Sponsor, and ASMR Tourism content. Future research can expand by adding more content categories.

Third, due to the limitation of the API, we can only crawl a maximum of 5,000 comments from each video. Future research can extend by using larger comment data, it can give more detailed result.

References

- Barberá, P., Jost, J. T., Nagler, J., Tucker, J. A., and Bonneau, R. 2015. "Tweeting from left to right: Is online political communication more than an echo chamber?" *Psychological science* (26:10), pp.1531-1542.
- Cinelli, M., Morales, G. D. F., Galeazzi, A., Quattrociocchi, W., and Starnini, M. 2021. "The echo chamber effect on social media." *Proceedings of the National Academy of Sciences* (118:9).
- Chac, H., Baek, M., Jang, H., and Sung, S. 2021. "Story scaping in fashion brand using commitment and nostalgia based on ASMR marketing," *Journal of Business Research* (130), pp. 462-472.
- Dwyer, P. 2007. "Building trust with corporate blogs," *ICWSM* (7), pp.1-8.
- Edwards, A. 2013. "How do participants in online discussion forums create 'echo chambers'? The inclusion and exclusion of dissenting voices in an online forum about climate change," *Journal of Argumentation in Context* (2:1), pp.127-150.
- Freeman, B. 1978. "Is 'YouTube' telling or selling you something? Tobacco content on the YouTube video-sharing website." *Tobacco control* (16:3), pp.207-210.
- Gilbert, E., Bergstrom, T., and Karahalios, K. 2009. "Blogs are echo chambers: Blogs are echo chambers," *Hawaii International Conference on System Sciences IEEE*, pp. 1-10
- Hand, D. J. 2009. "Measuring classifier performance: a coherent alternative to the area under the ROC curve," *Machine learning* (77:1), pp.103-123.
- Kim, S. J. 2018. "Sensory Intimacy of ASMR and its Implications on Gender/Sexuality," *Journal of Social Science* (29:4), pp. 171-196.
- Lee, W. H. 2018. "Mobile Content-type Advertising Trends in Social Media: Focused on Viral Video Advertising on YouTube," *Journal of Korea Design Forum* (59), pp. 107-116.
- Lee, S. H., and Kim, S. B. 2019. "The Boomerang Effect of Influencer Marketing : How the Interaction Between Influencer Type and Social Distance Affects Negative Word of Mouth Intentions," *The Korean Academic Association of Business Administration* (32:11), pp.2005-2028.
- Mutz, D. C. 2013. "Reflections on hearing the other side, in theory and in practice," *Critical Review* (25:2), pp. 260-276.
- Polito, K. 2017. "Intentional Autonomous Sensory Meridian Response: What is it and How Can it Help with Anxiety?" Retrieved from <https://inpathybulletin.com/intentionalautonomous-sensory-meridian-response-can-help-anxiety>
- Stark, B., Stegmann, D., Magin, M., and Jürgens, P. 2020. "Are algorithms a threat to democracy? The rise of intermediaries: A challenge for public discourse. Berlin: AlgorithmWatch," *Zugegriffen* (30).
- Zhang, S. 2011. Impact sensitive ranking of structured documents.
- Zimmer, F., Scheibe, K., Stock, M., and Stock, W. G. 2019. "Fake news in social media: Bad algorithms or biased users?" *Journal of Information Science Theory and Practice* (7:2), pp. 40-53.

D1.6 Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI) for e-Commerce: Is E-Commerce Ready for the Metaverse?

S. Venus Jin

Northwestern University in Qatar

E-mail: venus.jin@northwestern.edu

Abstract

In light of a wide spectrum of efficacies and benefits of virtual reality (VR), augmented reality (AR), mixed reality (MR), and artificial intelligence (AI) for e-commerce, this paper provides an updated literature review (recent research published mostly between 2019 and 2022) on the current status and the potential of VR, AR, MR, and AI for e-commerce. The present article also discusses implications of the AI-VR-Convergence for the future of e-commerce, virtual commerce (v-commerce), and social commerce (s-commerce).

Keywords: Virtual Reality, Augmented Reality, Artificial Intelligence, VR Ecosystem, The VR-AI-Convergence, Social Commerce, Virtual Commerce; Metaverse

[DAY 2]

E1 [ICEC-Paper Session]
Economic Analysis of IT

E1.1 Can the Cross-border eCommerce Platform Mitigate the Sellers' Risks?

Yingjian Liu, Jae Kyu Lee, Shan Liu
Xi'an Jiaotong University

Extended Abstract

The risk factors for Cross-border eCommerce (CBEC) were mostly studied from the buyer's perspective, and little studies were done from the seller's perspective. Thus, we develop a framework of risk management from the seller's perspective: Risk Identification, Risk Assessment, Risk Mitigation through CBEC Platform.

1. Risk Identification and Assessment

To identify the risk factors that sellers would experience in the process of CBEC (Figure 1), we conducted a comprehensive literature review about general seller's risks (Table 1), and specified the CBEC-relevant risks along the supply chain of CBEC in three stages: Pre-sale, On-sale and After-sale stages (Table 2). To validate these identified risks, we interviewed with 12 sellers who work in CBEC business.

To organize these risk factors, we adopt a Socio-Technical System Model that consists of Social System Risks (with four factors) and Technical System Risks (with two factors) as Figure 2. Four factors in Social System Risks are Buyer-Originated Risk, Seller-Originated Risks, Relationship Risks and Business Environment Risks. Two factors in Technical System Risks are Cross-border Payment Risk and Cross-border Delivery Risk. So the risks identified in Table 2 are mapped into these factors as Table 3. Furthermore, to investigate which risk factors are most sensitive, we assess the impact of different types of risks on seller performance.

2. Risk Mitigation through CBEC Platform

To understand the potential of mitigating the risks through the services of CBEC Platforms, we explored the services of leading CBEC Platforms in China: DHgate.com, AliExpress and Amazon. These platforms provide various service support for the sellers, so as to reduce the negative impact of risks faced by sellers. For example, seller training is provided to help sellers online CBEC skills, logistics services to help sellers reduce logistics risk, and so forth. Their roles are evaluated in terms of Platform Quality which can be measured in three dimensions: Information Quality, Service Quality and System Quality. They become the Moderating Variables in the Socio-Technical System Model in Figure 2. Control Variables are Buyer Type (B2B or B2C), Exporting region, Product type, Seller Size, and Seller's past experience.

- Dependent Variables: Seller Performance
- Independent Variables:
 - 1) Social Systems Risk
 - ① Buyer-Originated Risk
 - ② Seller-Originated Risk
 - ③ Relationship Risk
 - ④ Business Environment Risk
 - 2) Technical System Risk
 - ① Cross-border Payment Risk
 - ② Cross-border Delivery Risk
- Moderating Variables:

- 1) CBEC Platform Quality
 - ① Service Quality
 - ② System Quality
 - ③ Information Quality
- 2) CBEC Platform Sensitivity
 - ① DHgate.com
 - ② Amazon
- Control Variables
 - 1) Buyer Type (B2B or B2C)
 - 2) Exporting region
 - 3) Product type
 - 4) Seller Size
 - 5) Seller's past experience

3. Measurement Development

To measure the risk perception of sellers about the risks, the metrics are defined in Table 5. Questionnaires are developed to conduct the survey.

4. Data Collection and Analysis

We will conduct the survey with 300 Chinese sellers who used DHgate.com or Amazon. The respondents are invited at the CBEC Platform online community sites with incentive of report sharing and some financial reward.

To estimate the model, the estimation method PLS will be mainly used.

5. Expected Outcomes

We expect to obtain answers to the following questions.

- 1) Which risk factors are most critical to the CBEC sellers in China?
- 2) What are the levels of risks that the CBEC sellers in China experience?
- 3) What are the benefits of CBEC platform in mitigating the sellers risks in China?
- 4) What are the sensitivities of sellers' risks by Buyer Type (B2B or B2C), Export Region, and Product Types?

6. Final Version

The final version will be submitted with full paper version.

Figures, Tables & Captions

Figure 1. Cross-border Electronic Commerce Process

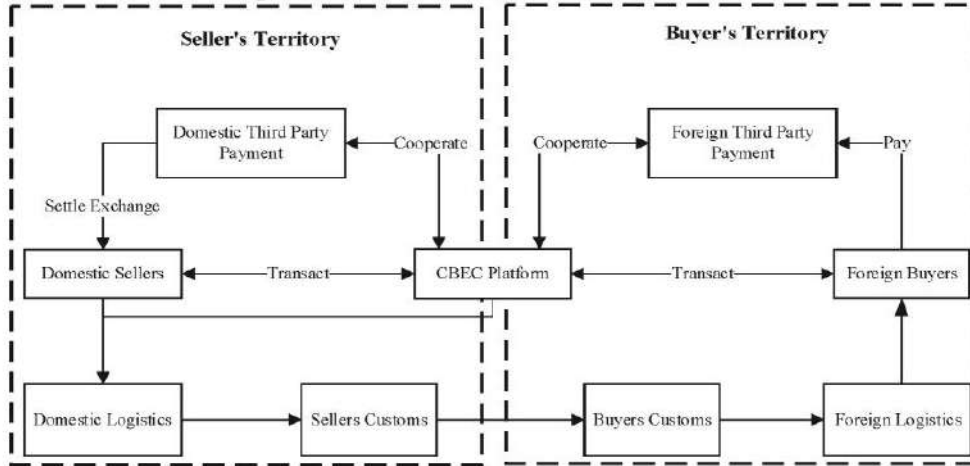


Figure 2. Socio-Technical System Model for Seller's Risks Management at CBEC

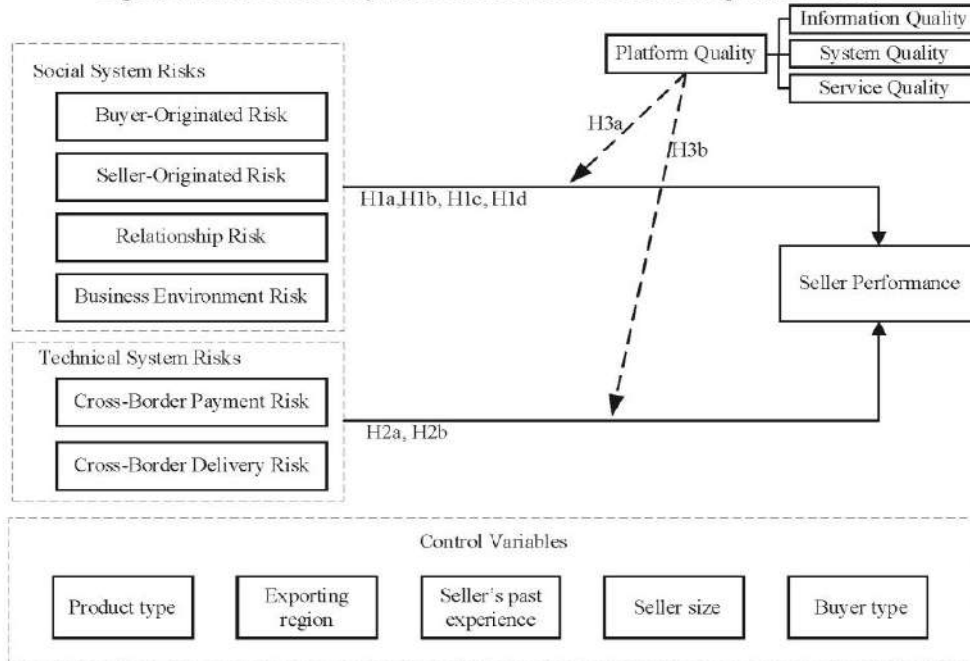


Table 1. Literature about Seller Risks during Cross-border e-Commerce

Main Process	Seller's Risk	Risk Description	Reference	
Pre-sale	Account Registration	-		
	Identity Authentication	-		
	Display Product Information	Product performance risk	A series of risks caused by the inability of product performance to meet the needs of overseas consumers, such as product quality risk, stocking and unsalable risk, etc.	(Zhou et al., 2018)
		Product description risk	The product content description is difficult to understand, which makes consumers unable to obtain product details, thus reducing their purchase intention.	(Zhu et al., 2019)
On sale	Taking Order	Communication risk	A series of risks caused by the lack of effective communication between the buyer and the seller, such as trust risk	(Cui et al., 2020)
	Order to Deliver	Logistics risk	A series of risks caused by long-distance cross-border transportation, such as wrong delivery, commodity damage and other risks	(Hong, 2015; Hong and Cha, 2013)
	Customs Clearance	Customs risk	A series of risks caused by the uncertainty of customs clearance at home and abroad, such as the risk of Customs confiscation	(Mou et al., 2020a)
	Payment	Cross border payment risk	Risks caused by payment uncertainty, such as exchange rate risk, payment security risk, etc	(Wu et al., 2021)
After sale	After Sales Disputes	-		
	Chargeback fraud	Chargeback fraud risk	A series of risks caused by the buyer's opportunistic behavior, such as the risk of chargeback fraud	(Guo et al., 2018)
Whole process	Environment risk	Uncontrollable risks caused by uncertain external environment, such as natural disasters (COVID-19, etc.), political public opinion risks (HM events), and platform anti-monopoly risks.	(Du et al., 2019)	
	Violation risk	Risks caused by the seller's violation of cross-border e-commerce platform rules or national laws and regulations	(Farhoomand et al., 2000)	

Main Process	Seller's Risk	Risk Description	Reference
		of the buyer and the seller, such as intellectual property risk, infringement of consumer privacy and other risks	

Table 2 Identified Seller's Risk during Cross-border e-Commerce Process

Main Process	Process Description	Risk Type
Pre-sale	Account Registration	The seller can register the account by setting the user name, login password and other information, and then completing the mobile phone and email authentication.
	Identity Authentication	According to the e-commerce law of the people's Republic of China, the seller shall submit its identity, address, contact information, administrative license and other true information to the platform, which shall be verified, registered, archived and updated regularly.
	Display Product Information	After identity authentication, the seller can upload products through the platform. The uploaded information mainly includes product basic information (title, basic attributes, specifications), product sales information (sales method, stock status, product price, etc.), product content description (product picture, detailed description, etc.), etc. after passing the platform audit, the products can be put on the shelf, otherwise they cannot be put on the shelf.
On-sale	Order Taking	Communication between the buyer and the seller, and finally the buyer take the order
	Delivery	After the buyer take an order, the seller shall deliver the products properly the buyer

5

Main Process	Process Description	Risk Type
		<ul style="list-style-type: none"> ● Delivery cost
Customs Clearance	During the delivery, it is necessary to complete customs inspection and other related work through domestic and foreign customs systems	<ul style="list-style-type: none"> ● In the process of customs clearance, it may be impossible to pass the customs due to some reasons
Payment	After the products are properly delivered, the seller transfers the money paid by the buyer for the products to its own account with the help of the cross-border payment platform, so as to return the order funds	<ul style="list-style-type: none"> ● Fake in payment (Chargeback) ● During this process, there are exchange rate fluctuations which may cause loss.
After-sale	After Sales Disputes	<ul style="list-style-type: none"> ● After the goods are delivered, the buyer may carry out complaints, disputes, evaluation, etc. ● If the buyer's after-sales disputes are not handled in time, the seller may face a series of problems, such as platform punishment, reputation decline and so on
	Guaranteed Return	<ul style="list-style-type: none"> ● Buyer was not satisfied with the delivered product, and decide to return ● High return rate
	Chargeback Fraud	<ul style="list-style-type: none"> ● Within a certain period of time after payment, the buyer applies to the bank for refusing to pay a transaction on the bill ● Buyers request a refund without returning the item to the seller, usually based on some unfounded excuse such as "products not delivered" or "transaction are unauthorized"

Table 3. Seller's Risks mapped into the Socio-Technical System Model

Risk	Risk Description	Covered Risks
Social system risk	Buyer-Originated Risk	Chargeback fraud risk
	Seller-Originated Risk	Violation risk, product performance risk, product description risk, product homogenization
	Relationship risk	Communication risk, After-sales dispute risk
	Business Environment Risk	Policy adjustment risk, violation risk, black swan event
Technical system risk	Cross-border delivery risk	Package loss, commodity damage, customs confiscation, delivery failure, etc
	Cross-border payment risk	Payment security risk and exchange rate fluctuation risk

Table 4 Measurement to Survey

Constructs	Item	Derived Measurements	References	
Social Systems Risk (SSR)	Buyer-Originated Risk (BOR)	BOR1	A considerable chargeback fraud risk involved in selling goods to buyers.	(Guo et al., 2018)
		BOR2	A high potential for chargeback fraud involved in selling goods to buyers.	
		BOR3	The high potential for chargeback fraud caused the loss of sellers' net benefits.	
	Seller-Originated Risk (SOR)	SOR1	Sellers not familiar with the platform regulation and related legal policies.	(Liu et al., 2019)
		SOR2	Sellers lack specialized skills and knowledge required by the trade.	
		SOR3	Inexperienced sellers.	
		SOR4	Sellers lack of commitment to their operation	
	Relationship Risk (RP_R)	RP_R1	Conflict among buyers and sellers	(Liu et al., 2019)
		RP_R2	Lack of mutual trust between buyers and sellers	
		RP_R3	Ineffective communication between buyers and sellers	
		RP_R4	Poor relationship between buyers and sellers	
	Business Environment Risk (BER)	BER1	Change in platform regulation and related legal policies during sellers' operation	(Wallace et al., 2004; Zhang et al., 2018)
		BER2	Changed Platform regulation and related legal policies with negative effect on cross-border trade	
BER3		Uncertain political and economic environment		
Technical System Risk (TSR)	Cross-border Payment Risk (CBPR)	CBPR1	Sellers' transaction information will be hacked.	(Mou et al., 2020)
		CBPR2	Hackers or viruses caused by security lapses of operation system or online payment tools.	
		CBPR3	Sellers' account information will be illegally used.	
		CBPR4	The payment platform cannot work properly.	
		CBPR5	Change in currency during sellers' operation	
		CBPR6	Changed currency with negative effect on cross-border trade	
	Cross-border Delivery Risk (CBDR)	CBDR1	Product would be delivered to the wrong address.	(Mou et al., 2020)
		CBDR2	Product would be lost during delivery.	
		CBDR3	A wrong product would be delivered.	
		CBDR4	The product would be intercepted by authorities in sellers' or buyers' countries before they reach buyers.	
		CBDR5	The product would be confiscated by authorities in sellers' or buyers' countries without compensation.	
		CBDR6	High risk that products will be confiscated.	
		CBDR7	The product will not clear customs (e.g., difference in product price, no invoice).	
Information Quality (InfQ)	InfQ1	This CBEC platform provides me with the precise information I need.	(Wang et al., 2016)	
	InfQ2	The information content provided by this CBEC platform meets my needs.		
	InfQ3	I think the information content provided by this CBEC platform is reliable.		
	InfQ4	This CBEC platform provides me with up-to-date information.		
Service Quality (SerQ)	SerQ1	When I have a problem, this CBEC platform shows a sincere interest in solving my problem	(Wang et al., 2016)	
	SerQ2	This CBEC platform service is always willing to help me		

Constructs	Item	Derived Measurements	References
	SerQ3	I feel safe in my transactions with this CBEC platform service in terms of security and privacy protection.	
	SerQ4	This CBEC platform service has the appropriate knowledge to answer my questions	
	SerQ5	This CBEC platform service gives me individual attention.	
	SerQ6	This CBEC platform service understands my specific needs.	
System Quality (SysQ)	SysQ1	It is easy to use this CBEC platform	(Wang et al., 2016)
	SysQ2	The interfaces of this CBEC platform are user friendly	
	SysQ3	It is easy for me to become skillful at using this CBEC platform	
	SysQ4	I find it easy to get this platform to do what I want it to do.	
Seller Performance (SP)	SP1	How would you rate the overall performance of your CBEC operations?	(Wade and Nevo, 2005)
	SP2	How would you evaluate the return on investment for your CBEC operations?	

References

- Ai, W., Yang, J., and Wang, L. 2016. "Revelation of Cross-Border Logistics Performance for the Manufacturing Industry Development," *International Journal of Mobile Communications* (14:6), pp. 593-609.
- Anic, I.-D., Škare, V., and Kursan Milaković, I. 2019. "The Determinants and Effects of Online Privacy Concerns in the Context of E-Commerce," *Electronic Commerce Research and Applications* (36), p. 100868.
- Anshari, M., Almunawar, M. N., and Lim, S. A. 2021. "Cross-Border E-Commerce and Small Medium Enterprises (Smes)," in *Cross-Border E-Commerce Marketing and Management*. pp. 273-284.
- Begum, N. N., and Hassan, M. M. 2021. "Cross-Border E-Commerce Payments," in *Cross-Border E-Commerce Marketing and Management*. pp. 78-97.
- Bingi, P., Mir, A., and Khamalah, J. 2000. "The Challenges Facing Global E-Commerce," *Information Systems Management* (17:4), pp. 22-30.
- Bostrom, R., and Heinen, J. 1977a. "Mis Problems and Failures: A Socio-Technical Perspective. Part I: The Causes," *MIS Quarterly* (1:3), pp. 17-32.
- Bostrom, R. P., and Heinen, J. S. 1977b. "Mis Problems and Failures: A Socio-Technical Perspective, Part II: The Application of Socio-Technical Theory," *MIS Quarterly* (1:4), pp. 11-28.
- Chen, Y.-S., and Huang, S. Y. B. 2017. "The Effect of Task-Technology Fit on Purchase Intention: The Moderating Role of Perceived Risks," *Journal of Risk Research* (20:11), pp. 1418-1438.
- Chiu, C.-M., Chiu, C.-S., and Chang, H.-C. 2007. "Examining the Integrated Influence of Fairness and Quality on Learners' Satisfaction and Web-Based Learning Continuance Intention," *Information Systems Journal* (17:3), pp. 271-287.
- Chiu, C. M., Wang, E. T. G., Fang, Y. H., and Huang, H. Y. 2014. "Understanding Customers' Repeat Purchase Intentions in B2c E-Commerce: The Roles of Utilitarian Value, Hedonic Value and Perceived Risk," *Information Systems Journal* (24:1), pp. 85-114.
- Connolly, R., and Bannister, F. 2007. "Consumer Trust in Electronic Commerce: Social & Technical Antecedents," *World Academy of Science, Engineering and Technology* (34), pp. 239-248.
- Crespo, A. H., del Bosque, I. R., and de los Salmones Sánchez, M. M. G. 2009. "The Influence of Perceived Risk on Internet Shopping Behavior: A Multidimensional Perspective," *Journal of Risk Research* (12:2), pp. 259-277.
- Cui, Y., Mou, J., Cohen, J., and Liu, Y. 2019. "Understanding Information System Success Model and Valence Framework in Sellers' Acceptance of Cross-Border E-Commerce: A Sequential Multi-Method Approach," *Electronic Commerce Research* (19:4), pp. 885-914.
- Cui, Y., Mou, J., Cohen, J., Liu, Y., and Kurcz, K. 2020. "Understanding Consumer Intentions toward Cross-Border M-Commerce Usage: A Psychological Distance and Commitment-Trust Perspective," *Electronic Commerce Research and Applications* (39).
- Dai, Y., Viken, G., Joo, E., and Bente, G. 2018. "Risk Assessment in E-Commerce: How Sellers' Photos, Reputation Scores, and the Stake of a Transaction Influence Buyers' Purchase Behavior and Information Processing," *Computers in Human Behavior* (84), pp. 342-351.

- DeLone, W. H., and McLean, E. R. 1992. "Information Systems Success: The Quest for the Dependent Variable," *Information Systems Research* (3:1), pp. 60-95.
- DeLone, W. H., and McLean, E. R. 2003. "The Delone and Mclean Model of Information Systems Success: A Ten-Year Update," *Journal of Management Information Systems* (19:4), pp. 9-30.
- DeLone, W. H., and McLean, E. R. 2004. "Measuring E-Commerce Success: Applying the Delone & Mclean Information Systems Success Model," *International Journal of Electronic Commerce* (9:1), pp. 31-47.
- Du, S., Li, H., and Sun, B. 2019. "Hybrid Kano-Fuzzy-Dematel Model Based Risk Factor Evaluation and Ranking of Cross-Border E-Commerce Smes with Customer Requirement," *Journal of Intelligent Fuzzy Systems* (37:6), pp. 8299-8315.
- Dutta, P., Suryawanshi, P., Gujarathi, P., and Dutta, A. 2019. "Managing Risk for E-Commerce Supply Chains: An Empirical Study," *IFAC-PapersOnLine* (52:13), pp. 349-354.
- Fang, Y. H., Chiu, C. M., and Wang, E. T. G. 2011. "Understanding Customers' Satisfaction and Repurchase Intentions," *Internet Research* (21:4), pp. 479-503.
- Farhoomand, A. F., Tuunainen, V. K., and Yee, L. W. 2000. "Barriers to Global Electronic Commerce: A Cross-Country Study of Hong Kong and Finland," *Journal of organizational computing electronic commerce* (10:1), pp. 23-48.
- Fortes, N., Rita, P., and Pagani, M. 2017. "The Effects of Privacy Concerns, Perceived Risk and Trust on Online Purchasing Behaviour," *International Journal of Internet Marketing and Advertising* (11:4), pp. 307-329.
- Gessner, G. H., and Snodgrass, C. R. 2015. "Designing E-Commerce Cross-Border Distribution Networks for Small and Medium-Size Enterprises Incorporating Canadian and U.S. Trade Incentive Programs," *Research in Transportation Business & Management* (16), pp. 84-94.
- Ghobakhloo, M., and Tang, S. H. 2015. "Information System Success among Manufacturing Smes: Case of Developing Countries," *Information Technology for Development* (21:4), pp. 573-600.
- Gibbs, J., Kraemer, K. L., and Dedrick, J. 2003. "Environment and Policy Factors Shaping Global E-Commerce Diffusion: A Cross-Country Comparison," *The information society* (19:1), pp. 5-18.
- Glover, S., and Benbasat, I. 2010. "A Comprehensive Model of Perceived Risk of E-Commerce Transactions," *International Journal of Electronic Commerce* (15:2), pp. 47-78.
- Gomez-Herrera, E., Martens, B., and Turlea, G. 2014. "The Drivers and Impediments for Cross-Border E-Commerce in the Eu," *Information Economics and Policy* (28), pp. 83-96.
- Guo, Y., Bao, Y., Stuart, B. J., and Le-Nguyen, K. 2018. "To Sell or Not to Sell: Exploring Sellers' Trust and Risk of Chargeback Fraud in Cross-Border Electronic Commerce," *Information Systems Journal* (28:2), pp. 359-383.
- Hadaya, P. 2008. "Determinants and Performance Outcome of Smes' Use of Vertical B-to-B E-Marketplaces to Sell Products," *Electronic Markets* (18:3), pp. 260-274.
- Han, F., and Li, B. 2020. "Exploring the Effect of an Enhanced E-Commerce Institutional Mechanism on Online Shopping Intention in the Context of E-Commerce Poverty Alleviation," *Information Technology & People*.
- Hong, I. B. 2015. "Understanding the Consumer's Online Merchant Selection Process: The Roles of Product Involvement, Perceived Risk, and Trust Expectation," *International Journal of Information Management* (35:3), pp. 322-336.

- Hong, I. B., and Cha, H. S. 2013. "The Mediating Role of Consumer Trust in an Online Merchant in Predicting Purchase Intention," *International Journal of Information Management* (33:6), pp. 927-939.
- Hoque, M. R., and Bashaw, R. E. 2021. "Cross-Border E-Commerce: An Emerging Norm," in *Cross-Border E-Commerce Marketing and Management*. IGI Global, pp. 1-29.
- Hsieh, M.-T., and Tsao, W.-C. 2014. "Reducing Perceived Online Shopping Risk to Enhance Loyalty: A Website Quality Perspective," *Journal of Risk Research* (17:2), pp. 241-261.
- Huang, W.-L., Hu, P., Tsai, S., and Chen, X.-D. 2021. "The Business Analysis on the Home-Bias of E-Commerce Consumer Behavior," *Electronic Commerce Research* (21:3), pp. 855-879.
- Ilmudeen, A. 2021. "Big Data, Artificial Intelligence, and the Internet of Things in Cross-Border E-Commerce," in *Cross-Border E-Commerce Marketing and Management*. pp. 257-272.
- Jeyaraj, A. 2020. "Delone & Mclean Models of Information System Success: Critical Meta-Review and Research Directions," *International Journal of Information Management* (54), p. 102139.
- Kim, T. Y., Dekker, R., and Heij, C. 2017. "Cross-Border Electronic Commerce: Distance Effects and Express Delivery in European Union Markets," *International Journal of Electronic Commerce* (21:2), pp. 184-218.
- Koh, T. K., Fichman, M., and Kraut, R. E. 2012. "Trust across Borders: Buyer-Supplier Trust in Global Business-to-Business E-Commerce," *Journal of the Association for Information Systems* (13:11), pp. 886-922.
- Li, J., Yao, Y., Xu, Y., Li, J., Wei, L., and Zhu, X. 2019. "Consumer's Risk Perception on the Belt and Road Countries: Evidence from the Cross-Border E-Commerce," *Electronic Commerce Research* (19:4), pp. 823-840.
- Li, J., Zhang, J., Qu, F., and Zhao, Y. 2018. "The Influencing Factors Model of Cross-Border Ecommerce Development: A Theoretical Analysis," *Wuhan International Conference on e-Business: Association For Information Systems*.
- Li, L., Lin, J., Turel, O., Liu, P., and Luo, X. 2020. "The Impact of E-Commerce Capabilities on Agricultural Firms' Performance Gains: The Mediating Role of Organizational Agility," *Industrial Management & Data Systems* (120:7), pp. 1265-1286.
- Liu, S., and Wang, L. 2014. "Understanding the Impact of Risks on Performance in Internal and Outsourced Information Technology Projects: The Role of Strategic Importance," *International Journal of Project Management* (32:8), pp. 1494-1510.
- Liu, S., Xia, F., Gao, B., Jiang, G., and Zhang, J. 2019. "Hybrid Influences of Social Subsystem and Technical Subsystem Risks in the Crowdsourcing Marketplace," *IEEE Transactions on Engineering Management*, pp. 1-15.
- Liu, S., Xia, F., Zhang, J. L., and Wang, L. 2016. "How Crowdsourcing Risks Affect Performance: An Exploratory Model," *Management Decision* (54:9), pp. 2235-2255.
- Ma, S., Chai, Y., and Zhang, H. 2018. "Rise of Cross-Border E-Commerce Exports in China," *China & World Economy* (26:3), pp. 63-87.
- Ma, Y., Ruangkanjanases, A., and Chen, S.-C. 2019. "Investigating the Impact of Critical Factors on Continuance Intention Towards Cross-Border Shopping Websites," *Sustainability* (11:21).
- McCole, P., Ramsey, E., and Williams, J. 2010. "Trust Considerations on Attitudes Towards Online Purchasing: The Moderating Effect of Privacy and Security Concerns," *Journal of Business Research* (63:9-10), pp. 1018-1024.

- Mou, J., Cohen, J., Dou, Y., and Zhang, B. 2020a. "International Buyers' Repurchase Intentions in a Chinese Cross-Border E-Commerce Platform a Valence Framework Perspective," *Internet Research* (30:2), pp. 403-437.
- Mou, J., Cui, Y., and Kurcz, K. 2020b. "Trust, Risk and Alternative Website Quality in B-Buyer Acceptance of Cross-Border E-Commerce," *Journal of Global Information Management* (28:1), pp. 167-188.
- Mou, J., Ren, G., Qin, C., and Kurcz, K. 2019. "Understanding the Topics of Export Cross-Border E-Commerce Consumers Feedback: An Lda Approach," *Electronic Commerce Research* (19:4), pp. 749-777.
- Mou, J., Zhu, W., and Benyoucef, M. 2020c. "Impact of Product Description and Involvement on Purchase Intention in Cross-Border E-Commerce," *Industrial Management & Data Systems* (120:3), pp. 567-586.
- Nicolaou, A. I., and McKnight, D. H. 2006. "Perceived Information Quality in Data Exchanges: Effects on Risk, Trust, and Intention to Use," *Information Systems Research* (17:4), pp. 332-351.
- Nuruzzaman, M., and Weber, A. N. 2021. "Supply Chain in Cross-Border E-Commerce," in *Cross-Border E-Commerce Marketing and Management*. pp. 54-77.
- Pavlou, P. A. 2002. "Institution-Based Trust in Interorganizational Exchange Relationships: The Role of Online B2b Marketplaces on Trust Formation," *Journal of Strategic Information Systems* (11:3-4), pp. 215-243.
- Pavlou, P. A., and Gefen, D. 2004. "Building Effective Online Marketplaces with Institution-Based Trust," *Information Systems Research* (15:1), pp. 37-59.
- Pee, L. G., Jiang, J., and Klein, G. 2018. "Signaling Effect of Website Usability on Repurchase Intention," *International Journal of Information Management* (39), pp. 228-241.
- Petter, S., DeLone, W., and McLean, E. 2008. "Measuring Information Systems Success: Models, Dimensions, Measures, and Interrelationships," *European Journal of Information Systems* (17:3), pp. 236-263.
- Petter, S., and McLean, E. R. 2009. "A Meta-Analytic Assessment of the DeLone and Mclean Is Success Model: An Examination of Is Success at the Individual Level," *Information & Management* (46:3), pp. 159-166.
- Premazzi, K., Castaldo, S., Grosso, M., Raman, P., Brudvig, S., and Hofacker, C. F. 2010. "Customer Information Sharing with E-Vendors: The Roles of Incentives and Trust," *International Journal of Electronic Commerce* (14:3), pp. 63-91.
- Ramanathan, R. 2011. "An Empirical Analysis on the Influence of Risk on Relationships between Handling of Product Returns and Customer Loyalty in E-Commerce," *International Journal of Production Economics* (130:2), pp. 255-261.
- Saona, P., Akther, N., Al Mamun, M. A., and Azad, M. A. K. 2021. "Technologies for Cross-Border E-Commerce," in *Cross-Border E-Commerce Marketing and Management*. pp. 30-53.
- Savrul, M., Incekara, A., and Sener, S. 2014. "The Potential of E-Commerce for Smes in a Globalizing Business Environment," *Procedia - Social and Behavioral Sciences* (150), pp. 35-45.
- Shi, Y., Wang, T., and Alwan, L. C. 2020. "Analytics for Cross-Border E-Commerce: Inventory Risk Management of an Online Fashion Retailer," *Decision Sciences*.
- Tam, C., Loureiro, A., and Oliveira, T. 2020. "The Individual Performance Outcome Behind E-Commerce," *Internet Research* (30:2), pp. 439-462.
- Tan, X., Wang, Y. W., and Tan, Y. 2019. "Impact of Live Chat on Purchase in Electronic Markets: The Moderating Role of Information Cues," *Information Systems Research* (30:4), pp. 1248-1271.

- Thaseen, S., Cherukuri, A. K., Kopparapu, A., and Velu, G. 2021. "Cross-Border E-Commerce Security Issues and Protections," in *Cross-Border E-Commerce Marketing and Management*. pp. 98-119.
- Trist, E. L. 1981. *The Sociotechnical Perspective in Perspectives on Organization Design and Behavior*. Wiley: New York.
- Van Hove, L., and Karimov, F. P. 2016. "The Role of Risk in E-Retailers' Adoption of Payment Methods: Evidence for Transition Economies," *Electronic Commerce Research* (16:1), pp. 27-72.
- Van Slyke, C., Shim, J. T., Johnson, R., and Jiang, J. 2006. "Concern for Information Privacy and Online Consumer Purchasing," *Journal of the Association for Information Systems* (7:6), pp. 415-444.
- Wade, M. R., and Nevo, S. 2005. "Development and Validation of a Perceptual Instrument to Measure E-Commerce Performance," *International Journal of Electronic Commerce* (10:2), pp. 123-146.
- Wallace, L., Keil, M., and Rai, A. 2004. "How Software Project Risk Affects Project Performance: An Investigation of the Dimensions of Risk and an Exploratory Model," *Decision Sciences* (35:2), pp. 289-321.
- Wang, C., and Teo, T. S. H. 2020. "Online Service Quality and Perceived Value in Mobile Government Success: An Empirical Study of Mobile Police in China," *International Journal of Information Management* (52), p. 102076.
- Wang, L., Yang, J., and Yin, S. 2015. "Electronic Commerce International Logistics Performance Influence Factor Analysis," *International journal of mobile communications* (13:5), pp. 498-509.
- Wang, S., Mao, J.-Y., and Archer, N. 2012. "Seller Performance in B2b E-Marketplaces: A Validated Exploratory Model Based on Resource-Based View and Transaction Cost Theories," *International Journal of Networking and Virtual Organisations* (11:3-4), pp. 225-248.
- Wang, W.-T., Wang, Y.-S., and Liu, E.-R. 2016. "The Stickiness Intention of Group-Buying Websites: The Integration of the Commitment–Trust Theory and E-Commerce Success Model," *Information & Management* (53:5), pp. 625-642.
- Wang, Y.-S. 2008. "Assessing E-Commerce Systems Success: A Respecification and Validation of the Delone and Mclean Model of Is Success," *Information Systems Journal* (18:5), pp. 529-557.
- Wang, Y., Jia, F., Schoenherr, T., Gong, Y., and Chen, L. 2020. "Cross-Border E-Commerce Firms as Supply Chain Integrators: The Management of Three Flows," *Industrial Marketing Management* (89), pp. 72-88.
- Wei, K. N., Li, Y. Z., Zha, Y., and Ma, J. 2019. "Trust, Risk and Transaction Intention in Consumer-to-Consumer E-Marketplaces an Empirical Comparison between Buyers' and Sellers' Perspectives," *Industrial Management & Data Systems* (119:2), pp. 331-350.
- Wu, J., Jiang, N., Wu, Z., and Jiang, H. 2021. "Early Warning of Risks in Cross-Border Mobile Payments," *Procedia Computer Science* (183), pp. 724-732.
- Xiaoni, Z., and Prybutok, V. R. 2005. "A Consumer Perspective of E-Service Quality," *IEEE Transactions on Engineering Management* (52:4), pp. 461-477.
- Xu, J., Benbasat, I., and Cenfetelli, R. T. 2013. "Integrating Service Quality with System and Information Quality: An Empirical Test in the E-Service Context," *MIS Quarterly* (37:3), pp. 777-794.

- Xu, X., and Schrier, T. 2019. "Hierarchical Effects of Website Aesthetics on Customers' Intention to Book on Hospitality Sharing Economy Platforms," *Electronic Commerce Research and Applications* (35), p. 100856.
- Yang, Q., Pang, C., Liu, L., Yen, D. C., and Michael Tarn, J. 2015. "Exploring Consumer Perceived Risk and Trust for Online Payments: An Empirical Study in China's Younger Generation," *Computers in Human Behavior* (50), pp. 9-24.
- Zhang, Y., Liu, S., Tan, J., Jiang, G., and Zhu, Q. 2018. "Effects of Risks on the Performance of Business Process Outsourcing Projects: The Moderating Roles of Knowledge Management Capabilities," *International Journal of Project Management* (36:4), pp. 627-639.
- Zhou, L. Y., Wang, W. Q., Xu, J. J., Liu, T., and Gu, J. B. 2018. "Perceived Information Transparency in B2c E-Commerce: An Empirical Investigation," *Information & Management* (55:7), pp. 912-927.
- Zhu, W., Mou, J., and Benyoucef, M. 2019. "Exploring Purchase Intention in Cross-Border E-Commerce: A Three Stage Model," *Journal of Retailing and Consumer Services* (51), pp. 320-330.

E1.2 Research on the Influencing Factors of Cross-border E-commerce Business Incubation from the Perspective of School-enterprise Cooperation

Zheng S.L.^a Du L.^b and Zhou Y.W.^c.

^a*Department of Economic and Management, Zhejiang University of Water Resources and Electric Power*

E-mail: zhengshl@zjweu.edu.cn

^b*Collage of International Education, Zhejiang University of Water Resources and Electric Power*

E-mail: dulik@zjweu.edu.cn

^c*Department of Economic and Management, Zhejiang University of Water Resources and Electric Power*

E-mail: 1322929698@qq.com

Abstract

Along with the Internet economy developing entrepreneurship has become the good choice of college students. However, there are still many problems. School-enterprise cooperation provides a new direction for training students to conduct cross-border e-commerce entrepreneurship. Based on the triple helix theory, it is found that conditions of incubator, school-enterprise cooperation degree, entrepreneurship education and entrepreneurial environment of universities directly affect the success rate of incubator of cross-border e-commerce entrepreneurial projects.

Keywords: University-enterprise cooperation, cross-border e-commerce, business incubation

Introduction

School-enterprise cooperation means that colleges and universities make use of regional industrial advantages, coordinate government relations, and introduce enterprises to cooperate in training talents, which is a high-quality win-win cooperation mode for the purpose of training talents. Business incubation refers to the provision of venues, funds, training and other services for start-ups to promote the steady growth and development of enterprises, with the ultimate goal of improving the success rate of entrepreneurship. Under the background of the government's "mass entrepreneurship and innovation" enabling development, college students are enthusiastic about entrepreneurship. With the promotion of The Belt and Road Initiative strategy, college students find that there is room to enter the cross-border e-commerce market with low threshold in e-commerce entrepreneurship, but the actual process of entrepreneurship is difficult. Exploring the influencing factors of cross-border e-commerce business incubation for college students can promote the integration reform of existing school-enterprise cooperation, better help college students start cross-border e-commerce businesses, reduce the cost of entrepreneurship and improve the success rate of entrepreneurship.

We analyzes the difficulties of college students' business incubation from the perspective of school-enterprise cooperation. Taking the school-enterprise cooperation education mode as the breakthrough, this paper seeks the influencing factors of business incubation of cross-border e-commerce entrepreneurship team under this talent training mode. Under the framework of synergy theory and triple helix theory, we discusses how to maximize the quality of cross-border e-commerce talent

training and the possibility of successful incubation under the mode of school-enterprise cooperation, so as to achieve win-win situation among universities, enterprises and entrepreneurial teams.

Theoretical Background and Research Model

Entrepreneurship Theory

The Theory of Entrepreneurial Synergy

Synergy refers to coordination and cooperation, which is based on resource sharing, cooperation and creation among various subjects, and ultimately the process of realizing value added. Ding et al., (2018) pointed out that if the elements of collaboration are divided differently, there will be different forms of collaboration, and the theory of collaboration must be applied in complex distribution systems. According to the purpose and the main body of this paper, it focuses on the three parts of synergy theory: universities, enterprises and entrepreneurs are all independent factors, which have their own structural characteristics and logical laws in their irregular spontaneous movements. After the external factors break the original equilibrium state, the original factors cooperate with each other to form a new equilibrium state of self-organizing ability. That is to say, entrepreneurship collaborates with universities and enterprises to form a new talent cultivation model and effectively cope with the impact of various external factors on entrepreneurs' entrepreneurship.

Triple Helix Theory

American sociologists Henry Etzkowitz and Loet Leydesdorff applied the triple helix theory of genetics to management and put forward the triple helix theory. The "triple helix" in the triple helix theory refers to the three main bodies of universities, enterprises and governments with different operating mechanisms and objectives. The triple helix mechanism can achieve this goal by effectively combining the forces of the three parties and ultimately benefiting together (Etzkowitz & Leydesdorff, 2000). Zhang et al. (2018) pointed out that the focus of the triple helix theory is to take universities as the central subject of the three subjects and establish a good way to integrate with the market, thus forming a continuous innovation flow and common development. Based on multi-dimensional collaborative entrepreneurship education model, innovative education model to integrate the resources of enterprises with vocational schools and universities, and the model of creating small towns for all, Li (2018) put forward a new three-helix collaborative education model which provides ideas for this study.

Research on School-enterprise Cooperation Model

The concept of school-enterprise cooperation first rose in foreign countries. School-enterprise cooperation initially refers to a simple cooperative educational relationship between universities and enterprises, and then gradually develops into a deep cooperative relationship. At present, scholars generally believe that school-enterprise cooperation originated from Schumpeter's innovation theory. On the basis of Schumpeter's theory, Roswell and Rosberg focus more on universities, enterprises and scientific research institutions, and put forward the innovation theory of school-enterprise cooperation. The main body of domestic scholars' research on school-enterprise cooperation is the government, which is the "invisible hand" to promote the development of school-enterprise cooperation on the basis of universities and enterprises.

The earliest form of school-enterprise cooperation originated from the dual university education model in medieval Germany, and "dual" refers to universities and enterprises. Wang (2019) believes that the dual-system university education model is a model of school-enterprise cooperation. The main feature of this model is that enterprises are the main body. The government regulates and educates people, which emphasizes the delivery of talents for posts. Xi (2018) summarized the foreign school-enterprise cooperation talent cultivation model as education foundation model, university academy of sciences model, industry-university-research model, business incubator model and teaching company model. School-enterprise cooperation in foreign countries has various ways of educating people, rich experience and great achievements in practical application. In the 1980s, based

on Hermann Haken's "synergy theory", domestic scholars put forward a new mode of school-enterprise cooperation matching China's development: the "industry-university-research" combination mode. Chen(2017) summarized school-enterprise cooperation into three modes, namely, order training mode, expert consultation mode and resource sharing mode.

Research on Business Incubation of College Students

Business incubation refers to the provision of conditions for the success of entrepreneurship, so that new ventures can "hatch" and grow up from the initial eggs. The platform that provides these conditions for entrepreneurs can be called business incubator or business incubation base. There are much practice and research in foreign countries, but the role of collaboration between universities and enterprises is neglected. Although business incubation in China started late, and entrepreneurship education in colleges and universities is scattered and weak, lacking a holistic strategic layout (Zheng et al., 2017), it has grasped the links and contradictions between the various subjects. According to their different subjects, there are three representative modes of incubation organization.

Public Incubator Model Led by Government

This incubation mode is generally led by the state and local governments, mainly in the form of incubation base, entrepreneurship park, public space and so on. Xu (2019) believes that this model does not aim at making profits, but mainly provides operating funds for incubators through financial funds. The park rents the workstation to college entrepreneurs at a very low price and provides college students with the infrastructure for the survival of enterprises. Therefore, college students can also receive policy-related information as soon as possible.

Private Sector-led Creative Incubator Model

Creative incubators are generally invested by private or private enterprises, employing entrepreneurs and professionals to incubate businesses, providing technical and financial support, the most important of which is the investment resources, based on the investment returns of the growth of new enterprises. Li (2020) found that the number of private incubators is growing rapidly. It accounts for more than 60% of all types of incubators and has become the main force to promote the development of business incubation. The main form is that after the entrepreneurship team of college students finds the opportunity of entrepreneurship, through the professional evaluation of the incubation team, it judges whether it is feasible and jointly forms a new enterprise with it.

Enterprise-led Business Incubation Model

Enterprise-led business incubation model means that enterprises invest to provide practice places for college students, and college students grow rapidly through the initial stage of entrepreneurship with the help of enterprise resources. Enterprises profit from new enterprises created by college students, with the goal that college students' entrepreneurship team can achieve breakthroughs and innovations on the platform in the future and bring new technologies to enterprises. In practice, the actual combat room of cross-border e-commerce projects is a type of incubation mode. Schools provide teaching and training venues, and cross-border e-commerce enterprises provide products and platform accounts, so as to enhance the operation ability of students' cross-border e-commerce platforms, and ultimately provide students with jobs or entrepreneurship projects.

Research Model

School-enterprise cooperation incubates cross-border e-commerce entrepreneurship for college students, which provides a variety of support conditions for college students and effectively improves the success rate of entrepreneurship. But due to the many roles involved in the process, there are still uncertainties about success. Based on the triple helix theory and synergetic theory, this study takes universities, enterprises and governments as three main bodies with different operating mechanisms and objectives. The government, as the "invisible hand", focuses on taking universities as the central subject of the three subjects and cooperating with enterprises to establish a good way to connect with

the market, thus forming a continuous innovation flow, combining with the theory of innovation and entrepreneurship, acting on business incubation and promoting entrepreneurship. Finally, we can achieve the goal of improving the success rate of college students' business incubation. Accordingly, the role relationship diagram of college students' cross-border e-commerce business incubation process from the perspective of school-enterprise cooperation is put forward (Figure 1).

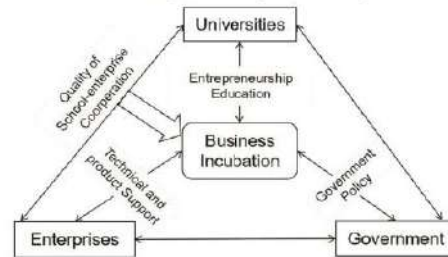


Figure 1. Role Relationship of College Students' Cross-border E-commerce Business Incubation Process from the Perspective of School-enterprise Cooperation

Under the school-enterprise cooperation talent training mode, we use questionnaire survey and factor analysis to analyze the current situation of cross-border e-commerce business incubation, and try to find which factors influence the business incubation success. At the same time, it explores how school-enterprise cooperation can create the best conditions for college students to start their own businesses and maximize the quality of cross-border e-commerce personnel training and the possibility of successful business incubation, as far as possible to achieve mutual benefit and win-win situation among universities, enterprises and students. Based on the above documents, in this study, the factors are summarized into five categories: college students' entrepreneurial ability, entrepreneurial environment, entrepreneurial education, school-enterprise cooperation and incubator conditions.

Research design

Data and sampling

In this study, the subjects of the questionnaire are college students who are engaged in entrepreneurship or college students who have graduated within five years. Because the respondents were scattered and considering the representativeness of the sample, the questionnaire was distributed online. A total of 367 questionnaires were distributed and 367 were recovered, with a recovery rate of 100%. The respondents covered 45 cities in 22 provinces. Therefore, the non-cross-border e-commerce entrepreneurship questionnaire was eliminated, and 127 valid questionnaires were finally obtained, accounting for 34.6% of the total number of questionnaires.

According to the sample analysis, when college students start cross-border e-commerce business, the entrepreneurial team is more inclined to be sales-oriented, and the proportion of school-enterprise cooperation participating in the incubation of entrepreneurial team reaches 45.67%. The vast majority of college students have participated in entrepreneurship training, practice or other related activities organized by the school. It can be said that school-enterprise cooperation plays an important role in the process of college students' business incubation.

Variable Measurements

The results of business incubation are measured by entrepreneurial performance, which should comprehensively reflect the effectiveness of the organization and its operational effects from a multi-dimensional perspective (Cai et al., 2014). This study refers to the research results of Cai et al., (2014), Cavazos et al., (2012) and Yang(2020). The measurement scale consists of six items, including staff turnover rate, capital situation, profit margin, return on investment, brand recognition and product service quality. The influencing factors of business incubation refer to the relevant literature at home

and abroad. Wang(2016) summarized the influencing factors of business incubation into six aspects: entrepreneur characteristics, entrepreneurial resources, entrepreneurial strategy, entrepreneurial environment and entrepreneurial performance. Referring to the scale, the scale consists of 25 items from five dimensions: entrepreneurial ability, entrepreneurial environment, entrepreneurial education, enterprise cooperation and business incubation base. The Likert five-point scale method was used in all scales, and 1-5 represented the degree of conformity from low to high, with positive scoring.

Data Analysis and Results

Reliability and Validity Analysis

The reliability of 127 sample data was analyzed, and the Cronbach α coefficient of each variable in the model was shown in Table 1, with the minimum coefficient of 0.681 and the maximum coefficient of 0.724, indicating that the consistency of each variable was good and passed the reliability test. The KMO values were greater than 0.7, and the Bartlett test significance was 0. Exploratory factor analysis was conducted on all items, and the two principal components of entrepreneurial performance explained 65.292% of the total variance. All the items of the influencing factors fall into the corresponding five factors, which can explain 71.768% of the total variance. According to the principle that each item is only in one factor and the load is more than 0.5, four items are deleted, namely, "entrepreneurs have rich professional theoretical knowledge of cross-border e-commerce", "entrepreneurs have strong ability to identify and grasp opportunities", "newly established companies have access to new research and new technologies", and "predict the behavior of competitors". The five factors respectively represent entrepreneurial ability, entrepreneurial environment, entrepreneurial education, business cooperation and business incubation base.

Table 1 Results of Reliability Test (n = 127)

Project	Cronbach α coefficient	KMO	Bartlett probability of significance
Entrepreneurial performance	0.708	0.717	0.000
Entrepreneurial ability	0.715		
Entrepreneurial environment	0.681		
Entrepreneurship education	0.716	0.882	0.000
School-enterprise cooperation	0.697		
Business incubation base	0.724		

Results of the Regression Analyses

There is a significant positive statistical correlation between the business incubation and the five factors($p<0.01$) through Pearson correlation analysis(Table 2) and the hypothesis are preliminarily accepted.

Table 2. Pearson correlation analysis

		Conditions of Business Incubation Base	School-enterprise cooperation	Entrepreneurship education	Entrepreneurial environment	Entrepreneurial ability
Business incubation	Correlation Coefficient	0.514**	0.402**	0.487**	0.444**	0.392**
	P-value	0.000	0.000	0.000	0.000	0.000

* $p<0.05$ ** $p<0.01$

The five dimensions of entrepreneurial ability, entrepreneurial environment, entrepreneurial education, enterprise cooperation and business incubation base conditions are used as independent variables,

which are represented by H1, H2, H3, H4 and H5 respectively, while the cross-border e-commerce business incubation is used as a dependent variable for regression analysis. Y is used to represent cross-border e-commerce business incubation, and a multiple linear regression model is established as follows:

$$Y = a + bH1 + cH2 + dH3 + eH4 + fH5 + \varepsilon$$

ε Is the random error, and a, B, C, d, e and f are the model parameters. The main task of this regression analysis is to calculate and estimate the unknown model parameters in the multiple linear regression equation and analyze them.

Using Pearson correlation analysis, the relationship between cross-border e-commerce business incubation and entrepreneurial ability, entrepreneurial environment, entrepreneurial education, enterprise cooperation and business incubation base all showed significant. On the premise of independent variables and dependent variables, the multiple linear regression model was used for regression analysis(table 3).

Table 3. Results of linear regression analysis (n = 127)

	Non-normalized coefficient		Normaliza tion factor	t	p	VIF	R ²	Adjust R ²	F
	B	Standard error	Beta						
a	1.212	0.295	-	4.105	0.000**	-			
H1	0.097	0.123	0.090	0.789	0.432	2.224			
H2	0.168	0.127	0.189	1.321	0.041	2.522	0.741	0.712	F(5, 121)=25.184,
H3	0.268	0.114	0.277	2.342	0.021*	2.363			p=0.000
H4	0.274	0.128	0.279	2.141	0.034*	2.815			
H5	0.277	0.138	0.281	2.009	0.047*	3.303			

Dependent variable: entrepreneurship performance; * p < 0.05, ** p < 0.01

As can be seen from the above table, the R value of the model is 0.741, which means that entrepreneurial ability, entrepreneurial environment, entrepreneurial education, enterprise cooperation and business incubation base conditions can explain 74.1% of the changes in cross-border e-commerce business incubation. The model passed the F test (F = 25.184, p = 0.000 < 0.05). It shows that entrepreneurial ability, entrepreneurial environment, entrepreneurial education, enterprise cooperation and business incubation base conditions will have an impact on cross-border e-commerce business incubation, and the regression effect is significant. Make Y means cross-border e-commerce business incubation. After calculation, ε approximates zero and can be neglected. The multiple linear regression equation is established according to the model as follows:

$$Y = 1.212 + 0.097 * H1 + 0.168 * H2 + 0.268 * H3 + 0.274 * H4 + 0.277 * H5$$

The influence intensity from strong to weak on the success of college students' incubation and entrepreneurship is the conditions of business incubation base, the degree of school-enterprise cooperation, university entrepreneurship education, entrepreneurship environment and entrepreneurship ability.

Conclusions and Recommendations

Conclusions

In cross-border e-commerce entrepreneurship under the school-enterprise cooperation mode, the starting point ability of college students is no longer important. For cross-border e-commerce start-ups, the entrepreneurial ability of college students does not significantly affect business incubation, which is related to the nature of cross-border e-commerce industry. Firstly, the cross-border e-commerce industry has low requirements for fixed assets and working environment, small investment and relatively low risk. Secondly, the enterprise eliminates the hidden danger of commodity inventory for the entrepreneurial team, which can play the role of "transmission and help"; Moreover, the current development of cross-border e-commerce platform is becoming more and more perfect, and the initial

operation of stores is standardized, such as Amazon platform uploading tutorials and templates on listing, which invisibly weakens the requirements of college students' entrepreneurial ability.

Entrepreneurial environment significantly affects cross-border e-commerce business incubation. Entrepreneurial environment can be seen as a collection of all factors affecting the growth and development of enterprises, including policy, economy, market competition, culture and so on. The cooperation among universities, enterprises and governments can provide rich entrepreneurial resources for start-ups, thus improving the survival rate of start-ups (Tian and Dai, 2019). Under the supportive policy environment, it is conducive for start-ups to integrate and utilize multi-resources, build their own competitiveness and pass the start-up period smoothly.

Entrepreneurship education, as an initial driving force, significantly affects cross-border e-commerce business incubation. Through the full flow of capital, information, teachers, talents and other resources, universities and enterprises can achieve the result of complementary resources, mutual benefit and win-win. Entrepreneurship education has begun to take shape in China, but the training mechanism of innovative entrepreneurship education under the framework of school-enterprise cooperation is not perfect enough. It often leads to the lack of sustainability of cooperative projects, so exploring the integration system of school, enterprise and the government should be pay more attention.

The depth and sustainability of school-enterprise cooperation significantly affect cross-border e-commerce business incubation. At present, innovation and entrepreneurship has a good opportunity for development, and school-enterprise cooperation mode is an important way to cultivate innovative and entrepreneurial talents. At present, the effect of school-enterprise cooperation in China is not satisfactory, the mode and depth of cooperation needs to be improved. But empirical evidence can still show that both sides of school-enterprise cooperation will significantly affect the success rate of cross-border e-commerce business incubation, improve the mode of school-enterprise cooperation, and strengthen the depth and sustainability of cooperation.

Business incubators significantly affect cross-border e-commerce business incubation. Business incubators have played a great role in the practice of college students' entrepreneurship (Xu, 2019). With the help of enterprises, college students can get through the initial stage of entrepreneurship more steadily and have the opportunity to invest and grow. Enterprises profit from new enterprises founded by college students. The goal is that the entrepreneurship team of college students can achieve breakthroughs and innovations on the platform in the future and bring new technologies to enterprises. Empirical studies show that business incubators have irreplaceable value in practice, which also puts forward higher requirements for the functions of incubators.

Recommendations

Improve the business environment for entrepreneurship and increase project support. The government should provide policy and project support to meet the needs of college students' entrepreneurship, and relax some requirements in cross-border e-commerce policy. It is pointed out that a good business environment can improve the entrepreneurial tendency and rate. At the same time, when providing financial services such as loans, in addition to lowering the financing threshold for college students, certain risk protection measures should be taken to increase their confidence in entrepreneurship. The government gives full play to the role of "visible hand", builds a bridge for the cooperation between enterprises and universities, vigorously supports college students' entrepreneurship projects, ensures the maximization of school-enterprise cooperation results, forms a virtuous circle and produces a spiral upward trend.

Multi-level management of entrepreneurship education to improve the intermediate links of education. At present, there are various forms of entrepreneurship education, but in order to ensure the sustainable development of entrepreneurship education, we should establish a multi-level organizational framework for entrepreneurship education, implement level-by-level management, and standardize entrepreneurship education. Independent entrepreneurship colleges are set up at the school level, entrepreneurship centers are set up at the college level, and students set up entrepreneurship associations, which are managed step by step from top to bottom. At the same time, relying on school-

enterprise cooperation, the projects of enterprises should be introduced appropriately, so that students can learn and operate in the classroom, and excellent projects can be directly incubated.

Deepen integration between schools and enterprises and optimize the mode of school-enterprise cooperation. By means of project cooperation, enterprises can obtain equipment, venues, human resources and other resources to make up for and save costs. Schools can use the project as a carrier to enhance the ability of school teachers to solve problems and enhance the service ability of local economy in Colleges and universities. Students can get a trusted practice platform with professional guidance, reliable supply chain and policy guarantee. The three resources flow and diffuse horizontally, integrate and upgrade vertically, and work together to play the role of sustainable innovation and development.

Construct the performance evaluation system of business incubator and improve the service level. The current market environment is constantly changing, and business incubators should be more flexible and provide positive and reliable help. Constructing the performance evaluation system of business incubators can encourage business incubators. Keep finding and solving problems. At the same time, efforts should be made to build a perfect responsibility system and supervision system. And clear responsibility can improve the efficiency of promoting college students' entrepreneurship, and adjust the service content of business incubators according to the actual situation, which has obvious practical value for business incubators and college students' start-ups.

References

- Ding W J, Wang J X, He S Z. 2018. "Research on Multiple Collaboration of Innovation and Entrepreneurship Education in Higher Vocational Colleges from the Perspective of Synergy Theory," *Education and Vocation*,(23), pp. 64-68.
- Etzkowitz, H. , & Leydesdorff, L. . 2000. "The dynamics of innovation: from national systems and "mode 2" to a triple helix of university–industry–government relations," *Research Policy*, (29:2), pp. 109-123.
- Zhang J, Ma Y H, Xu X J. 2018. "Research on the Construction of Chinese Entrepreneurship Education Ecosystem from the Perspective of Triple Helix Theory —Based on the Experience of American Entrepreneurship Education Ecosystem," *Education Exploration*,(5), pp. 110-113.
- Li D L.2018. "Bottleneck and Path Design of Integrating Innovation and Entrepreneurship Education into Talent Training System in Colleges and Universities," *Innovation and Entrepreneurship Education*(9:01), pp. 80-83.
- Wang H L. 2019. "The Experience and Enlightenment of German Dual System Vocational Education Specialty Setting," *Education and Vocation*(05), pp. 86-92.
- Xi C H. 2018. "Research on the Innovation of School Enterprise Cooperation Mode". Central China Normal University.
- Chen W B, Zhou H Y, Ma W X. 2010. "A New Model of Higher Education Reform: Exploration and Research on School-enterprise Cooperation," *Gansu Science and Technology*(26:6), pp. 169-170 + 160.
- Zheng G, Mei J Y, He X B. 2017. "How much influence does entrepreneurship education have on college students' entrepreneurship practice? Based on the empirical survey of entrepreneurial enterprises in the National University Science Park of Zhejiang University," *China Higher Education Research*(10), pp. 72-77.
- Xu J R. 2019. "Research on the Development of High-tech Industry Business Incubation under the New Economic Form —Based on the Perspective of Government Capital Utility," *Soft Science*(33:4), pp. 48-52.
- Lee T H.2020. "Research on the Development Dilemma and Countermeasures of Technology Business Incubator under the Background of Mass Entrepreneurship and Innovation," *SME Management and Technology*(12), pp. 164-165.
- Cai L , Hughes M , Yin M . 2014. "The Relationship between Resource Acquisition Methods and Firm Performance in Chinese New Ventures: The Intermediate Effect of Learning Capability," *Journal of Small Business Management*(52:3), pp. 365-389.

- Cavazos D E, Patel P, Wales W .2012. "Mitigating environmental effects on new venture growth: The critical role of stakeholder integration across buyer and supplier groups," *Journal of Business Research*(65:9), pp. 1243-1250.
- Yang F. 2020. "Research on the influence of graduate students' entrepreneurial ability on entrepreneurial performance," *Education Research of Tsinghua University* (41:6), pp. 114-121.
- Tian B F, Dai L L.2019. "International Entrepreneurship Path of Chinese New Ventures Based on Cross-border E-commerce" *Scientific Research Management* (40:9), pp. 149-158.

E1.3 Civic Technology Development in a Community of Practice

Chen, J. and Chen Y.
National Chi-Nan University
E-mail: jessicafen@gmail.com, s110213518@mail1.ncnu.edu.tw

Abstract

Most of the civic technologies are driven by a community of practice and are based on a free/open software model by bringing together volunteers in various public fields. A successful civic technology community requires an elaborate structure and operational process to encourage citizen participation. This study aims to explore the core elements of the structure and process in civic technology communities with a case study in Taiwan—G0V.tw. “G0V” is a well-run community with the explicit mission of promoting the transparency of government data for citizen engagement in society. We will explore how a civic technology community designs its structure to support the development of shared goals, community identity, cultural and historical heritage among its collaborators via the Community of Practice perspective. The results of the study can help citizens, governments, and businesses to understand and learn the managerial implications and values from such self-governance organisms.

Keywords: Civic technology, Civic technology community, Civic practice, Community of practice, Open data, Common good, Citizen Engagement

Introduction

With the promise of informed citizens, there has been a move towards civic technology (or civic tech) development. Civic technology represents a ‘greater-than-the-parts whole’ for addressing public issues and pursuing the common well with the empowerment of information technologies, open/public data, and civic engagement. The social innovations enabled by civic technology take place when citizens work together and use their knowledge, skills, perspectives, and motivations to make a difference, to promote life quality in a community form (Spitz et al. 2017). Another common characteristic of civic technology is that it is created by civic communities of practice (CoPs). While CoPs are an age-old phenomenon, today a growing number of researchers and practitioners in various sectors are still viewing CoPs as a key for change and innovation. New communication and collaborative technologies expand the possibilities for the community and call for new kinds of CoP based on shared practice such as citizen engagement CoP. One good example is the civic technology community in Taiwan, G0V. ‘G0V’ is one of the top three civic technology communities in the world. The civic technology community is an emergent interest among citizens, civic hackers, and other stakeholders for solving public problems with the empowerment of technology. Historically, the inability to develop a shared basis of authority has led many collectivist groups to fail (O’mahony, and Ferraro 2007). Because most civic technology communities are volunteer-based and based on Open-Source Software (OSS) concept, sustainable development and continuous public engagement are critical for civic CoPs. For sustainable development, a successful civic technology community requires an elaborate structure and operational process to encourage citizen participation as well as facilitate collaboration.

Few studies investigate the structure and dynamic process of the civic technology community. An appealing and important issue is to investigate how a civic technology community organizes volunteer participators and works responsively and effectively to meet the public needs and bring common good. This research takes a step toward filling this gap by examining the phenomenon of civic technology communities from the perspective of the CoP. Based on Wenger’s framework for communities of practice (CoP), this study will investigate the structural and process elements of civic technology

community with a famous civic technology community in Taiwan, G0V. G0V is already one of the top civic technology communities in the world and the cultural and historical heritage, governance mode, and communication and negotiation methods among members have maturely developed and shaped.

Literature Review

Community of Practice

“Communities of practice (CoPs)” is described as a socialization process of legitimate peripheral participation (Lave and Wenger 1991). According to Lave and Wenger (1991, p. 98), a CoP is “*a system of relationships between people, activities, and the world; developing with time, and in relation to other tangential and overlapping communities of practice.*” Later, Wenger-Trayner (2015) referred a CoP as “*groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly*” (Wenger-Trayner 2015: front page). CoP participants contribute to the community with their variety of experiences and “*share understandings concerning what they are doing and what that means in their lives and for their communities.*” (Lave and Wenger 1991, p. 98).

First, building a community requires the development of a community mind represented in shared values, conceptions, and ideas about the practice and human nature (Sergiovanni 1994). Hence, heritage formation, including the shared goal, shared practice, belief systems (meaning), and collective stories (shared memory) that capture canonical practice is important to a CoP (Barab and Duffy 2000). These shared experiences come to constitute a collective knowledge base by continually negotiated anew and interactions (Lave and Wenger 1991; Barab and Duffy 2000). The mind structure provides a CoP and its participants with purpose and meanings that are embodied in duties and obligations. Fulfilling these duties and obligations requires selfless behavior and altruistic love (Barab and Duffy 2000).

Second, comparing to well-designed structure, CoPs perspective emphasizes the embeddedness of the experiences in the community and the mutual negotiation process of meaning which is a central component in the development of self. In the negotiation process, the individual and the community constitute nested interactive networks in which individuals transforming and maintaining the community as they appropriate its practices (Lemke 1997; Rogoff 1990). Relationships within a community are based not on contracts, but on understanding about what is shared, and on the emerging web of obligations that embody the shared things (Sergiovanni 1994).

Wenger-Trayner (2015) also indicated a CoP is dynamic and involves learning on the part of everyone. Community forms are usually used to solving problems and sharing knowledge (Hargadon and Bechky 2006) and are identified as a means to connect people and share knowledge across silos and boundaries and borders (Stofberg 2020). Hence, community are thought useful to an economy that relies upon the production and diffusion of knowledge (O'mahony, and Ferraro 2007).

Learning in CoPs is also viewed as a process of becoming a part of a greater whole (Sfard 1998). Individuals in a CoP view themselves as part of something larger for allowing the various participants to form a collective whole when they work on particular problems or goals (Barab and Duffy 2000). Such a collective whole is formed as a shared identity through the negotiation among the collective intelligence over time. CoP theory emphasizes the process of “building a shared identity and a collective intelligence garnered over time. Members have a “none of us is as good as all of us” mentality” (Highlighted in origin). It is through the carrying out of these practices that an individual participant binds himself to the community. The community itself functions within a broader societal role that gives it meaning and purpose (Barab and Duffy 2000). The greater whole of a CoP also increases the relationship and social ties among members.

Lave and Wenger (1991) proposed a concept of “*legitimate peripheral participation (LPP)*.” LPP refers both to the role transformation and identity development of individual members from learners to masters and to the reproduction and evolution of a community (Ye and Kishida 2003). A new participant's identity is developed from the entrance as a peripheral participant to becoming a master with respect to other new peripheral participants who also become masters over time (Ye and Kishida 2003). The greater shared identity, as aforementioned, is conserved and reproduced through the ontogenetic

development of its new members who learn via LPP and become masters that embody the mature practice and structural characteristics of the community (Ye and Kishida 2003).

Participants develop a sense of self through engaging in the discourse of a CoP and in the context of that community's values (Bereiter 1994, 1997). Members' competence also emerges in a participation process. The shared competence emerging from participation in the social context of a CoP helps distinguish members from non-members (Lave and Wenger 1991; Ye and Kishida 2003).

Civic Technology

Civic technology is on the rise around the world and is referred to as the technology-based civic products designed specifically to achieve social change (Mačiulien and Skaržauskien 2020). Civic technology is referred as both tools and processes that use information and communication technologies to support civic problem solving and improve quality of life (Wilson and Chakraborty 2019; McCann 2015). Civic technology is getting recognized because it offers the possibility that citizens, local nonprofits communities, and participants can help to reinvent government from the outside (McNutt et al. 2016). Therefore, civic technology represents "a greater-than-the-parts whole" (McNutt et al. 2016, p.155).

Typically, civic technology leverages open data or open source to address challenges that may be invisible to or neglected by the government (McNutt et al. 2016; Wilson and Chakraborty 2019). The phenomenon of open or public data use is rooted in the concept of openness that citizens have the right to access information from the government under which they live (Mustill 2019). Open data use and applications are thought of as means to pursue public good (Howard 2012; Tennison 2014). An example of civic technology with open data in Taiwan is the "Looking at Taiwan with data" , which is a website committed to transforming complex open data into easy-to-read visual charts and reports that can be easily understood and acted upon by all with the empowerment of citizen technology.

The modality of civic technology development is usually through the collaborative works within CoPs. While civic technology can be developed by a few individuals or small groups, using a CoP form is an increasingly common and visible vehicle for initiating and sustaining a civic technology ecosystem (Wilson and Chakraborty 2019). Such CoPs usually constituted by civic hackers, citizens, and local authorities who share a concern and are affected by the contexture public issues. Schrock (2016) viewed civic hackers as the "progressive roots of civic data hacking" in terms of data activism and advocacy. Civic hacking "provides a mode of participation in digital infrastructures that debates and confronts the politics of technology for governance" (Schrock 2016: 594).

A civic technology community has neither a well-defined identifiable group nor a socially visible boundary. Civic technology attracts people who are already engaged in civic activities and use online platforms as a means of supplementing and deepening their levels of civic engagement (Cantjoch, Galandini, and Gibson 2016)). In addition to individuals who bring technical skills, civic technology and ethos require citizens' inputs and participations with insight derived from lived experience as a means of establishing the legitimacy and bolstering the likely impacts of the work (Wilson and Chakraborty 2019). Collaborations in a CoP for civic technology development emphasize meaningful citizen engagement for broader policy discussions and identifying alternative courses of action by integrating technical and non-technical expertise within an inclusive, collaborative environment (Wilson and Chakraborty 2019). Regarding civic technology development, focusing on individual community issues is necessary because a deliberate community structure and process "increase the opportunity to connect and engage local residents in problem identification, data interpretation, and problem-solving" (Kontokosta 2016: 68, 69). Civic technology development in a CoP also enables the members to capture and share existing knowledge to identify, build trust and capacity, discuss and create best practices for improving the common good. Citizen engagement is indispensable and is a key factor of effective and legitimate public issues deployment, given that "the experience of participating helps to create the kind of individuals necessary to operate a democracy" (Hopkins 2001: 183).

Civic technology communities are creating a new distributed ecosystem to put open government data to work and civic hacking is recognized as data activism and advocacy. The development of civic technology requires transparency, meaningful participation, and responsiveness to community needs and priorities (McNutt et al. 2016; Wilson and Chakraborty 2019). For developing civic technology,

the focus should be on people, respond to the needs articulated by the community, and demonstrate meaningful community engagement and participation (McCann 2015; Wilson and Chakraborty 2019).

To demonstrate meaningful community engagement and participation, the structure and process of civic technology initiatives are matters. A civic technology community required a structure and negotiation framework that can facilitate greater understanding, relationship creation, norm negotiation among community participators, as well as enhance self-development and learning of the individual participators. Many civic technology communities develop based on the OSS model (Wilson and Chakraborty 2019). Open-software is matter to civic technology because it reduces lock-in to a particular solution and a particular vendor. In an OSS community, the structural and coordinative process is fundamentally different from traditional organizations. An OSS community usually consists of a large number of volunteer participators who make contributions either individually or as part of a temporary team (Sharma et al. 2002). Many OSS developers have demonstrated by contributing their time and knowledge for the benefit of the whole community (Ye and Kishida 2003). By establishing their own identity or shaping the identity of others through voluntary participation, members help reproduce and preserve the community. This process is also in their own interests because community members' identity, skills, and reputation as masters, rely on the continuous existence of the community.

Community of Practice

Heritage	Learning	Negotiation Process	Legitimate participation	Shared identity
----------	----------	---------------------	--------------------------	-----------------

Figure 1. Central Components of Civic Technology Community

Research Method

In order to investigate the structure and process of a civic technology community, this study will first adopt qualitative methods, including interviews and case studies (G0V). The analysis will follow a constructivist grounded theory approach (Charmaz 2006) because its principle of theoretical sampling helped to explore the open-ended range of practices without applying pre-conceived categories. An interpretive approach will then be used for the case development of G0V.

The unit of analysis is a community and the level of analysis is both community and individual level. Data will be collected by interview, observation related activities hold by G0V and rich secondary data provided by G0V online. The informants of the case (G0V) will be community participants of G0V. We will examine the resources and rules of G0V's structure (as Figure 1). As an OSS community, all the information of G0V is open and available and can be easily accessed. G0V has a clear policy and rich data for the researchers. The secondary data provided by G0V includes Prior studies, Open Source Collaboration Manual, community status, irregular updates, monthly community events, G0v interviews, filming related to G0V participants and G0V slang and quotations, etc. G0V is therefore a good representative civic technology community for study.

CoP Case: G0V Zero Hour Government

The G0V movement, or G0V, is a community that pushes for information transparency. "G0V Zero Hour Government," in the spirit of open source, calls on citizen hackers and people in various fields who care about public issues to join the ranks of transforming and monitoring the government through collective collaboration. By replacing the "o" in 'gov' with the numeric 'zero,' G0V hopes to rethink the role of government from zero, which represents the vision of the digital native generation from the world of 0/1. G0V aims to "write programs to transform society" by developing various information tools with open data/source to empower otherwise disconnected citizens to supervise the government.

Structure of G0V

Here is a preliminary look at the cultural and historical heritage of G0V, including shared community values and memories, community consensus, and self-leadership mechanisms in operation.

Shared value and memory:

G0V's core idea is that "by embracing activism, open source models, and civic spirit, we can combine the paradigms of free software, mass media, and social movement groups to create communities committed to information transparency" (G0V 2014). G0V has a famous motto: *Don't ask why 'nobody' is doing something; start by admitting you are that 'nobody'* and "nobody is everything!" In other words, every citizen who participates in G0V is a greater 'us' and a bigger collective whole.

This motto also fully expresses the spirit of G0V as a civic community that encourages people to participate, do things together, and take up their social responsibility. G0V participants call it the "spirit of doing", a "self-doing" spirit and action force that "does not need to wait for anyone's consent" and has been the driving force behind the community's development for more than eight years. The founder of G0V had proposed three operational concepts of G0V with "G0V hackathon - writing programs to transform society": (1). *Decentralization*: Each project will be assigned by specialization to support each other horizontally, so that no one can represent G0V alone. (2). *Transparency of information*: All government information is available on an easy-to-read website, so that it can be quoted for monitoring and proposed amendments. (3). *Open source*: All G0V projects are released under an open source and Creative Commons license, allowing community members to take over development (G0V 2014).

The G0V community has no distinction between master and slave, important or not, every participant and role has the same importance, and everyone is qualified and has the possibility to contribute to the community. Community members must follow the concept of open source and collaboration, and anyone who fits this concept can call themselves a G0V participant. One example of G0V's adherence to this shared value is reported in a story about a contributor to the 2016 G0V Annual Meeting who questioned G0V's selection criteria due to his own extensive experience of not being accepted. Co-founder Terry Wu commented, "But when he thought he was more qualified to be selected, he had already violated G0V's spirit of collaboration."

The common community values of self-contribution, open-mindedness, the decentralized value of "anyone is eligible" and the civic engagement based on "you and I are the NOBODY" can be interpreted from the G0V Zero Hour Government Manifesto.

We are a polycentric community of self-organized contributors. ... The G0V community is made out of these self-governing projects. There is no single center or representative of G0V.

We are citizens collaborating to bring about change. ... Starting from the open-source movement, G0V is an active citizen of Taiwan. We the G0V contributors support freedom of speech and information transparency. By providing digestible information and hands-on digital tools, we the G0V contributors bring more citizens to participate in public issues and influence government actions.

We have fun and want to change the status quo. ... We the G0V contributors love to dig into problems, and we take pleasure in finding solutions and taking action to make a change. We connect different expertise to amplify our collective force. Guided by imagination, we collaborate and explore new frontiers. We act to change the status quo. We refuse to be silent accomplices. (source: <https://G0V.tw/intl/en/manifesto/en/>)

G0V's heritage and shared memory are preserved in the collaboration tool HackMD (<https://G0V.hackmd.io>). The platform keeps records of all G0V meetings, interviews, and other collaborative processes, and keeps a textual record of all discussions, so that any new villagers (legitimate peripheral participation) can learn about G0V's traditions and projects at any time, and quickly join the collaborative ranks, so that they can be the core legitimate participants.

Participants of G0V:

The scale of participation, commitment, and expertise of the citizens of a civic community are key to its long-term development. As a civic technology community, the public issues involved are very diverse and require the knowledge and skills of many different fields in addition to IT talent to solve different public issues. G0V's participants are very diverse and are categorized in G0V's Open Source Collaboration Handbook as issue-focused, software developers, textual or visual arts Project managers, villagers (participants), domain specialists, public officials, and journalists/academic researchers. For

example, PMs can help lead the discussion, divide the project into tasks, and track progress; issue followers can express what kind of data they want to use to reveal their concerns and what kind of information they want to present; and villagers can join the IRC/slack workgroup to know who is working on what and when new people come in. When new people come in, they can greet them and help test the features they have just made, help search for original data, organize data help, and help with promotional activities, etc., and behave as a legitimate peripheral participation (LPP). The G0V community has reached out to nearly 9,000 participants across three continents. The manifesto begins with a clear statement about the diversity of citizen participants.

We come from everywhere. ... G0V is a community of open collaboration. We the G0V contributors are from everywhere. We are software developers, designers, activists, educators, writers, citizens and netizens of every profession. We gather in the hope to improve Taiwan's civil society through technology and collaboration. If you're willing to contribute your skills and expertise, you can take part in G0V. (source: <https://G0V.tw/intl/en/manifesto/en/>)

Self-initiated and self-organized:

According to G0V's manifesto, G0V's cultural heritage and shared values guide its mode of operation—decentralized and self-organized polycentric operation, operating as a community with blurred internal and external boundaries, a community operation where anyone is qualified and has the potential to contribute.

We are a polycentric community of self-organized contributors. ... G0V projects are self-initiated and self-organized. With this Manifesto as the base of consensus, every G0V project makes its own decisions on its operation and governance. The G0V community is made out of these self-governing projects. There is no single center or representative of G0V. (Source: <https://G0V.tw/intl/en/manifesto/en/>).

Process of G0V

Participation mechanisms:

There are three important components of G0V: people, pit, and 'thon.' The human component is expressed in the professional diversity of the participants and their respective abilities and backgrounds in the field. The operation of G0V relies on two major modes of operation, "pit" and "pine."

The pit: G0V calls each project a "pit" with the act of initiating a project called "Dig in" and participants participating in a project called "Fill in." G0V has accumulated 1,000 projects through hackathon events and GitHub, with one famous pit being the "Political Contribution Project." G0V's collaboration process is based on the use of various online tools, such as HackMD, Google Docs for various idea discussions, Slack, Telegram for real-time multi-person text discussions, and open source code on GitHub for more flexible integration of resources and collaboration.

We live open-source. ... We the G0V contributors communicate and collaborate online, while convene and connect in hackathons offline. Project outcomes (including but not limited to text, images, code, data, analysis, and processes) are open-source, allowing more people to use, improve, comment, and maximize their usage. (Source: <https://G0V.tw/intl/en/manifesto/en/>)

A full-day hackathon where participants have three minutes to present their projects and seek like-minded partners to form a team to turn ideas into practical actions and be executed through online and offline collaboration. The project will be executed through online and offline collaboration. In addition to the bi-monthly large scale hackathon, there are also medium-sized monthly hackathons and occasional mini-hackathons that can be developed according to the needs of each project, bringing ideas into focus through physical activities. The G0V team has set up a participation and selection mechanism to openly recruit projects with public interest and foresight, and support project teams to invest in development and project maintenance, so as to expand the impact to more levels of the community.

Negotiation-of-meanings:

The use of the Hackpad online collaboration platform and hackathon events are important processes for G0V members to negotiate together to achieve shared values among members, and are also ways for G0V projects to take shape. For example, after the 318 campaign, some community participants also proposed the idea that G0V should use this energy to organize political parties, which directly touched the nerve between G0V and political positions. After a long period of discussion and negotiation, "no party, no faction" became the consensus formed by G0V members through joint consultation.

"Nobody can represent anybody", most participants of G0V are volunteers. As a decentralization organization, without a spokesman, people know nothing about them. Even they join the activity, is there someone can completely answer those questions is still unknown. When they discuss about the whole society's problem, it always costs a lot of time, because there's no hosts and no predetermined spindle. Take 10th anniversary celebration for G0V as an example, people discussed from the way of celebration, target audience, to the details about time and place, even the organizer of this activity are serious problems. After an afternoon passed, all have decided are the way of celebration and the organizer. And those remaining questions still need to discuss by organizer and every department's heads. The way of discussions is not only ineffective, but also the conclusions are easy to subvert.

One kind of teams of G0V is called "Jothon," which means to initiate and organize a team for a new hackathon. Only three regular staff in G0V and the rest of participants in G0V are all volunteers or interns. The main works of Jothon are arranging time and places for regular activities, compiling the annual report, and organizing other smaller activities. Take the INFRATHON (infrastructure and marathon) which held in 12, March 2022 in Taipei as an example. The participant are people who have engaged in G0V for a long time. INFRATHON holds at irregular time, and its main requirement is to resolve by is there any important cases which need to discuss. The INFRATHON (hackathon for administration of G0V) discussed about governance rules in slack and domain names, the 10th anniversary celebration for G0V, and annual report on website. Because decentralization is the main idea of G0V, any details about activities or any rules about systems are discuss in INFRATHON by volunteers. For example, the management of the channel (a project) in slack, no one can change its name or manage the members except the creator. But what if the creator doesn't want to manage this channel anymore? If there's someone wants to manage this channel after the creator disappear, it needs an administrator to change their permissions. However, how to define that the creator disappeared? Should the successor had some ideas about this project, in case that the successor give up this project in a short time? Those rules need to discuss and check carefully. Also, these rules make the management of slack much more complete. Does the management in domain name, its rules need to be checked and discussed again? Are these rules still work nowadays? Are those administrators still participant in G0V's activities? All these rules needed to be discussed by participants in the INFRATHON.

Conclusion

This study aims to explore the core elements of the structure and process in civic technology communities. Several contributions are expected. This study plan to examine the structure, resources, and rules of a community to explore issues ignored in the existing literature and contribute to model development of civic technology community. The qualitative case study of G0V can provide a deep look into the dynamic system of civic community. By investigating the structure and process of civic technology communities, practitioners in civic activities or citizen-sourcing can know how to design community structures and processes to improve community performance and sustainability and further encourage more citizen participation in civic activities. The results of the study can help citizens, governments, and businesses to understand and learn the managerial implications and values from such self-governance organisms. The results can also provide guidance for designing a sustainable community.

References

Barab, S.A., and Duffy, T. 2000. "From practice Fields to Communities of Practice," Theoretical

- Foundations of Learning Environments (1:1), pp. 25-55.
- Bereiter, C., Scardamalia, M., Cassells, C., and Hewitt, J. 1997. "Postmodernism, Knowledge Building, and Elementary Science," *The Elementary School Journal* (97:4), pp. 329-340.
- Charmaz, K. 2006. *Constructing Grounded Theory: A Practical Guide through Qualitative Analysis*, London: Sage.
- G0V. 2014. "First Year of G0V," TAHR PAS seasonal journals (Spring), Retrieved from <https://www.tahr.org.tw/publication/1369>, 2020/8/27 accessed =
- Hargadon, A.B. and Bechky, B.A. 2006. "When Collections of creatives Become Creative Collectives: A field Study of problem Solving at Work," *Organization Science*, (17:4), pp. 484-500.
- Hopkins, L. D. 2001. *Urban development: The logic of making plans* (Vol. 166). Washington, DC: Island Press.
- Howard, A. 2012. *Data for the Public Good* [ebook]. Sebastopol: O'Reilly Media, Inc.
- Kontokosta, C. E. 2016. "The quantified Community and neighborhood Labs: A Framework for computational Urban Science and civic Technology Innovation," *Journal of Urban Technology* (23:4), pp. 67-84.
- Lave, J., and Wenger, E. 1991. *Situated Learning: Legitimate Peripheral Participation*, Cambridge: UK, Cambridge University Press.
- Lemke, J. 1997. "Cognition, context, and learning: a social semiotic perspective," In D. Kirshner & J. A. Whitson (Eds.) *Situated Cognition: Social, Semiotic, and Psychological Perspectives*, pp. 37-56.
- Mačiulienė, M. and Skaržauskienė, A. 2020. "Building the capacities of civic tech communities through digital data analytics," *Journal of Innovation & Knowledge* (5:4), pp. 244-250
- McCann, S., and Delap, J. 2015. "Mentoring Case Studies in the Access and Civic Engagement Office, Dublin Institute of Technology," *International Journal of Evidence Based Coaching and Mentoring*, (13:1), pp. 106-120.
- McNutt, J. G., Justice, J. B., Melitski, J. M., Ahn, M. J., Siddiqui, S. R., Carter, D. T., & Kline, A. D. 2016. "The Diffusion of Civic Technology and Open Government in the United States," *Information Polity* (21:2), pp. 153-170.
- Mustill, E. 2019. "Understanding How Open Government Data is Used in Capital Accumulation: Towards a Theoretical Framework," *Journal of Critical Library and Information Studies* (2:2), DOI: <https://doi.org/10.24242/jelis.v2i2.63>.
- O'mahony, S., and Ferraro, F. 2007. "The Emergence of Governance in an open Source Community," *Academy of Management Journal*, 50(5), 1079-1106.
- Sharma, S., Sugumaran, V., and Rajagopalan, B. 2002. "A framework for creating hybrid-open source software communities," *Information Systems Journal* (12:1), pp. 7-25.
- Sergiovanni, T. 1994. *Building Community in Schools*, San Francisco, CA: Jossey-Bass Publishers.
- Sfard, A. 1998. "On two metaphors for learning and the dangers of choosing just one," *Educational Researcher*, 27(2), 4-13.
- Schrock, A. 2016. "Civic hacking as data activism and advocacy: a history from publicity to open government data," *New Media & Society*, 18(4), 581-599.
- Spitz, R., Pereira Jr, C., Queiroz, F., Leite, L. C., Dam, P., Ferranti, M. P., Kogut, R. and Oliveira, W. 2017. "Gamification, citizen science and civic engagement: in search of the common good," In *Proceedings of the 6th Balance-unbalance- A Sense of Place*, Wesley Oliveira.
- Stofberg, A. 2020. "Community of practice: A Tool for Reflection on Intercultural Learning," Retrieved from <http://www.intercultproject.com/community-of-practice>, 2020/11/01 accessed.
- Tennison, J. 2014. "Open Data is a Public Good. It Should not be Confused with Data Sharing," Retrieved from <https://www.theguardian.com/commentisfree/2014/may/12/response-confuse-open-data-sharing-government>, 2020/7/15 accessed.
- Wenger-Trayner, E. and Wenger-Trayner, B. 2015. "Introduction to Communities of Practice: A Brief Overview of the Concept and its Uses," Retrieved from <https://wenger-trayner.com/introduction-to-communities-of-practice>, 2020/11/01 accessed.
- Wilson, B. and Chakraborty, A. 2019. "Planning Smart(er) Cities: The Promise of Civic Technology," *Journal of Urban Technology*, DOI: 10.1080/10630732.2019.1631097.
- Ye, Y., and Kishida, K. 2003. "Toward an Understanding of the Motivation of Open Source Software Developers," In *IEEE 25th International Conference on Software Engineering Proceedings*, pp. 419-429.

E1.4 Impact of Movie Search Volume on Short-term Stock Market Valuation of Movie Companies

Lin, Y.^a, Ye, Q.^b and Xia, H.^c

^a School of Management, Harbin Institute of Technology
E-mail: linyangyin@gmail.com

^b School of Management, Harbin Institute of Technology
E-mail: yeqiang@hit.edu.cn

^c School of Management, Harbin Institute of Technology
E-mail: xiah@hit.edu.cn

Abstract

The motion picture business is a high-profile industry that attracts extensive public attention, especially during the theatrical launch of popular movies. In this study, we incorporate the search volume of a movie to measure the attention of potential retail investors who have interests in stocks of the companies that participated in the movie's production and distribution. In a sample constructed from domestic movie market in mainland China, this study empirically assesses the pre- and post-launch impacts of movie search volume on the short-term stock valuation of corresponding movie companies. We confirm the theory of attention and find a positive relationship between the increase in the search volume of a movie and abnormal stock return for the next trading day in the week prior to the theatrical release of the movie and in the three weeks thereafter, which is more persistent than the relationship regarding the search volume of corresponding stocks.

Keywords: search volume, investor attention, stock returns, motion pictures

Introduction

Classic finance theory posits that the stock price of a firm reflects the capital market's expectation of its future performance under the assumption of investor rationality (Rappaport, 1998). Accordingly, a firm's positive stock return suggests that the market anticipates a brighter prospect of the firm and larger future cash flows than what were previously expected. Meanwhile, recent studies in behavioral finance provides another perspective with respect to the limited rationality and attention of investors, especially individual ones, to explain the change of stock prices. Among those theories, a compelling one is the theory of attention proposed by Barber and Odean (2008) which reasons as follows: retail investor can sell only the stocks already owned, but can choose from all stocks available in market to buy, which means buying requires much more resource of attention than selling. Therefore, for a stock, increased attention from retail investors leads to net buying by them and accordingly a positive price pressure.

Da et al.(2011) first introduces the aggregate search frequency in Google measured by Search Volume Index (SVI) as a direct measure of investor attention and finds that an increase in SVI of a firm's stock sticker predicts higher short-term abnormal return of its stock in an empirical analysis of U.S. Russell 3000 stocks, echoing the theory of attention. Da et al. also finds that the SVI of the main product of a firm does not have such prediction power, excluding the alternative explanation that a successful launch of new product causes both the increase of stock SVI and stock price. A series of studies thereafter also adopt similar approach to empirically test the theory of attention in stock markets of other countries and for other securities, e.g., commodity futures (Kou et al., 2018), and have confirmed its explanatory power. There also exists opposite result that high SVI leads to low stock return (Bijl et al, 2016).

The extant literature that tests the prediction power of SVI on stock price is usually based on stocks in broad-based index, which might be the reason that the SVI of a firm's main product performs poorly in prediction the stock price. Companies listed in broad-based stock index are in different industry groups majored in a variety of business, and even those in the same industry could have diversified business modes and sources of revenue. Thus, the mechanism that a company's main product performance influences its future profitability could be very sophisticated and quite different across a large number of samples. Moreover, few retail investors are competent to make sound evaluation on the products or services that they are not familiar with in daily life and not in their area of expertise. Accordingly, it could be expected that the increase in the SVI of a firm's main product in general can neither reflect the investors' attention to the stock, nor indicate that the investors have optimism view of the company's future performance, and thus fails in predicting the stock price.

The above argument about stocks in broad-based index, however, could be invalid when we check certain industries. To our knowledge, there is a lack of study that examines the predicting power of the SVI of both of a company's stock and main product on its stock price for a specific type of companies whose performance of new product launch has explicit and dominant influence on its future profitability. This paper is an attempt to fill this gap to further investigate the theory of attention in the retail investors' behavioral pattern. To this end, the motion picture business makes an excellent test filed for several reasons. First, the entire revenue and profit of a movie company could be very closely associated with a single movie project, especially for a large-budget production. Accordingly, it is reasonable for the market to update the anticipation of a movie company's prospect over the performance of a movie that it invested. Second, movies are very typical experience goods and their box office revenue is highly uncertain before the release date but would be mostly realized in a relatively short period (usually no more than 3 months) after release. "Movies behave like short-lived innovations", as Chance(2008) notes. Investors can easily evaluate them and update their belief on the fair value of the movie company's stock. Third, the box office revenue of movies is largely uncorrelated with the performance of financial market, easing the concerns on confounding variable issues when examining the effects of movies on its investor's stock return.

Mainland China and United States are the two largest motion picture markets in recent years. We choose the former as the data source due to two extra advantages it possesses for our research purpose over the later. First, the current major movie studios in U.S. (the "Big Five majors", i.e., Universal Pictures, Paramount Pictures, Warner Bros. Pictures, Walt Disney Pictures and Columbia Pictures) all belong to giant conglomerates or privately owned company (The Walt Disney Company, AT&T, Sony, Comcast, and National Amusements, respectively). Therefore, the performance of a single movie that one of the conglomerates invest in most cases is unlikely to have significant impact on its short-term stock price. In contrary, as detailed in section 3, the listed movie company in mainland China are much smaller and the box office revenue contributes a major portion of the total revenue. Second, other than box office revenue, movies can generate cash flows for its investors in the long run through merchandise sale and other distribution channels including Blu-ray discs, TV broadcasting, and online streaming. This portion of cash flow is significant in U.S., but is almost negligible in mainland China. In summary, movie companies in mainland China rely more heavily on the instant performance of movies they invest than those in U.S. and thus better suit our research purpose.

This paper aims to empirically investigate the roles that investor attention and expectation of firm performance play in explaining the short-term abnormal return of stocks in the context of the movie industry in mainland China. Specifically, we collect the daily SVI of both the movie and its investor from Baidu.com (the dominant search engine in mainland China) in one month before and after the movie's release day, as well as the daily box office data in the first month of launch, and examine how they drive the short-term abnormal stock return of the movie company. The results of this study further confirm the validity of the attention theory in the China mainland stock market, and more importantly, reveal that in the movie industry, the retail attention on a company and its main product measured by SVI could both have significant predicting power of stock return during the short periods before and after the product launch day.

The rest of the paper is organized as follows. Section 2 presents related conceptions and formulates hypotheses. Section 3 introduces data sources and sample construction. Section 4 provides empirical results and discussion. Section 5 concludes the paper.

Conceptual Development

Background

Movie industry thrives in China over the last decade albeit the serious shock by the COVID-19 pandemic. In 2020, China overtook the U.S as the world's largest theatrical market. A more noteworthy trend in China is the rise of domestic movies versus imported ones. The percentage of China's locally produced movies in total box office has risen from 48.5% in 2012 to 84.5% in 2021. Local blockbusters are replacing Hollywood global earners such that "Avengers: Endgame" is now the only one left in the top 10 grossing movies in China. The motion picture business in China has become one of the high-profile industries that attracts tremendous investment and draws great public and government attention.

The box office revenue of a movie played at cinemas are shared by the upstream (movie investors including producers and distributors) and downstream (theater chains and cinemas). For domestic movies in mainland China, after a deduction of 3.3% business tax and 5% special film funds, the producers and distributors are allocated a fixed share of 30% and 13-15% of the remained box office income respectively (MPA Asia Pacific 2017). Movie companies in A-Shares (mainland China-based public companies traded on Shanghai or Shenzhen stock exchanges) are much smaller in market capitalization than their counterparts in US: as of 2022-01-19, the highest value of the former is Wanda Film Holding valued at around \$5.5 billion, approximately 5% of the value of Sony Group Corp, the smallest giant conglomerates of the latter. Accordingly, the highly uncertain and unpredictable share of box office income becomes a more significant source of the profit fluctuation for movie companies in mainland China than in US. We've seen plenty cases in which the stock price of a movie company boosts with the release of a blockbuster that it invested. For instance, the release of Wolf Worrier 2, the highest-grossing movie of 2017, was followed by an increase of 56% in the stock price of its main distributor Beijing Culture in twelve days; similarly, the launch of the 2019 highest-grossing movie Ne Zha pushed the stock price of its producer Enlight Pictures by 17.1% in ten days.

Although the actual content and quality of a movie will be revealed to the public only after its release, its investors endeavor to attract the highest possible public attention through advertising. In the era of Web 2.0, a significant share of movie advertising budget is spent at online channels including social networks, online communities, short-video sharing platforms, review/rating apps, and search engines. Elberse and Anand (2007) conclude that 90% of a movie's advertising budget is used in a short period before its theatrical launch. According to Maoyan Pro, an Internet service that keeps record of the marketing statistics of China movie market, we observe a similar pattern: the total view counts of the various types of movie promotion usually rise promptly from one week before release and start to diminish in a few days afterwards. The amount of public attention that a blockbuster draws around its release day can be astonishingly large. As an example, within three days after the release of the Battle at Lake Changjin, the all-time highest-grossing movie in China, its latest trailer was played 3.91 million times and relevant short videos on Douyin (the China's version of TikTok) got 2.04 billion views in total. Therefore, we expect that a highly topical movie could also draw the attention of stock investors and lure them into the consideration of buying the stocks of the movie's producers and distributors.

Capital Asset Pricing and Theory of Attention

Classic capital asset pricing theories are based on expected return model which states that the fair price of a security can be calculated via the expectation of its future return projected on the basis of current information set, and the efficient markets hypothesis (EMH) assumes that the security price already incorporate available information completely (Fama, 1970). Finance and Marketing literature has documented the impact of new products, innovations, and marketing activities on stock prices. Srinivasan et al. (2009) find that new products, especially those with pioneering innovations, have positive postlaunch effects on stock prices; additionally, adequate marketing of new products that

communicates the value of innovations to consumers is also essential. Joshi and Hanssens (2009) note that advertising expenditure can have both a positive indirect effect through promoting sales/profits and a positive direct effect that increases a firm's intangible assets on firm value.

Investment on motion picture projects, especially those with large budget, are highly risky. In some respects, we could view movies projects as the R&D process of pioneering innovations. The producer and distributor of a movie can only know whether it will be a hit or flop after the first few days of its theatrical launch. Nevertheless, the public can still formulate their expectation on the performance of movies based on public information conveyed through the marketing activities by the distributors. The stock investors can then adjust the belief on the fair value of stock of the corresponding movie companies. Chance et al. (2008) develop a stochastic model to value revenue streams from innovations and illustrate the model in valuation of options on movie box office revenue. Joshi and Hanssens (2009) examine the relationship between the revenue expectation built up for a movie by prelaunch advertising and the postlaunch stock price of the movie studio, and find that movies with high advertising expenditure are associated with lower postlaunch stock returns.

Assuming that stock prices instantaneously incorporate all relevant public information, the semi-strong form of EMH implies that the investors always possess sufficient attention so as to process and react to various stock-related information instantly, which is obviously an oversimplification of reality especially for unprofessional retail investors. The theory of attention theory proposed by Barber and Odean (2008) provides a mechanism of how limited attention drives security price change: abnormal increase in retail attention leads to more buying than selling activities, which predicts short-term price increase and long-term price reversal. Aggregate search frequency of stocks in mainstream search engines has been widely used as a direct measurement of retail attention in literature since Da et al..

Abnormal Return of Movie Company Stocks

This study tries to locate the factors that are related to the theatrical launch of movies and would have predicting power over the short-term abnormal return of stocks for movie companies in A-Shares which invest those movies. As the influence of a new movie usually takes effect in a short period (a few weeks) around its release day, we investigate the abnormal return of movie stock on a daily basis.

We first focus on the public attention of movies which can be directly measured by their aggregated search frequency on Baidu.com (movie-SVI). Although the majority of searches on movie are initiated by potential audiences, we believe that movie-SVI is also a good proxy for the attention of retail investors to the movie-related stocks. On one hand, it is common knowledge for stock investors interested in movie industry of A-Shares that the high risk of movie projects is a major source of uncertainty in the yearly profit of movie producers and distributors. When a retail investor considers to buy the stock of a movie company, she probably would investigate and evaluate the movie(s) recently invested by the company, especially the ones which will launch soon or just got released, and search engine is the most commonly used portal to collect relevant information. On the other hand, unlike the famed "Big Five" major movie studios in U.S., movie companies in mainland China are much lower in public visibility. During the short period around a movie's theatrical launch, the surge of movie-SVI indicates high public attention to the movie, which could then draw the interests of potential retail investors in stocks of the related movie companies. Therefore, according to the attention theory (Barber and Odean, 2008), we propose our main hypothesis:

Hypothesis 1. Abnormal movie-SVI is positively related to the future short-term abnormal stock return.

As literature has documented, aggregated search frequency of stocks of movie companies (stock-SVI) directly measures the attention and demand for relevant public information of the potential retail investors. For stock-SVI, we use the SVI of the Chinese names of the stock instead of the SVI of the stock ticker which are more common in literature. The stickers of A-Shares are six-digit numbers (e.g., 300251 for Enlight Pictures) which are difficult to memorize for retail investors. In a preliminary data analysis of Baidu SVI, we find that the search frequencies of stock stickers of several movie companies in A-Shares are below a certain threshold and Baidu does not provide their SVI. We speculate that the retail investors tend to use the Chinese names of movie stocks as keywords for Baidu. We thus propose the second hypothesis which is again based on the attention theory:

Hypothesis 2. Abnormal stock-SVI is positively related to the future short-term abnormal stock return.

A movie company's stock price prior to the release of a movie that it invested incorporates the public expectation of the movie performance based on available public information, whereas the actual performance is gradually revealed via its daily box office. The efficient market model suggests that the stock price after movie release would reflect the adjustment to performance expectation. We define a simple indicator "abnormal daily box office" which is calculated as the difference between the box office of today and that of yesterday to capture the adjustment of movie performance expectation. Accordingly, we propose the third hypothesis:

Hypothesis 3. Abnormal daily box office is positively related to the future short-term abnormal stock return.

Data and Sample Construction

Data Source

Movie, stock, and search frequency data of mainland China during the years of 2017, 2018 and 2019 are collected to construct samples for our analysis. Samples prior to 2017 are deserted because of serious missing-value issue in the necessary Baidu SVI data, and we stop at the end of 2019 as the movie market of China has been undergoing an abnormal depression due to the serious shock of COVID-19 pandemic since then.

A mobile application crawler is developed to collect movie-related data including the basic movie information, the daily box office revenue, the main investors (producers and distributors), etc., from Maoyan Pro APP. We focus only on the domestic movies in the yearly top 100 grossing movies of mainland China, since movies ranked below 100 are usually undistinguished and cannot generate remarkable revenue or public attention for its investor. For the remaining 154 local movies, we check their main investors and locate 14 of them which are among the A-Shares listed companies in the film and television sector. We further examine the 2017 financial statements of the 14 companies and exclude Zhejiang Talent and H&R Century, because their main business is TV shows and the revenue from movie projects is almost negligible. In the end, the stocks of the remaining 12 companies are included in this research: Wanda Film (002739), China Film (600977), Huayi Brothers (300027), Beijing Enlight (300251), Zhejiang Huace (300133), Beijing Jingxi (000802), Zhongnan Red Cultural (002445), Shanghai Film (601595), Shanghai New Culture (300336), Omnijoi Media (300528), Beijing HualuBaina (300291) and China Television Media (600088). Among the 154 local movies, 102 are invested by the selected 12 companies, and the rest are excluded.

We then develop a web crawler to collect the daily SVI data for both the selected movies and their investors' stocks during the periods of four weeks before and four weeks after the movie's release day from Baidu Index service. The daily stock price and volume data and relevant accounting information is obtained from Tushare, a financial data provider of A-Shares market.

Sample Construction

Based on the investment relationship, the 102 movies and 12 companies generate 169 movie-stock pairs as movies may have more than one investor. Wanda Film was under trade suspension from 2017.7.4 to 2019.11.9 and had invested 26 movies during this period, so the corresponding 26 movie-stock pairs has to be removed. We then construct samples for our analysis based on the remaining 143 movie-stock pairs. For each pair, we collect the daily stock and SVI data for four weeks both before and after movie release, and the daily box office data for four weeks after movie release to construct research samples.

Unlike previous research on the relationship between investor attention and stock return, both of them in this study are severely affected by a significant event, i.e., the theatrical launch of movie. Hence, the pattern of their relationship might vary depending on the time point relative to this event. To investigate the dynamics in stock market caused by movie release, we construct six consecutive periods surrounding the day of movie release: period[-3], period[-2], period[-1], period[1], period[2], period[3], where the release day is the first day of period[1], and each period contains exactly five trading days.

Accordingly, each period is usually seven days, but will be longer than if holidays are involved. We conduct empirical analysis on a daily basis instead of weekly basis applied in most previous research separately for each of the six periods so as to better capture the rapid change in investor attention and expectation in a relatively short period.

Daily abnormal stock returns as the dependent variable in our empirical model incorporate new market information and sentiment for more than one nature days if the previous day is a non-trading day. We create a dummy variable H that indicates whether an instance is on a day that succeeds a non-trading day, i.e., Monday or the first day after a holiday, to control the possible market difference. The abnormal return for a movie stock is in basis points (0.01%) and calculated as the difference between returns on the stock and on the CSI(China Securities Index) Film & Television Index (930781.SS), which captures the its excess return over the weighted average return of A-Share stocks in the film & television industry. Other variables are similarly defined as previous studies and summarized in Table 1.

Table 1. Variable Definitions

Variable	Definition
<i>Variables from Baidu Index</i>	
SVI_S	Stock SVI, daily aggregate search frequency from Baidu Index based on stock name
ASVI_S	Abnormal Stock SVI, the log of this day's SVI_S minus the log of average SVI_S during its previous period
SVI_M	Movie SVI, daily aggregate search frequency from Baidu Index based on movie name
ASVI_M	Abnormal Movie SVI, the log of this day's SVI_M minus the log of average SVI_M during its previous period
<i>Variables related to stock</i>	
Ret	Daily stock return
Pftl Ret	Daily portfolio stock return, calculated based on CSI Film & Television Index
AbnRet	Abnormal stock return, calculated by Ret minus Pftl Ret
MV	Market capitalization
TV	Stock turnover rate
<i>Variables related to movie</i>	
Box	Daily movie box office
Boxdiff	Abnormal daily box office, calculated as current Box minus the previous day's Box
H	Dummy variable which equals 1 if this day succeeds a non-trading day and 0 otherwise

Empirical Analysis

Research Methodology and Results

In this section we empirically investigate how a sharp change in the retail attention and the performance of movie companies affect abnormal stock returns in short future. Due to the short life of a movie's public presence (usually only a few weeks) and the high volatility of relevant attention and stock price during that period, we regress the abnormal stock return of the next trading day on the independent and control variables defined in Section 3. The corresponding empirical models for the three periods before movie release are:

$$AbnRet[j]_{it+1} = \beta[j]_0 + \beta[j]_1 AbnRet[j]_{it} + \beta[j]_2 ASVI_S_{it} + \beta[j]_3 ASVI_M_{it} + \beta[j]_4 TV_{it} + \beta[j]_5 H_{it} + \varepsilon[j]_{it},$$

where $j = -3, -2, -1$ (1)

The empirical models for the three periods after movie release when the daily box office data becomes available are:

$$AbnRet[j]_{it+1} = \beta[j]_0 + \beta[j]_1 AbnRet[j]_{it} + \beta[j]_2 ASVI_S_{it} + \beta[j]_3 ASVI_M_{it} + \beta[j]_4 TV_{it} + \beta[j]_5 H_{it} + \beta[j]_6 Boxdiff_{it} + \varepsilon[j]_{it},$$

where $j = 1, 2, 3$ (2)

Ordinary least squares estimations are obtained for the 6 models above. Models for $j=-3$ and $j=-2$ fail in the F-test, suggesting insufficient evidence for the prediction power of public attention over stock return of movie companies during early periods (more than one week before movie release). Models for $j=-1, 1, 2,$ and 3 are significant at 1% level and their regression results are reported in Table 2. The

independent variables are standardized so their coefficients can be interpreted as the impact of the change of one standard deviation. We find empirical evidence that a positive abnormal stock return for movie companies immediately follows an increase in the public attention on movies, as measured by abnormal movie-SVI, for the periods of one week before and three weeks after the launch day of movies, which supports hypothesis 1. Meanwhile, the positive relationship between an increase in public attention on stocks measured by abnormal stock-SVI and abnormal stock return of the next trading day is significant only in period[-1] and weakly significant in period[1]. After movie release, the relationship between its abnormal daily box office and the next trading day's abnormal stock return becomes significant and positive for the first two weeks. Overall, hypothesis 2 and 3 are partially supported.

Specifically, in the week right before movie release, increases in ASVI_Movie and ASVI_Stock of one standard deviation lead to positive changes of 50.3 and 136.7 basis points in abnormal stock return for the next trading day, respectively. The predicting power of ASVI_Movie maintains in the range of 67.3 to 83.6 basis points per standard deviation during the main life of a movie, while that of ASVI_Stock declines fast after the movie is launched. This result is not completely aligned with previous literature of retail investor attention for general stocks, in which the ASVI of stock consistently leads to positive abnormal stock return. The possible reasons might lie in the characteristics of the movie industry. Unlike Disney, most movie studios in mainland China are mid-sized companies that have limited public visibility on Internet. After a movie is released, it is more likely that the interested retail investors choose to search on Baidu.com the movie itself rather than its investors and distributors, because the former would provide information to assess the movie performance, which is the main source of uncertainty in the profitability of movie studios and more valuable than information of the movie companies in most cases. Additionally, the public attention on movies may attract potential retail investors, thus ASVI_Movie can also capture this passive attention on the related stocks.

Table 2. Estimation of Model Parameters

	Period[-1]	Period[1]	Period[2]	Period[3]
AbnRet	0.068 (0.040)	0.11 (0.033)**	0.025 (0.037)	0.011 (0.038)
ASVI_M	50.32 (16.70)**	67.67 (14.58)***	67.30 (22.14)**	83.59 (33.20)*
ASVI_S	136.69 (26.91)***	34.78 (18.52)	31.32 (19.70)	10.36 (20.84)
H	44.89 (20.78)*	-49.73 (19.17)**	23.19 (18.89)	-31.79 (19.05)
TV	-24.87 (15.41)	-49.90 (9.56)***	-30.04 (8.18)***	-20.77 (9.89)*
MV	-0.86 (8.72)	-0.23 (7.72)	6.98 (7.34)	9.37 (7.28)
Boxdiff		70.11(12.88)***	50.98 (17.00)**	-2.92 (32.79)
Constant	-37.96 (15.02)*	-55.71 (15.13)***	37.67 (17.36)*	20.92 (15.18)
Observations	715	697	715	715
R ² / R ² adjusted	0.061 / 0.053	0.138 / 0.130	0.049 / 0.039	0.023 / 0.013

Note: *, **, and *** represent significance at 10%, 5%, 1%, and 0.1% level, respectively. The dependent variable is the abnormal stock return (in basis points) of the next trading day.

Robustness Check

Several tests have been performed to check the robustness of our empirical results. (1) We change the main model from daily basis to weekly basis by using weekly average ASVI of movies and stocks to predict next week's abnormal stock return, which is a more common approach in similar literature (Da et al., 2011; Liu and Ye, 2016). (2) Company-fixed panel regressions are used to estimate model coefficients instead of the original OLS regressions. (3) We also apply different approaches of constructing variables. Abnormal stock return is alternatively calculated as the characteristic-adjusted return proposed by Daniel et al. (1997) and used in Da et al. (2001), and as the excess return determined in the market model as in Joshi and Hanssens (2009). The regression results of the aforementioned alternative models turn to be consistent with those of the original model, which confirms the robustness of our empirical findings. For the sake of brevity, we omit the detailed report of those results.

Conclusions

In this paper we relate the online search frequency of newly launched products to retail investor attention on corresponding stocks in the context of the movie industry in mainland China. Classic empirical literature on the price pressure of stock caused by investor attention finds no evidence that the Internet search volume of a company's main products has an impact on its stock price in general, while we propose that such impact may exist in certain industries, e.g., the movie industry, where the new product launch is highly arresting and its performance has significant influence on the company's profitability. Using data of China domestic movies, studios, and search volume, our empirical model shows that abnormal SVI of a movie has positive impact on abnormal return of related movie stocks in a short future during the periods around the movie release when it attracts high public awareness; additionally, we find that higher abnormal stock SVI and box office also predict stock prices of next trading day, but their predicting power is less persistent than that of the abnormal movie SVI.

Starting from Da et al (2011), Internet search volume of stock as a direct measure of investor attention has become prominent in financial economics literature. However, studies using more recent data, e.g., Bijl et al. (2016), suggest that the positive relationship between stock SVI and future stock returns is getting weaker or even reversed. One possible explanation might be that the market now can incorporate the information in stock SVI very swiftly and efficiently. Therefore, with the growing importance and variety of alternative data in financial markets, it is important to explore novel industry-specific leading indicators of stock prices. By introducing search volume of movies as a new indicator of retail investor attention on stocks of the movie studios and distributors, this study extends the theory of attention literature and provides insight for future research that there may exist alternative and industry-specific measurements for investor attention other than stock SVI. Our analysis is limited majorly in that we did not consider the different shares of a movie's investment and actual profits or losses among its producers and distributors due to low data availability in movie industry of mainland China.

References

- Rappaport, A. 1998. "Creating Shareholder Value: A Guide for Managers and Investors," *Free Press*, New York.
- Barber, B. M., & Odean, T. 2008. "All That Glitters: The Effect of Attention and News on The Buying Behavior of Individual and Institutional Investors," *Review of Financial Studies*, (21:2), pp. 785–818
- Da, Z., Engelberg, J., & Gao, P. 2011. "In Search of Attention," *The Journal of Finance*, (66:5), pp. 1461-1499.
- Kou, Y., Ye, Q., Zhao, F., & Wang, X. 2018. "Effects of Investor Attention on Commodity Futures Markets," *Finance Research Letters* (25), pp. 190–195.
- Bijl, L., Kringhaug, G., Molnár, P., & Sandvik, E. 2016. "Google Searches and Stock Returns," *International Review of Financial Analysis* (45), pp. 150–156.
- Chance, D. M., Hillebrand, E., & Hilliard, J. E. 2008. "Pricing an Option on Revenue from an Innovation: an Application to Movie Box Office Revenue," *Management Science* (54:5), pp. 1015–1028
- MPA Asia Pacific. 2007. "China-international Co- production Handbook," <https://www.mpa-apac.org/wp-content/uploads/2018/05/2017-China-Co-Production-Handbook.pdf>
- Elberse, A., B. Anand. 2007. "The Effectiveness of Pre-Release Advertising for Motion Pictures: An Empirical Investigation Using a Simulated Market," *Information Economics and Policy* (19:3-4), pp. 319–343
- Fama, E. F. 1970. "Efficient Capital Markets: A Review of Theory and Empirical Work," *The Journal of Finance* (25:2), pp. 383.
- Srinivasan, S., Pauwels, K., Silva-Risso, J., & Hanssens, D. M. 2009. "Product Innovations, Advertising, and Stock Returns," *Journal of Marketing* (73:1), pp. 24–43.
- Joshi, A. M., & Hanssens, D. M. 2009. "Movie Advertising and the Stock Market Valuation of Studios: A Case of 'Great Expectations?'," *Marketing Science* (28:2), pp. 239–250
- Liu, X., Ye, Q. 2016. "The Different Impacts of News-Driven and Self-Initiated Search Volume on Stock Prices," *Information and Management* (53:8), pp. 997–1005.
- Daniel, K., Grinblatt, M., Titman, S., & Wermers, R. 1997. "Measuring Mutual Fund Performance with Characteristic-Based Benchmarks," *The Journal of finance* (52:3), pp. 1035-1058.

E1.5 An Economic Analysis of Software Piracy in a Competitive Cloud Computing Market: A Product Bundling Perspective

Zhiyuan, Liu^a, Yuexiang, Yu^b, Jikun, Lv^c and Xiong, Zhang.^d

^a School of Economics and Management, Beijing Jiao Tong University
E-mail: 19711092@bjtu.edu.cn

^b School of Economics and Management, Beijing Jiao Tong University
E-mail: 19711113@bjtu.edu.cn

^c School of Economics and Management, Beijing Jiao Tong University
E-mail: 19711022@bjtu.edu.cn

^d School of Economics and Management, Beijing Jiao Tong University
E-mail: xiongzhang@bjtu.edu.cn

Abstract

In cloud computing era, incumbent vendors are offering both on-premises software and cloud based software service. Simultaneously, they are facing competition from new entries who just offers cloud based software. However, piracy exists in on-premises software for incumbent vendors. Therefore, incumbent vendors are facing pressures from piracy and new entries at the same time. Using the framework of product bundling, this study builds a stylized analytical model to investigate the optimal product bundling strategies for software vendors in the presence of software piracy. The research found that the pure bundling strategy is the best choice for existing software vendors in the market in most cases because of more flexible bundling price. Pure component strategy can be more profitable than pure bundling strategy when piracy costs are in the medium level.

Keywords: Software piracy, cloud computing, product bundling, market competition

Acknowledgement

This research is supported by grants from the National Natural Science Foundation of China (Grant 71801014) and Beijing Social Science Foundation (Grant 17GLC069). Xiong Zhang (xiongzhang@bjtu.edu.cn) is the corresponding author.

E1.6 The Impact of Information Systems Vulnerability Announcements on Firms' Market Value

Chen, Jianlong.^a, Xu, Haijie.^b and Zhang, Xiong.^c

^a School of Economics and Management, Beijing Jiaotong University
E-mail: 19711001@bjtu.edu.cn

^b School of Economics and Management, Beijing Jiaotong University
E-mail: 19711033@bjtu.edu.cn

^c School of Economics and Management, Beijing Jiaotong University
E-mail: xiongzhang@bjtu.edu.cn

Abstract

Information systems vulnerabilities are causing serious negative impacts on firms. This paper aims to examine the impact of announcements of information systems vulnerability on the market value of firms in China. Using security incidents in Chinese firms from 2015 to 2021, we study how the characteristics of firms and vulnerabilities impact firms' market value. Specially, we find that state-owned enterprises suffer more negative effects than other types of firms. This study also provides useful insights and suggestions for firms.

Keywords: Information Security Announcements, Event Study, Abnormal Return, Regression Analysis

Acknowledgement

This research is supported by grants from the National Natural Science Foundation of China (Grant 71801014) and Beijing Social Science Foundation (Grant 17GLC069). Xiong Zhang (xiongzhang@bjtu.edu.cn) is the corresponding author.

[DAY 2]

A2 [Startup Session] Korean Startups,
Leading AI and E-Commerce

A2.1 이커머스 시대의 인공지능 기반 물류 플랫폼

박진수 (콜로세움)

콜로세움은 전국의 물류센터 네트워크와 AI솔루션으로 이커머스 상품의 보관, 포장, 배송, 반품 처리까지

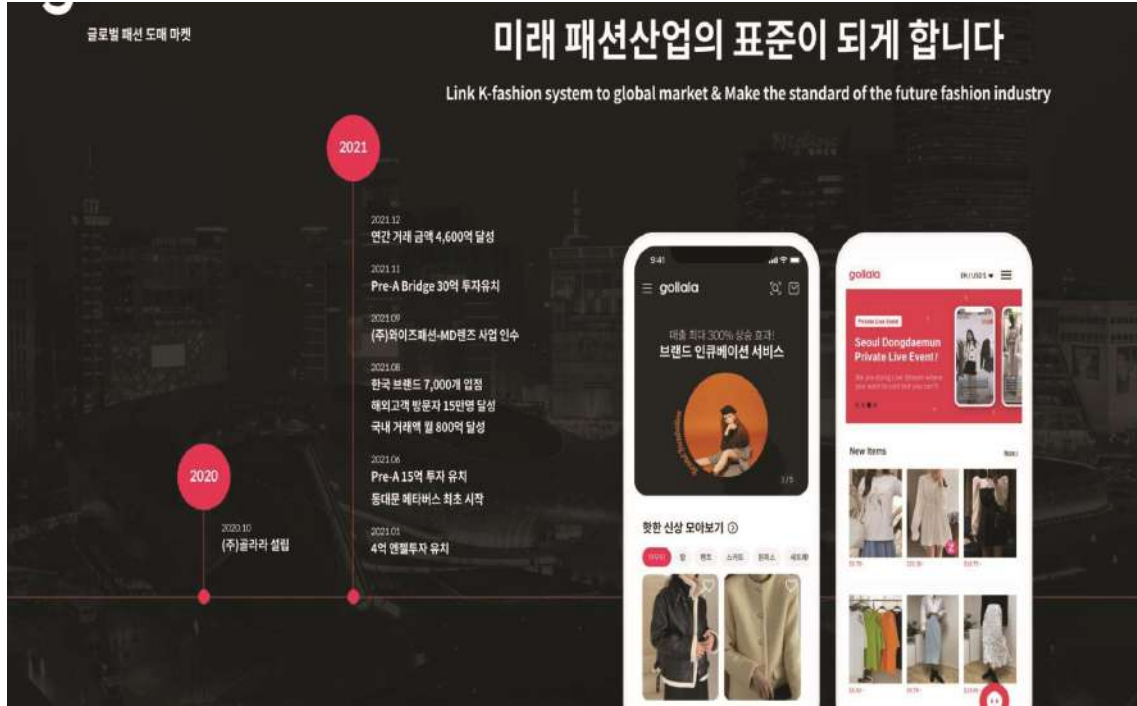
다 알아서 해주는 풀필먼트입니다.

콜로세움은 시와 빅데이터 기술을 기반으로 전국의 전문 물류센터를 연결하여, 고객 맞춤 물류서비스를 다 알아서 제공해드립니다.

오늘의 이커머스 물류를 초간단하게 만듭니다

A2.2 글로벌 패션 전자상거래 플랫폼의 변화

Vivien Nam (GOLLALA)



A2.3 전자상거래 및 인공지능 변화와 스타트업들의 활동 토론

이한수 (이탈리코)

[DAY 2]

B2 [Special Session] Graduate Student Research
Colloquium for Publication in High-ranking
Journals

B2.1 Detection of interaction-based knowledge for reclassification of service robots: big data analytics perspective

왕 밍
순천향대학교
일반대학원 경영학과
Jcakwang1121@sch.ac.kr

여 방
순천향대학교
일반대학원 경영학과
Lyuf06@sch.ac.kr

최재원
순천향대학교
글로벌경영대학 경영학과
jaewanchoi@sch..ac.kr

Abstract – With the advancement of artificial intelligence technology, the robot industry in human-robot interactive service has rapidly developed. The purpose of this paper is to uncover user acceptance of human-robot interactive service robots based on online reviews. Extract reviews the public service robots and the domestic service robots from YouTube uses word2vec, sentiment classification, and LDA (Latent Dirichlet Allocation) analysis methods for research. The results show that in the interactive technology, the public service robots, the domestic service robots, and the service robots can well receive the user’s speech, gestures, and understanding of emotional states and navigating with and around. However, collaborating with humans, users may be more fearful and worried. At the same time, the positive topic of the public service robots is experience value, and the negative topic is system quality. The positive topic of the domestic service robots is anthropomorphism, and the negative topic is perceived intelligence. The positive topic of the service robots is perceived enjoyment, and the negative topic is service quality. This research not only studies service robots, but also divides service robots into public service robots and domestic service robots for comparison and adds interactive technology for research, and supplements YouTube’s text mining to analyze on service robots. This research provides users with automated, intelligent and professional technologies, so that users have a more efficient, professional and better experience in different scenarios, strengthens users’ understanding of human-robot interaction service robots, and makes users accept service robots are of great significance.

Key Terms – Human-robot interactive, service robot, Word2Vec, sentiment classification, Latent Dirichlet Allocation.

B2.2 Exploring Consumers' Perceptions of the Influencer Sponsorship Disclosure Posts: the Perspective of Product Involvement and Brand Strength

Xiuping Zhang
순천향대학교 경영대학
zhangxiuping@sch.ac.kr

Jaewon Choi
순천향대학교 경영대학
jaewonchoi@sch.ac.kr

Abstract – Consumers' changing media consumption behaviors have prompted the growth of influencer marketing. The regulator emphasizes that influencers must disclose posts that work with brands as advertisements to protect consumers' right to know. Based on the differences in product involvement (high involvement products and low involvement products) and brand strength (strong brand and weak brand), this study examines the factors that affect consumers' acceptance of influencer sponsorship disclosure posts. This study uses the method of data mining to analyze consumers' comments and explore consumers' attitude of the influencer sponsorship disclosure posts from four aspects: the content generated by influencers, influencers, products and brands. It is expected that the findings of this study can provide brand communication managers and influencers with important information on how to design sponsorship disclosure posts to meet consumer expectations.

Key Terms – Influencer marketing, Sponsorship disclosure, Text mining

B2.3 Boycott or Not? How do paid Advertisement Controversy in Youtuber Industry for Consumer's Boycott Intention

왕 밍
순천향대학교 일반대학원 경영학과
Jcakang1121@sch.ac.kr

Abstract

The main purpose of this study is to explore the perceived deception, perceived risk and negative emotional factors impact on distrust, dissatisfaction, boycott intention of consumer toward product and Youtuber who failed to provide sufficient information about paid advertisements in their content which called "hidden advertisement". A total of 306 YouTube viewers from South Korea were interviewed in an online survey. As a result of the study is as follows: First, the perceived deception, perceived risk, negative emotional factors have been shown to increase the consumer's distrust and dissatisfaction. Second, we found that both consumer's distrust and dissatisfaction have positively influenced boycott intention toward YouTubers and boycott intention toward product. This study tries to identify the boycott intention of online consumer and it aims at finding out the reasons why boycotts can occur because in this issue the boycott just not only stopped at boycotting influencer or YouTuber, consumer distrust and dissatisfaction also can affect to boycott intention toward product and affect a long-term branding effort of company.

Boycott intention, Consumer distrust, Consumer dissatisfaction

Keywords: Hidden advertisement, Influencer,

B2.4 The Study on Determinants of User Satisfaction with Interoperable AI Voice Assistants

김엘레나
순천향대학교 경영학과
Voogiejam22@sch.ac.kr

최재원
순천향대학교 경영학과
jaewonchoi@sch.ac.kr

Abstract –This study is built to identify the effect of System Quality and Service Convenience on Satisfaction in context of Interoperability of AI Voice Assistants. The proposed model was tested with Structural Equation Modelling (SEM). The results of SEM testing showed that System Quality has a positive effect on the Satisfaction. It has also proved that the System Quality has a positive effect on the Service Convenience as well. Service Convenience as well was proved to have a significant effect on the Satisfaction. Thus, all three of proposed hypotheses were supported in this study. Last, the analysis of Variance was applied to discover the differences in groups with different levels of perceived AI Voice Assistant interoperability.

Key Terms – AI Voice Assistant Interoperability, System Quality, Service Convenience

I. Introduction

Artificial Intelligence (AI) is one of technological innovations, which performs manual work, that requires human intelligence. The main feature of AI, which outstands hundreds of previous inventions and make it so outstanding is that AI uses big data to broaden the possibilities of its' task performance abilities and achieve best performance. Nowadays, AI is used in almost every field of human life: healthcare, law, finance, education, transport, and Virtual assistants. Virtual assistant or Voice assistant is a software that understands the user's language and performs the instructions that the user wants. Voice assistant service was created as a system, which could use AI to provide intelligent search techniques to simplify the search process, leading to a sufficient timesaving for multitasking (Rousso and Schwartz 2004). By applying its improved intelligent searching techniques, Voice assistant systems (VASs) are used as tools for online shopping, learning new languages, answering questions, controlling/using other applications and devices (Nasirian, Ahmadian & Lee, 2017). Apple made a huge breakthrough when the first ever digital virtual assistant Siri was introduced as a feature on company's iPhone 4s in 2011. Since then, similar attends of several companies brought many voice assistants to the market. According to latest forecast from Gartner,

worldwide artificial intelligence software revenue is forecast to total US \$62.5 billion in 2022, which compared to US \$51.5 billion In 2021, representing an increase of 21.3% in total (Gartner, 2021).

Virtual Assistant software also taking a big part in of the revenue: the AI Voice Assistant software market revenue for 2022 is \$7.12 billion dollars, which indicates the growth compared to \$6.2 billion in 2021.

Though the AI Voice Assistants are constantly evolving, the adoption of such technologies remains a big issue. The adoption of AI technologies differs across the world (Mishra & Shukla, 2020).

Voice-based virtual assistants are becoming more common on mobile devices. The technologies are now being integrated into other devices, such as laptops and desktop computers, and whole new market of stand-alone items that function as smart home assistants, like Amazon Echo, is emerging (Guzman, 2018). Given the exponential rise of voice-based technology, many tech-users now have a chance to communicate with voice assistants as part of everyday life, exactly as they would with other humans (Sundar et al., 2017). Equipped with the set of useful features. AI-based voice assistants could not only play digital music through Wi-Fi and Bluetooth, but also can perform various verbal commands, based on users' needs (Ling, et al., 2021). As for 2021 year, the active usage of AI voice assistants still differs depends on the region. For example, even though market researchers give the AI voice assistant technology a big growth in revenue, in case of South Korea, the country with the highest percent of households using the internet, only 33% of population in age of 20-50 are using AI Voice Assistant. In case of Taiwan, more than 80 percent of people have smartphones, but only less than 10 percent of the people adopted smart speakers, as well as India, where smart voice assistants remain as a relatively young product (TWNIC, 2018; IDC, 2019). Moreover, as market competition for AI Voice Assistants has intensified due to the indiscriminate launch of AI Voice Assistants, the areas that users can use through one AI voice Assistant are decreasing. To address current issue, Microsoft Cortana and Amazon Alexa has launched an integrated service, where both features

of each Voice Assistant can be used on one device. This integration of two Voice Assistants gives user the opportunity to get access to exclusive features of one or another voice assistant wherever they wanted. For example, a person with Cortana can order products off Amazon or manage existing orders with voice instructions. In case of manufacturers, the creation of interoperable Voice Assistant services brings companies greater powers to compete with other AI Voice Assistant service providers. In case of other ICT companies, the biggest manufacturer of smart voice speakers, Amazon could not skip the opportunity to expand its zone of interest and launched the Voice Interoperability Initiative in 2019. Currently, The Voice Interoperability Initiative has gained support from 80 companies, including brands like Baidu, BMW, Bose, Microsoft, Salesforce, Sony and more, including companies like Facebook, Qualcomm, and Intel as a part of the initiative. Prior studies on AI Voice assistants made a focus on factors, that influence the adoption of voice assistants and increase the purchase intention of smart voice speakers. Thus, the functionality and main attributes of AI Voice Assistant were tested by such models as Task-technology Fit Model and Diffusion of Innovations (Ling, et al., 2021). Technology Acceptance Model also is broadly used as a conceptual framework to test users' tendency to use Voice Assistant technology (Nasirian, Ahmadian & Lee, 2017). As the market of Voice Assistant related technologies is growing, there remains a big issue of lack of the research on voice assistants interoperability.

In this study, we aim to discover a method for increasing the usefulness of ai voice assistant to utilize the multi-area of AI voice assistant service. Through previous research on the interoperability of mobile services, we intended to conduct research on the compatibility of ai voice assistant and to find out the effect of interoperability on service convenience and system quality. The topic of Interoperable Voice Assistant systems remains unexplored in prior literature. To find out efficient implications on this topic, we conducted the research, consisting of two studies: First – How consumers perceive the AI Voice Assistant service, tested in UEQ+ model. The second study is conducted in aim to find answers to three main questions. First, Does Interoperability affect system quality and service convenience? Second, Does Service quality of AI Voice Assistants affect service convenience? And third, Does Service Quality and Service Convenience affect consumers' satisfaction and their intention to recommend the interoperable AI Voice Assistants?

II. Research Model



<Figure 1> Research Model

III. References

- Gartner, "Gartner Forecasts Worldwide Artificial Intelligence Software Market to Reach \$62 Billion in 2022", (2021).
- Guzman, A. L., "Voices in and of the machine: Source orientation toward mobile virtual assistants.", *Computers in Human Behavior*, (2019), 90, 343-350.
- IDC, "India Smart Speakers Market Touches a New High in 2018", IDC India Reports, (2020). <https://www.idc.com/getdoc.jsp?containerId=prAP44965119>.
- Ling, H. C., Chen, H. R., Ho, K. K., & Hsiao, K. L., "Exploring the factors affecting customers' intention to purchase a smart speaker", *Journal of Retailing and Consumer Services*, 59, (2021), 102331.
- Mishra, A., A. Shukla, 2020. Psychological Determinants of Consumer's Usage, Satisfaction, and Word-of-Mouth Recommendations Toward Smart Voice Assistants. In book: Re-imagining Diffusion and Adoption of Information Technology and Systems: A Continuing Conversation (pp.274-283)
- Nasirian, F., Ahmadian, M., & Lee, O. K. D., "AI-based voice assistant systems: evaluating from the interaction and trust perspectives", (2017).
- Rouso, A., and Schwartz, S., "Apparatus, Method and System of Artificial Intelligence for Data Searching Applications.",(2004) Google Patents.
- Sundar S., Eun HwaJung, T. Franklin Waddell, Ki Joon Kim, "Cheery companions or serious assistants? Role and demeanor congruity as predictors of robot attraction and use intentions among senior citizens", *International Journal of Human-Computer Studies*, (2017), 97, 88-97
- TWNIC, "ANNUAL REPORT",(2019), <https://www.twnic.net.tw/doc/twrp/201812b.pdf>

B2.5 What makes people purchase used products online using C2C used product platform?

Henry Ofori
Ajou University
henryofori@ajou.ac.kr

Abstract

C2C used product platforms are revolutionizing the used product consumption and transition market on a global scale. Currently, in Korea, 25% of smartphone users utilize second-hand services to purchase products (Lee, 2020). In the USA, usage of C2C used product platforms such as, Thredup, Etsy, Depo, eBay, and Facebook Marketplace has increased, while in countries such as China Idle fish (Taobao) has become the largest C2C community-based used product platform (Booker, 2021). These increases in usage support projections that anticipate that the product market will double within the next five years, with revenue projections close to \$77 billion (Thredup, 2021); it also indicates that C2C used product platforms are focused on the exponential growth and successful trade of used products.

Previous studies conducted on C2C sharing platforms focused on ride sharing (Shao, Zhang, Li, & Zhang, 2022), accommodation (Yang, Lee, Lee, & Koo, 2019), and e-commerce (Shihab, Maulana, & Hidayanto, 2018) platforms, however, not enough attention has been given to C2C platforms which enable consumers to engage in used-product transactions, thus a gap in C2C used-product platform research exists. Therefore, the main goal of this paper is to explore how consumer value serves as an antecedent of consumer engagement and platform attachment and how it leads to the continuous use intention and recommendation intention of consumer-to-consumer (C2C) used-product platforms through the lens of users and the gratification theory. In addition, the moderating effect of the platform type will be explored.

Analysing the structural equation model with survey responses from experienced users of C2C used-product platforms such as Dangguen market and Joongonara reveals that multidimensional consumer values significantly influence consumer engagement and platform attachment. Consumer engagement is observed to substantially impact the

continuous use intention and recommendation intention of C2C used-product platforms. In contrast, platform attachment significantly affects only the recommendation intention. However, the multigroup analysis result shows that community-based connectors, C2C, and supportive used-product platform types do not moderate the strength of the relationship between the exogenous and endogenous constructs of the model. The results raise a favourable theoretical implication for future and practical implications for C2C used products and e-commerce firms.

Keywords: Consumer value, platform attachment, consumer engagement, continuous use intention, C2C used-product platform, uses and gratification theory

References

- Booker, A. (2021, 10). Secondhand Luxury Platform Profile: Alibaba's Idle Fish. Retrieved from <https://jingdaily.com/secondhand-luxury-platform-profile-alibabas-idle-fish/#:~:text=Idle%20Fish%20allows%20secondhand%20items,around%20300%20million%20registered%20users.>
- Lee, P. (2020, June 29, 2020). Dangguen: Introducing the second-hand disrupter from Seoul. Retrieved from <https://pickool.net/danggeun-is-disrupting-second-hand-goods-trades/>
- Shao, Z., Zhang, L., Li, X., & Zhang, R. (2022). Understanding the role of justice perceptions in promoting trust and behavioral intention towards ride-sharing. *Electronic Commerce Research and Applications*, 51, 101119. doi:<https://doi.org/10.1016/j.elerap.2022.101119>
- Shihab, M. R., Maulana, D., & Hidayanto, A. N. (2018). Determinants of Repurchase

Intention in C2C E-Commerce: Customers' Perspectives of Merchants and Platform Providers. *Information Resources Management Journal (IRMJ)*, 31(3), 54-76.

doi:10.4018/IRMJ.2018070104

Thredup. (2021, 6). 2021 Fashion Resale Market and Trend Report. Retrieved from <https://www.thredup.com/resale/#resale-industry>

Yang, S.-B., Lee, K., Lee, H., & Koo, C. (2019). In Airbnb we trust: Understanding consumers' trust-attachment building mechanisms in the sharing economy. *International Journal of Hospitality Management*, 83, 198-209. doi:<https://doi.org/10.1016/j.ijhm.2018.10.016>

[DAY 2]

C2 [KIISS-Paper Session]
Intelligent Devices and Services

C2.1 지능형 홈뷰티 디바이스 개발을 위한 방법

방예원
한동대학교 콘텐츠융합디자인학부
22000321@handong.ac.kr

박 준
한동대학교 ICT창업학부
21900307@handong.ac.kr

정두희
한동대학교 ICT창업학부
profchung@handong.edu

국문초록

최근 홈 뷰티 디바이스 시장이 성장함에 따라 LED 마스크의 효능과 사용자 경험이 대두되고 있다. 이러한 시점에 AI 기반 혁신 기능 적용 모델을 통해 LED 마스크의 개선점과 보완점들을 분석하여 인식, 예측, 최적화, 소통, 생성의 각 요소에서 AI 기술을 LED 마스크에 효과적으로 도입 및 활용하는 것이 필요하다. 본 연구는 지능형 LED 마스크가 뷰티 디바이스 시장에서 소비자들의 수용을 끌어내려면 어떤 점을 고려해야 하는지, 그중 어떤 점을 중점적으로 다루어야 하는지를 파악하기 위해 마켓 풀 (Market-Pull) 기반의 분석 방법론을 다루었으며 인공지능의 특성을 활용하여 기존 LED 마스크 제품의 기능적인 측면을 고도화하기 위해 KANO 모델과 TOPSIS 모델을 통합한 새로운 연구 방법론을 제안한다. KANO 모델을 통해 소비자들이 우선적으로 LED 마스크 제품에 원하는 품질 기능들을 선별 및 평가하였고 TOPSIS를 기반으로 LED 품질들에 대한 중요도를 구하여 우선순위를 도출하였다. 연구 결과 소비자들이 우선적으로 원하는 기능들은 피부 상태 분석 진단 기능, 사용자 맞춤형 기능, 디스플레이 기능들이었으므로 나타났다. KANO - TOPSIS 통합 모델을 기반으로 소비자들이 원하는 LED 마스크 제품의 기능들을 제시한 점과 새로운 통찰을 제시하여 뷰티 디바이스 시장에서 수용도 높고 우수한 지능형 LED 마스크 제품을 제안한다는 점에서 의의가 있다.

주제어

인공지능, LED 마스크, 카노(KANO) 모델, 탑시스(TOPSIS) 모델

C2.2 중소기업의 스마트팩토리 사용자 만족이 경영성과와 고도화 수용의도에 미치는 영향: 정보시스템성공모형을 기반으로

김윤재
경희대학교 일반대학원 경영학과
yoonjae2022@khu.ac.kr

정창근
경희대학교 경영대학원 경영학과
starchang@khu.ac.kr

양성병
경희대학교 경영대학 경영학과
sbyang@khu.ac.kr

Abstract - 제4차 산업혁명을 기반으로 하는 스마트팩토리는 제조업 관점에서는 자원의 효율성과 적응성 향상을, 가치사슬 관점에서는 고객 또는 공급자의 통합을 특징으로 하는 지능적이고 스마트한 공장을 의미한다. 이러한 제4차 산업혁명의 흐름에 발맞춰 우리나라에서도 2014년 제조업 혁신 3.0전략을 발표한 이후 국가경쟁력 제고와 제조업 경쟁력 확보를 위한 스마트팩토리 보급 및 확산사업이 활발히 진행되고 있다. 그러나 스마트팩토리 구축기업의 약 75%가 MES, ERP, SCM 등 공정 소프트웨어 솔루션 도입 등 기초 단계에 머무르고 있으며, 솔루션을 기 구축한 기업들마저 이를 지속적으로 활용하지 못하는 경우도 흔하게 발생하고 있다. 기존 선행연구의 대다수는 구축단계까지의 일부 사례를 적용한 연구가 대부분을 차지하고 있으며, 일부 공정의 스마트팩토리 추진사례를 소개하거나 구축 및 운용 시 빅데이터 적용방안 등에 대한 연구에 초점을 맞추고 있어 스마트팩토리의 지속적 활용에 대한 실증적 연구는 부족한 실정이다. 이에 본 연구에서는 정보시스템 성공모형(Information Systems Success Model)과 스마트팩토리 관련 선행연구를 기반으로 스마트팩토리 사용도 및 사용자 만족에 영향을 주는 주요 선행요인(시스템 품질, 정보품질, 서비스 품질, 품질비용, 정부지원)을 도출하고, 이 요인들이 사용도 및 사용자 만족을 거쳐 지속사용의도, 경영성과 및 고도화 수용의도에 미치는 영향을 실증해 보고자 한다. 나아가 경영성과와 고도화 수용의도의 영향 관계에 있어 고도화 구축비용의 조절효과를 추가 검증하고자 한다. 도출된 연구가설의 검증은 위해 이미 스마트팩토리를 도입하여 기초 단계에 머무르고 있는 중소기업의 대표, 임원 및 실무자를 대상으로 설문조사를 실시하고, 수집된 자료는 구조방정식모형을 적용하여 분석할 예정이다. 본 연구는 정보시스템 성공모형을 활용하여 중소기업의 스마트팩토리 사용 만족으로 인한 경영성과와 고도화 수용의도에 미치는 구체적인 영향 메커니즘을 최초로 실증한 연구라는 점에서 학술적 의의를 찾을 수 있다. 본 연구결과를 통해 중소기업이 스마트팩토리를 구축한 이후에도 이를 지속적으로 활용하고, 나아가 고도화

단계까지 추진하여 경쟁력을 더욱 향상시킬 수 있는 전략 마련의 근거를 제시할 수 있을 것으로 기대한다.

Key Terms - 스마트팩토리, 사용자 만족, 경영성과, 지속사용의도, 고도화 수용의도, 정보시스템 성공모형, 중소기업

이 논문은 2020년 대한민국 교육부와 한국연구재단의 지원을 받아 수행된 연구임 (NRF-2020S1A5B8103855).

C2.3 저성능 자원에서 멀티 에이전트 운영을 위한 의도 분류 모델 경량화

윤용선
(주) 자이냅스
ysyoon@xinapse.ai

강진범(주)
자이냅스
jb.kang@xinapse.ai

국문초록

최근 자연어 처리 분야에서 대규모 사전학습 언어 모델(Large-scale pretrained language model, LPLM)이 발전함에 따라 이를 미세조정(Fine-tuning)한 의도 분류 모델의 성능도 개선되었다. 하지만 실시간 응답을 요하는 대화 시스템에서 대규모 모델을 미세조정하는 방법은 많은 운영 비용을 필요로 한다. 이를 해결하기 위해 본 연구는 저성능 자원에서도 멀티 에이전트 운영이 가능한 의도 분류 모델 경량화 방법을 제안한다. 제안 방법은 경량화된 문장 인코더를 학습하는 과제 독립적(Task-agnostic) 단계와 경량화된 문장 인코더에 어답터(Adapter)를 부착하여 의도 분류 모델을 학습하는 과제 특화적(Task-specific) 단계로 구성된다. 다양한 도메인의 의도 분류 데이터셋으로 진행된 실험을 통해 제안 방법의 효과성을 입증하였다.

주제어

목적 지향 대화 시스템, 의도 분류, 모델 경량화

Acknowledgement (사사)

논문에 대한 지원기관이 있는 경우, 여기에 사사를 표기합니다.

C2.4 Patch Mix 기반의 이미지 생성을 통한 전기차 배터리 OOD 연구

이지훈
연세대학교
디지털애널리틱스융합학과
alex6758@yonsei.ac.kr

조영규
연세대학교 산업공학과
cykpig@yonsei.ac.kr

김우주
연세대학교 산업공학과
wkim@yonsei.ac.kr

Abstract - 오늘날 제조 공정에서 양산되는 다양한 데이터와 이의 분석 방법에 따라 다양한 도메인에서의 데이터 분석 모델 개발에 대한 연구가 활발하게 이루어지고 있다. 제조 공정에서 미세하게 등장하는 불량 데이터를 정확하게 탐지하지 못할 경우, 큰 문제로 이어질 수 있기 때문에 제조 공정에서의, 정확한 이상 탐지에 대한 연구가 활발하게 진행 중이다.

이에 본 논문은 이미지 이상 탐지(*Image anomaly detection*)를 패치 믹스 기반의 이미지 생성을 통해 *Outlier Exposure* 방법론의 보조 데이터셋으로 사용해 기존의 문제 해결을 제안한다. 이미지 이상 탐지는 정상 데이터에서 나타나는 패턴과 다른 패턴을 가진 이미지 데이터를 검출하는 것을 목표로 하는 문제이며, *Outlier Exposure*는 학습 과정에 있어 기존의 연구처럼 정상 데이터만을 학습하는 것이 아닌 불량 보조 데이터 셋도 같이 학습함에 따라 OOD 성능을 높이기 위해 제안된 방법론이다.

효과적인 이미지 이상 탐지(*Image anomaly detection*)를 위해, 학습 과정에서는 *ImageNet Pretrained EfficientNet B0 model*을 사용하여 *Multiclass Classifier*를 학습한다. 이 과정에서 *Patch Cloning* 기반으로 이미지를 생성하고, 다양한 *augmentation* 적용과 *Weight sampling*을 통해 *Mix* 이미지를 생성한다. 이후 원본 이미지와 *Mix* 이미지에 대해 최종 *Weight*를 부여해 *Mix*해 최종 불량 이미지를 생성했다. 생성한 이미지를 불량 보조 데이터 셋으로 사용하고 학습과정에서 정상 데이터에는 *CrossEntropy Loss*를 보조 데이터에는 *Uniform Loss*를 추가하여 사용했다. 이를 통해 정상 이미지는 잘 예측하고 불량 이미지의 경우 *Uniform*한 *Softmax*값을 가지게 했다. 이를 통해 정상과 매우 유사한 분포를 지니며 다양한 불량 보조 데이터 셋 생성을 했다. 이 데이터를 *Outlier Exposure* 방법론의 보조 데이터 셋으로 사용해 전기차 배터리 OOD 탐지 성능을 향상시켰다.

전기차 배터리 이미지 데이터로 실험을 진행한 결과, 본 연구를 통해 제안된 방법론이 기존 *Image augmentation* 및 합성 기반의 생성 방식들보다 높은 성능을 보임을 확인하였다.

본 연구는 정상 데이터로만 학습을 하던 기존의 이상 탐지의 성능을 높이기 위해 보조 데이터 셋을 추가로 사용한 연구로, 이 과정에서 정상과 최대한 유사한 분포를 지니며 다양한 클래스 생성을 통해 모델을 *Robust*하게 학습하고 *Recall*, *Precision*, *F1-score* 등 기존의 성능이 향상되었고 *Generative Model* 보다 이미지 생성 속도가 빠른 점에 의의가 있다. 이상 데이터 탐지를 위해 이미지의 특성을 활용한 딥러닝 모델을 통해 이상 탐지 연구에 새로운 방향을 제시한다고 생각한다.

Key Terms - *OOD*, *Anomaly Detection*, *Image Augmentation*, *Natural Anomalies*, *Patch Cloning*

본 연구는 중소기업기술정보진흥원의 산학연 *Collab R&D*사업의 전기차 배터리 제조 공정 자동화를 위한 딥러닝 결합 분류 기술 개발 프로젝트의 지원을 받았습니다.

III. 참고문헌

Hendrycks, Dan, and Kevin Gimpel. "A baseline for detecting misclassified and out-of-distribution examples in neural networks." *arXiv preprint arXiv:1610.02136* (2016).

Liang, Shiyu, Yixuan Li, and Rayadurgam Srikant. "Enhancing the reliability of out-of-distribution image detection in neural networks." *arXiv preprint arXiv:1706.02690* (2017).

DeVries, Terrance, and Graham W. Taylor. "Improved regularization of convolutional neural networks with cutout." *arXiv preprint arXiv:1708.04552* (2017).

Deecke, Lucas, et al. "Image anomaly detection with generative adversarial networks." *Joint european conference on machine learning and knowledge discovery in databases*. Springer, Cham, 2018.

Hendrycks, Dan, Mantas Mazeika, and Thomas Dietterich. "Deep anomaly detection with outlier exposure." *arXiv preprint arXiv:1812.04606* (2018).

Yun, Sangdoon, et al. "Cutmix: Regularization strategy to train strong classifiers with localizable features." *Proceedings of the IEEE/CVF international conference on computer vision*. 2019.

Schlüter, Hannah M., et al. "Self-Supervised Out-of-Distribution Detection and Localization with Natural Synthetic Anomalies (NSA)." *arXiv preprint arXiv:2109.15222* (2021).

[DAY 2]

D2 [ICEC-Paper Session]
Machine Learning & Text Mining II

D2.1 The Heterogeneous Impact of Churn Customers

Park, W.^a and Ahn, H.^b

^a Graduate School of Business IT, Kookmin University
E-mail: lifefeelso@hotmail.com

^b Graduate School of Business IT, Kookmin University
E-mail: hcahn@kookmin.ac.kr

Abstract

In this study, we suggest an elaborate way to achieve customer demand from the perspective of churn management. We argue churn segmentation should be divided in accordance with heterogeneity egos such as voluntary/involuntary churn customers. Prior research mainly focused on churn prediction rather than retention though the retention is cost-effective and profitable for the firm. However, relatively few studies concentrate on the part of the retention strategy, called win-back. It has been known that customer reacquisition resulted in significant values. When reviewing former studies, we identified they underestimate heterogeneity churn egos though they should be treated individually. Thus, with the various metrics that proved their effectiveness, we will prove empirically the significant impact of the heterogeneity egos based on their second lifetime. It is vital because it could enhance a firm's competitiveness in terms of individual treatment, especially in the matured market. We expect this sophisticated customer segmentation to apply in various industries and argue that heterogeneity churn management should be considered a firm's success factor.

Keywords: Heterogeneity churn, Voluntary churn, Involuntary churn, win-back

Introduction

Customers have been leaving firms due to various reasons. To respond to these concerns, many studies have investigated the reason why customers disconnect their relationship with the firm and suggested a retention strategy that is able to prevent those customers from leaving. The phenomenon is observed in various areas (Lemmens and Gupta 2020) though firms make efforts to prevent this unpleasant observation. In addition, in terms of profitability, it should be noticed that the effort of new customer acquisition requires a higher cost than retention (Reichheld and Sasser 1990) especially when the market is matured (Stauss and Friege 1999). Since firms acknowledge this fact, they do not underestimate retention and they set it as their vital business goal (Lemmens and Gupta 2020; Rust et al. 1995; Ascarza 2018). The firms' initiatives they conducting to prevent or at least mitigate customer defection, may not guarantee a higher rate of conservation. We are aware of the firms' ordinary retention efforts such as conserving higher customer satisfaction or managing customers who are determined as loyal. They thought they have been hedging defect risk. However, Ascarza (2018) asserted firm's approach that determining a high-risk customer is futile. If the degree of customer satisfaction is decreased or the repurchase rate curve towards the downside then those signals might be considered risky, which alerts the firm and forces it to drive a proactive retention effort however it could be futile. It means retention itself is not a sufficient strategy to conserve customers. In addition, we assumed this futile effort could be accelerated due to an inevitable defection (Kumar et al. 2015), which means customer churn occurs inevitably (or unintentionally) regardless firm's effort to hold them. Thus, the firm should consider a supplementary strategy to properly handle the inevitable defection and fill the insufficiency. Reacquiring customers (Thomas et al. 2004) can be suitable as a supplementary. They will be reacquired by the firm's effort and Kumar et al. (2015) named those reacquired customers as win-back customers.

Though prior research revealed the importance of retention, the impact of defection, and the way of successful re-engagement such as win-back, they seem less emphasis on the customer churn willingness. Only a few studies intended to classify churn customers as voluntary and involuntary however they did not importantly treat this heterogeneity. We hypothesized churn customers have heterogeneity that will bring a different impact on the firm. Thus, we will study how the churn customer heterogeneity makes a different impact on a firm's performance and we will assess it based on the second lifetime of win-back customers.

Identifying heterogeneity impact would make an academic contribution to the research while suggesting advanced managerial practice in terms of churn customer management. It will enable the building of a sophisticated churn management strategy in accordance with heterogeneity effects. If a firm underestimates this heterogeneity effect, the firm will lose an opportunity of enhancing market competitiveness.

Literature Review

Customer reacquisition (win-back) and its financial performance measurement

Compared to customer churn research, customer reacquisition has received less attention from researchers despite its importance. Few are proactively studying those customers who defected relationship with a firm and restore the relationship by the attraction of the firm. The firm makes efforts to regain customers who once leave their service and this specific effort named various terms. Recently it has been widely called win-back, Stauss and Friege (1999) initially introduced it. However, even if a firm succeeds in winning customers back, it will be a serious concern whether the win-back customer would be profitable. If the concern can't be relieved, the win-back behavior could increase uncertainty about the firm's performance. To resolve the uncertainty concern of the firm, Kumar et al. (2015) suggested measuring profitable customers based on their second-life time. In their research, they classified customers into price-sensitive or service-sensitive groups and measure their contribution through an equation of the second lifetime. In the norm, a longer duration resulted in performance improvement.

Customer retention is generally known as an effective strategy (Reichheld and Sasser 1990). However, even if a firm pursues retention, inevitable churn must occur that distorts retention effort. The win-back strategy, in this case, complementary choice (Stauss and Friege 1999) that mitigates the impact.

Metrics influential to win-back

Though we acknowledged the ultimate role of win-back, our knowledge of the most profitable customer in their second lifetime stage is still ambiguous. Former studies identified prior experience associated with first-lifetime duration, an unengaged period due to customer defection, and a price, a customer had paid before the defection as significant factors, which allow for determining profitable customers.

The prior experience forms a perception of service and decided subsequent service usage (Bolton and Drew 1991; Eugene and Mary 1993). According to Gupta et al. (2006) and Tokeman et al. (2007), a higher length of persistency can be a representative factor of customer satisfaction that leads positive financial impact on the firm. Since satisfaction is presented as a longer duration, a customer's longer first lifetime indicates that the customer had a positive experience. It can be interpreted as the customer has a higher possibility of win-back. A certain period, disconnected from the firm might affect a negative impact. The former study revealed longer unengaged can be resulted in a negative impact on the firm (Kumar et al. 2015). Thus, it is a vital metric that enables an assumption of whom being an unprofitable customer in their second lifetime stage. Finally, the price is the most sensitive metric to identify a willingness of winning back. Thomas et al. (2004) and Kumar et al. (2015) asserted the price is associated with the customer's willingness to the relationship restoration with the firm.

In addition to these representative influential factors, a recent study found the effect can be moderated and extended the research scope into an organizational perspective. Kumar et al. (2018) asserted that

customers make a different impact on their second lifetime according to their status. A cured customer resulted in a positive impact while incurring one cause second churn. Arnd et al. (2020) introduced that a tolerance culture can make a positive impact on the organizational performance in terms of win-back. It is a novel approach that extended the research scope from individual to organizational level.

The heterogeneity churn customer – voluntary/involuntary

In addition to the metrics we reviewed, we observed a fact that the churn customer ego differs. It means churn reasons beyond satisfaction, lapse duration, and price that were investigated in the former studies. We find churn customers show heterogeneous churn behavior that voluntary churn and involuntary churn. Therefore, a firm must treat churn customers heterogeneously. We also discovered those customers' churn behavior is motivated by intrinsic and extrinsic respectively. For instance, voluntary churn customer leaves the firm due to competitors' attraction while involuntary customer unintentionally leaves the firm due to temporary or inevitable sufferings – for instance, financially unaffordable a service or product. The concept of voluntary/involuntary churn was introduced in a few studies, however, they did not identify the impact of its heterogeneity instead they used the term to explain specific customer behavior. In this study, we will empirically validate the significance of the novel variable, the heterogeneous churn.

Hypotheses

In this study, we propose four hypotheses to reveal profitable win-back customers. The hypotheses are established under theories such as customer satisfaction, a negative effect of relationship disconnection period, experienced service price impact, and heterogeneity churn behavior. The first assumption we are willing to test is the positive impact of customer satisfaction and to understand whether customer satisfaction makes a positive impact on the firm as well as customers' win-back decisions. Customer satisfaction is a very explicit metric, which makes a considerable impact on a firm's financial performance (Tokman et al. 2007; Gupta and Zithaml 2006). Though numerical expression of the degree of satisfaction was a challenge to the satisfaction research, two approaches enabled quantitative measurement – using the Customer Service Index (Yi and Bak 2020) or determining customer tenure period (Tokeman et al. 2007). Both are representative measurements to explicitly transform the abstract concept into measurable numbers. In this research, we will adopt the tenure period to identify how customers are satisfied firm's service. Kumar et al. (2015) renamed the length of the customer tenure in his/her lifetime as first-lifetime duration and suggested its usage. According to their research, a longer first lifetime indicates the higher customer satisfaction with the firm's service, and those customers have a higher possibility of win-back as profitable customers. However, prior research applied it to subscription or non-contractual business settings. We assume the first-lifetime impact will be equally effective in the financial industry, where we are concentrating. Thus, we hypothesize the first-lifetime impact as below:

H1. A positive customer's first-lifetime experience will be associated with the willingness of win-back and will bring a positive impact on their second lifetime.

It might be skeptical whether the win-back generates profit for the firm. Therefore, it makes the firm to hesitate that conducting a win-back campaign. According to Griffin and Lowenstein (2001), a defected customer showed a 20% to 40% chance of repeat sales. The sales ratio is higher than newly acquired customers (5% to 20%). In addition, a firm can predetermine the profitable customers when they revitalize the relationship with the firm. Former researchers revealed it by key features such as prior tenure, customer lapse duration, and amount of payment (Griffin and Lowenstein 2001; Thomas et al. 2004; Kumar et al. 2015). In this research, we will present the win-back performance through the customer's second-lifetime duration and revenue, which Kumar et al. (2015) suggested.

The second determinant, we considered is the customer's non-engagement period. It is a matter of resiliency. A firm's longer disconnection period with a customer might require more recovery effort

even if the profitability is uncertain. However shorter relationship disconnection period will show higher resiliency. The period, which we call lapse duration, makes a significant impact on customers' win-back decisions as well as customers' performance in their second lifetime stage. The longer lapse duration makes a negative impact while the shorter lapse duration makes the opposite effect (Griffin and Lowenstein 2001; Kumar et al. 2015). Therefore, we assumed the lapse duration effect as below:

H2. The second-lifetime duration and revenue will be affected by the lapse duration. A longer lapse duration will make a negative impact however shorter lapse duration will make a comparably positive effect.

The price customer paid in their first lifetime is another vital factor to decide on win-back and continuing their second lifetime. For the relationship between payment and win-back, we can explain it by reference price, which means the perceived price (Kalyanaram and Winer 1995). Thomas et al. (2004) asserted that offering discounted prices will gain customers when a firm conducts a win-back campaign. Thus, if the offered price is less than the reference price, the customer will decide on the win-back. However, the research concentration we are conducting is on customers' post-win-back behavior such as staying long with the firm and generating higher revenue – we consider this behavior as customer loyalty. In this perspective, It should be noticed that customers whose concern is only price showed a smaller lifetime period, for they are fragile to competitor's offerings (Stauss and Friege 1999). But it is in contrast with the result that Kumar et al. (2015) found. The defective customers due to price showed a long SLT duration.

From the profit perspective, higher-paying customers might be primarily considered profitable customers as Thomas et al. (2004) stated that loyal customers who willing to make higher payments. We assumed longer lifetime will make higher payments however Reinartz and Kumar (2000) stated longer lifetime customers made fewer payments than shorter lifetime customers. Regarding the price impact on second lifetime and win-back decisions, we couldn't find eligible research results to explain this phenomenon. Instead, based on former research, we infer the price impact seems complicated. Thus, we will identify the complicated relationship between price and second lifetime in this research following the below hypothesis:

H3. The price paid in the first lifetime stage will be associated with the loyalty of the second lifetime.

To our best knowledge, most churn management research less concentrate on heterogeneity churn behavior. Thus, we investigate how heterogeneous churn behavior impacts the second lifetime. In specific, we classify churn behaviors into two types - voluntary and involuntary.

Keaveney (1995) is primarily defined as involuntary churn. In her research, it occurred when customers moved or services closed. Modisette (1999) defined voluntary churn as customer switching behavior and involuntary as a failure of payment or fraudulent service acquisition. Braun and Schweidel (2011) introduced uncontrollable churn, which provides advanced insight to establish a churn management strategy. The former studies determined three representative churn types as in Table 1.

Table 1. Type of churn

Type	Description
Voluntary	A customer decides to leave for a personal reason such as service switching
Involuntary	Financially irresponsible or temporarily insufficient to afford the firm's service
Uncontrollable	Beyond general situations such as death, moving, and so on

To conduct precise campaigns and make advanced results, heterogeneity should be importantly treated as Burez and Van (2007) emphasized. The discrete churn impact has been underestimated. Only a few are studied but they did not adopt it as a vital factor when they study churn management. We realized its importance and will reveal the effect of heterogeneity churn through this research especially the effect on the second lifetime by hypothesizing the impact as below:

H4. Voluntary and involuntary churn customers will show discrete behavior in their second lifetime stage.

Research Method

Data Collection and Empirical Test Plan

To conduct the research, we collected data from an insurance company in Korea through precisely querying to prepare a dataset, consisting of 22,476 records. We manipulate the data to ensure its quality. For instance, minimize multi-contract impact, prevent distorting product trends, and follow the industrial standard to define churn status. For multi-contract concerns, we assume those records bring unexpected results - Imagine one customer has 20 or 30 contracts and high premium payment. Since the unit of analysis is customer, we merged multi-record into one single record and applied average for numerical data. Regarding the product trend, we didn't allow multi-sales channels, for each channel has a distinctive product. Thus, we chose a single sales channel. Finally, we defined a churned customer as a customer whose contracts are entirely lapsed in the case of a multi-contract customer.

We will analyze the data with a multi-regression model. Since all data are numerical, the regression is an appropriate model to estimate the hypothesis we established. The regression will evaluate variable effectiveness on the second lifetime by the standardized coefficient and we will ensure the model is trustworthy by evaluating the F-score of the model and determining multicollinearity.

References

- Arnd, V., Christian, H., and Olivia, G. 2020. "Tolerating and Managing Failure: An Organizational Perspective on Customer Reacquisition Management," *Journal of Marketing* (84:5), pp. 117-136.
- Ascarza, E. 2018. "Retention Futility: Targeting High-Risk Customers Might Be Ineffective," *Journal of Marketing Research* (55:1), pp. 80-98.
- Bolton, R.N., and Drew, J.H. 1991. "A Multistage Model of Customers' Assessments of Service Quality and Value," *Journal of Consumer Research* (17:4), pp. 375-384.
- Braun, M., and Schweidel, D.A. 2011. "Modeling Customer Lifetimes with Multiple Causes of Churn," *Marketing Science* (30:5), pp. 881-902.
- Burez, J., and Van, d.P.D. 2007. "CRM at a pay-TV company: Using analytical models to reduce customer attrition by targeted marketing for subscription service," *Expert System with Applications* (32:2), pp. 277-288.
- Eugene, W.A., and Mary, W.S. 1993. "The Antecedents and Consequences of Customer Satisfaction for Firms," *Marketing Science* (12:2), pp. 125-143.
- Griffin, J., and Lowenstein, M. W. 2001. *Customer win back: How to recapture lost customers and Keep them loyal, 1st ed*, San Francisco: Jossey-Bass.
- Gupta, S., and Zithaml, V. 2006. "Customer Metrics and Their Impact on Financial Performance," *Marketing Science* (25:6), pp. 718-739.

- Kalyanaram, G., and Winer, R.S. 1995. "Empirical Generalizations from Reference Price Research," *Marketing Science* (14:3), pp. G161-G169.
- Keaveney, S.M. 1995. "Customer Switching Behavior in Service Industries: An Exploratory Study," *Journal of Marketing* (59:2), pp. 71-82.
- Kumar, V., Bhagwat, Y., and Zhang, X.A. 2015. "Regaining "Lost" Customers: The Predictive Power of First-Lifetime Behavior, the Reason for Defection, and the Nature of the Win-Back Offer," *Journal of Marketing* (79:4), pp. 34-55.
- Kumar, V., Leszkiewicz, A., and Herbst, A. 2018. "Are You Back for Good or Still Shopping Around? Investigating Customer Repeat Churn Behavior," *Journal of Marketing* (55:2), pp 208-225.
- Lemmens, A., and Gupta, S. 2020. "Managing Churn to maximize Profits," *Marketing Science* (39:5), pp. 956-973.
- Modisette, L. 1999. "Milking wireless churn for profit," *Telecommunications* (33:2), pp 73-74.
- Reichheld, F.F., and Sasser, W.E. Jr. 1990. "Zero Defections: Quality Comes to Services," *Harvard Business Review* (68:5), pp. 105-111.
- Reinartz, W.J., and Kumar, V. 2000. "On the Profitability of Long-Life Customers in a Noncontractual Setting: An Empirical Investigation and Implications for Marketing," *Journal of Marketing* (64:4), pp. 17-35.
- Rust, R.T., Zahorik, A.J., and Keiningham, T.L. 1995. "Return on Quality (ROQ): Making Service Quality Financially Accountable," *Journal of Marketing* (59:2), pp. 58-70.
- Stauss, B., and Friege, C. 1999. "Regaining Service Customers Costs and Benefits of Regain Management," *Journal of Service Research* (1:4), pp. 347-361.
- Thomas, J.S., and Blattberg, R.C; Fox, E.J. 2004. "Recapturing Lost Customers," *Journal of Marketing Research* (41:1), pp. 31-45.
- Tokman, M., Davis, L.M., and Lemon, K.N. 2004. "The WOW factor: Creating value through win-back offers to reacquire lost customers," *Journal of Retailing* (83:1), pp. 47-64.
- Yi, Y., and Bak, H. 2020. "A Comprehensive Review of Customer Satisfaction, Service Quality and Customer Participation Behavior," *Journal of Consumer Studies* (31:5), pp.49-90.

D2.2 A Multi-CNN Model Interacting Contents and Ratings for Predicting Review Helpfulness

Xinzhe Li ^a, Qinglong Li ^a and Jaekyeong Kim ^{a,b*}

^aDepartment of Big Data Analytics, Kyunghee University, 02447, Seoul, Korea

^bSchool of Management, Kyunghee University, 02447, Seoul, Korea

*Corresponding author: jaek@khu.ac.kr

Abstract

With the growth of the e-commerce industry, online consumer reviews significantly impact the consumer purchase decision process. Since the consistently increasing number of reviews, the consumer can face an information overload problem. Thus, the consumers have a challenge exploring the information they need. Thus, we argue that predicting the review helpfulness becomes significant. When predicting review helpfulness, since the review contents and star ratings are information written from the same consumer experience, the consistency of the review contents and star ratings is essential. Previous studies predict review helpfulness by considering review content and star ratings simultaneously. However, such an approach has limitations in the representation capacity of star ratings and the capture of the interaction between review content and star ratings. The current study proposed a CNN-CRI mechanism to address the limitations of the previous study. To evaluate the proposed methodology, we utilized real-world online review data from Amazon.com. The results show that our study model indicates better performance than the state-of-the-art approach.

Keywords: Review helpfulness prediction, online review, star ratings, content-rating interaction

1. Introduction

As the e-commerce market grows, online consumer reviews are receiving excessive attention as they impact consumers' purchasing decisions (Gottschalk and Mafael 2017). Consumers face difficulties when exploring helpful reviews, since the information overload problems. The e-commerce websites have introduced a system, which could vote the review to address such issues. For example, Amazon.com asks consumers, "Was this review helpful?" to get helpfulness votes on reviews. Currently, online e-commerce websites provide reviews as per the helpfulness votes ranking to help consumers make purchase decisions (Siering et al. 2018). Such approaches are advantageous because they can offer feedback fast to consumers. Nevertheless, the reviews written a long before would receive more helpful votes, and the latest reviews have few chances to receive helpful votes (Ghose and Ipeirotis 2010). Thus, since the latest reviews cannot receive any helpful vote, such reviews cannot be easily referred to customers while the purchase decisions process (Ghose and Ipeirotis 2010). Therefore, we

argue it needed to conduct a related study since predicting review helpfulness can help the consumer purchase decision process.

The aim of review helpfulness prediction is to recommend helpful reviews to consumers which allows them to make decisions by using the information contained in the review. The previous approach has predicted review helpfulness only using review contents. Figure 1 shows an example of an electronics product review, (a) and (b) are reviews containing the same positive emotions but different star ratings. In (b), such a mismatching opinion between review content and star rating may be due to consumer carelessness or being ironic. Nevertheless, there is a chance that opinion inconsistency would cause other consumers confusion to reduce review reliability and review helpfulness. In other words, considering only the review contents, (a) and (b) have a similar effect on the consumer purchase decision process. Thus, predicting review helpfulness must simultaneously consider the review content and ratings to address such an above problem.



Figure 1. Inconsistency between Review Content and Star Rating

According to Salehan and Kim (2016); Siering et al. (2018), review contents have been converted into a high-dimensional vector, whereas star ratings have been utilized as scalar values. However, such methods minimize the impact of star ratings on the helpfulness of reviews. Qu et al. (2018) aim to enhance the predictive performance of the Convolutional Neural Networks (CNN) star ratings as the last word of the review contents in the embedding layer. As such, star ratings have been converted into feature vectors following the same dimension as the review contents, later connect the review contents with the star ratings. Du et al. (2020) capture the interaction effectively through the linear relationship between review contents and star ratings. The consistency among review contents and star ratings based on a linear relationship has been captured through the element-wise interaction shared by the content and rating feature vectors. However, such approaches to predict review helpfulness have limitations: (1) the representation capacity of star ratings is limited. (2) The interaction of review contents and star ratings is limited.

To address the limitation of the previous study, we proposed a CNN-based prediction model for review helpfulness using review Content and star Rating Interaction (CNN-CRI) mechanism to capture the interaction between review contents and star ratings effectively. The review content and star ratings were input into individual embedding vectors, converted into vectors of the same dimension, and connected to indicate equal representation. We also utilized a multi-CNN mechanism to extract semantic representation features in review contents. We simultaneously consider the linear and nonlinear methods to capture the interaction between the review contents and star ratings. We utilized real-world online review data on the e-commerce website Amazon.com to evaluate the proposed methodology. The original dataset contains 8,872,495 online reviews collected from May 1996 to July 2014. Our results indicate that the proposed study model improves performance more than the state-of-the-art approach. The contributions that this study have made are summarized as follows:

- This study proposed a review helpfulness prediction model based on review contents and star ratings interaction to help consumers explore helpful reviews.
- This study simultaneously captured the linear and nonlinear interaction to address the limitations in the representation capacity of the interaction between review content and star ratings.
- This study has conducted several experiments using a real-world Amazon dataset. The results indicate that the proposed methodology can enhance prediction performance and increase consumer satisfaction.

The rest of the composition of this study is as follows. Section 2 describes the theoretical background for review helpfulness prediction. Section 3 describes the proposed review helpfulness prediction mechanism. Section 4 describes the experimental dataset, evaluation metric, and results. Finally, Section 5 discusses the discussion, limitations.

2. Related Work

In the previous study on review helpfulness prediction, specific information relating to the review contents was viewed as a factor influencing the review helpfulness through regression analysis (Kim et al. 2006; Liu et al. 2008; Zhang and Varadarajan 2006). Nevertheless, such approaches utilized different criteria to select factors depending on the domain. Meanwhile, such approaches take a lot of time for researchers to learn basic knowledge of a particular domain. Recently, as deep learning advanced, deep learning techniques such as CNN were developed and can be modelled, which is widely used to predict review helpfulness. CNN with the ability to extract deep features has illustrated remarkable performance over many Natural Language Processing (NLP) tasks (Chen et al. 2019). Therefore, we utilize the CNN model to extract semantic features in review contents. Chen et al. (2018) utilizes CNN to assign different weights in the embedding layer depending on the effect of words on review helpfulness. Saumya et al. (2020) set kernel size to 3, 4, and 5 to predict review helpfulness through learning n-gram semantic features. Such studies have demonstrated exceptional performance in review helpfulness prediction. However, as mentioned above, since review contents and star ratings are information left by the same consumer on a particular product, the consistency between review contents and star ratings should be considered when evaluating review helpfulness.

In the previous study which considers the review contents and the star ratings simultaneously, the review content and the rating had been combined. However, such studies are far from fully utilizing rating information. Salehan and Kim (2016); Siering et al. (2018) utilize star ratings as scalar values. However, scalar representation limits the representation capacity of star ratings as well as its influence on review contents. In Qu et al. (2018), star ratings have been utilized as the last word of the review contents, and the interaction between reviews and ratings is extracted through the convolution layer and max pooling layer in CNN. Under this setting, star ratings only locally interact with the last few words of the review contents. Therefore, the representation capacity of interaction is limited. To overcome such an issue, (Du et al. 2020) extract interaction information through the methodology that review contents and star ratings are embedded separately and converted into vectors. The linear interaction between review contents and star ratings is extracted through element-wise manner for predicting review helpfulness. Although such a study has addressed the issue of limited interaction due to the representation capacity of star ratings, it still has a limitation in extracting interaction.

To effectively extract the interaction, we base on such a study to predict review helpfulness by simultaneously considering the linear and nonlinear relationships between review contents and star ratings. Thus, we utilize element-wise and concatenation manners on the review content and star rating vectors.

3. CNN-CRI Framework

The mechanism of the CNN-CRI model proposed in this study is illustrated in Figure 2. Given a review $d = (s, r, c, l)$ is a tuple of its review content s , the star rating r , the helpfulness score c , and the helpfulness label l . The CNN-CRI model consists of three modules: Review Content Encoder (RCE), Star Rating Encoder (SRE), and Content-Rating Interaction (CRI). s, r is extracted as feature vector through RCE, SRE module. The CRI module extracts the information interaction from CRI, then compute the helpfulness score c and classifies the helpfulness label l . Whether the review is helpful or not is classified by comparing c with the threshold value θ , as defined in Equation (1).

$$l = \begin{cases} 1, & \text{if } c \geq \theta \\ 0, & \text{if } c < \theta \end{cases} \quad (1)$$

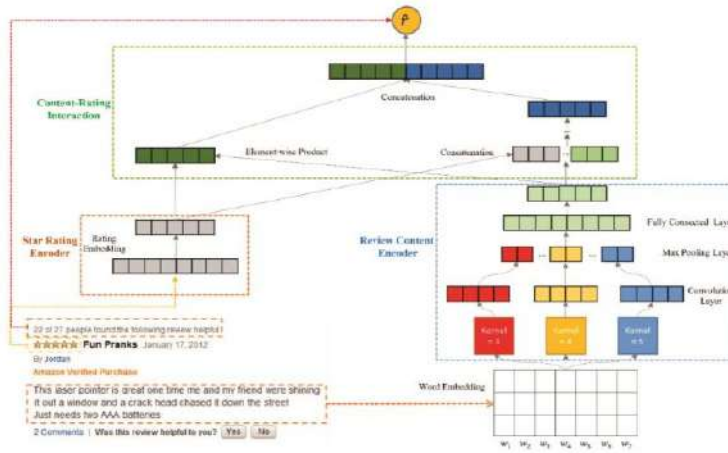


Figure 2. CNN-CRI Model Mechanism

3.1 Review Content Encoder

The RCE module employs a multi-CNN to extract semantic features of the review contents. Given a review content $s = \{x_1, x_2, \dots, x_N\}$ is a sequence of N tokenized words. In the embedding layer, let $x_i \in \mathbb{R}^{|V|}$ be the V -dimensional pretrained word vector of the i -th word in content, and V is the vocabulary size. Review contents are converted via the CNN model to a fixed-length feature vector $O = [o_1, o_2, \dots, o_m]$ through m maximum values acquired from the max pooling layer. Also, we have set kernel size=3, 4, and 5 to extract semantic features.

The review content and star rating feature vectors need to be converted into the same dimensionality to perform the element-wise manner and enable equivalent representation capacity of information. Multilayer Perceptron (MLP) is a feed-forward neural network and can make flexible dimensionality reduction to the input data (Atkinson and Tatnall 1997; Zheng et al. 2016). Thus, review content and

the star rating feature vectors can be reduced to the same dimensionality through MLP, as defined in Equation (2). ϕ_{o_x} indicate the mapping function for the x -th layer, W_x, b_x, a_x indicate the weight matrix, bias vector, and activation function ReLU of the x -th layer.

$$\begin{aligned} \phi_{o_1}(O) &= a_1(W_1^T O + b_1), \\ &\dots \\ \phi_{o_L}(O_{L-1}) &= a_L(W_L^T O_{L-1} + b_L) \end{aligned} \quad (2)$$

3.2 Star Rating Encoder

Similar to the embedding process of the RCE module, the SRE module converts each star rating $r \in R = \{1, 2, 3, 4, 5\}$ is converted into a star rating feature vector in $r' \in \mathbb{R}^N$. Meanwhile, the star rating feature vector is converted to the same dimensionality as the review contents through MLP to perform element-wise manner.

3.3 Content-Rating Interaction

CRI module is a process of extracting the linear and nonlinear interactions between review contents and star ratings through performing element-wise and concatenation manner on the feature vectors. Thus, linear and nonlinear interaction vector h, h' is defined in Equations (3) and (4).

$$h = \phi_{o_L}(O_{L-1}) \otimes \phi_{r'L'}(r'_{L-1}) \quad (3)$$

$$h' = \phi_{o_L}(O_{L-1}) \oplus \phi_{r'L'}(r'_{L-1}) \quad (4)$$

To prevent bias against specific interaction when predicting review helpfulness, the nonlinear interaction vector h' is converted to the same dimensionality as h . Finally, we combine the two types of interaction vectors into H for predicting the helpfulness score and classify the results, which can be defined in Equation (5).

$$\hat{y} = \sigma(W_H \bullet H + b_H) \quad (5)$$

σ indicates the sigmoid activation function. The input interaction vectors are classified as 0 or 1 and returned as output. A value of 0 output indicates that the review is unhelpful, and a value of 1 indicates a helpful review.

4. Experiments

4.1 Dataset

We utilized Amazon Books 5-Core dataset(He and McAuley 2016) to evaluate the proposed methodology. The original dataset consists of 24 domains collected from May 1996 to July 2014 at Amazon.com. Amazon Books is the largest domain in Amazon datasets containing 8,872,495 reviews from 603,668 consumers on 367,928 products as shown in Table 1. 5-Core indicates each consumer or product has at least five reviews. To conduct experiments effectively, we skipped reviews with less than 10 votes to prevent "words of few mouths" phenomenon (Roy et al. 2019).

Table 1. Statistics of Amazon Books Dataset

Consumers	Products	Ratings & Reviews	Helpfulness
603,668	367,928	8,898,041	4,756,837

Review length is a significant parameter in the CNN model. Through comparing the review length, we found that the longest review's length is 17 times longer than 90% of the rest. To accelerate the model training process, we utilized the maximum length of 90% of the rest reviews (Dong et al. 2020; Zheng et al. 2016). In the previous studies, the ratio 0.6 was set as the threshold for classifying reviews into helpful and unhelpful (Fan et al. 2019; Malik and Hussain 2018). Therefore, we utilized a helpfulness score of 0.6 for classifying reviews. Moreover, to prevent the model's predictive bias, we utilized 180,000 reviews for each type of review to train the model and assessed its performance (Mitra and Jenamani 2021; Yang et al. 2020). We set 80% of the dataset as a training dataset and measured the performance with the remaining dataset.

4.2 Evaluation Criteria and Comparison Methods

To evaluate the proposed CNN-CRI model, we utilized Accuracy, Precision, Recall, and F1-Score metrics to evaluate classification performance (Bilal et al. 2021; Liu et al. 2017). To evaluate the proposed model's performance, we compared the proposed model with the state-of-the-art models utilized to predict the review helpfulness. CNN, CM (Qu et al. 2018), Support Vector Machine (SVM), Naive Bayes, CNN-CRI(Linear), CNN-CRI(Nonlinear), CNN-CRI (Linear), CNN-CRI(Nonlinear) are state-of-the-art models which consider only linear or nonlinear interaction between review content and ratings.

4.3 Parameter Settings

Table 2 shows the parameters employed in this study, which are determined through fine-tuning the model. We compared the word embedding dimension from 100 to 500. When the dimension is 300, the performance of the model is optimal. Furthermore, we compared the dropout rate from 0.1 to 0.9. We found that when the value of the dropout rate is 0.4, the model's performance is optimal. In the experiment, we found that vocabulary size has a certain impact on the model's performance. We started with the number of words (90,131) in the dataset, and the frequency of the words is reduced from the words with the lowest frequency, and an experiment is repeated for every 10,000 words. We found that when the value of the vocabulary size is 4,000, the model's performance is optimal.

Table 2. Model Hyper Parameters

Word Embedding Dimension	Vocabulary Size	Review Length	Dropout Rate	Convolution Kernel	Early Stopping
300	40,000	276	0.4	3, 4, 5	10 epochs

4.4 Results

We conducted the experiment five times and reported the mean and the standard deviation of the classification performance. Table 3 and Figure 3 indicates the mean and the standard deviation of classification performances of the CNN-CRI model with the state-of-the-art models.

Table 3. Model Performance Comparison

Model	Accuracy + SD	Precision + SD	Recall + SD	F1-Score + SD
CNN-CRI	72.556±0.811	71.102±1.748	75.777±2.772	73.3±0.689
CNN-CRI(Linear)	70.503±1.907	70.878±3.494	70.322±3.5	70.447±1.368
CNN-CRI(Nonlinear)	69.483±0.359	70.38±0.819	68.383±2.876	69.667±1.168
CM	69.344±0.442	67.717±1.258	70.567±4.174	69.872±1.357
CNN	67.461±0.513	66.671±1.462	70.089±2.592	68.279±0.603
SVM	62.903	61.871	67.25	64.448
Naïve Bayes	57.764	65.519	32.778	43.696

The CNN-CRI model outperformed other state-of-the-art models with an accuracy of 72.556% and an F1-Score of 73.3%. Compared with the CNN-based models, the prediction performance improved from 2.9 to 7.6% with the Accuracy metric. Similarly, using the F1-Score metric, the prediction performance improved from 4 to 7.4%. Moreover, deep learning models are significantly better than machine learning models. Such results indicate that deep learning models can effectively extract deep information features because of their complex structure.

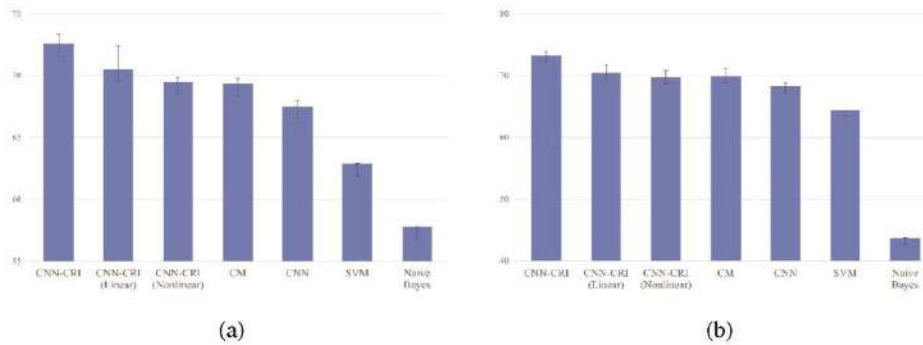


Figure 3. Model Performance Comparison of Accuracy (a) and F1-Score (b)

Compared to the CM model, the methodology that treats star ratings as the last word of the review contents is better than only utilizing semantic features. The result indicates that review contents and star ratings should be considered simultaneously when evaluating review helpfulness. However, compared to other CNN-CRI related models, the result indicates that CM has a limitation in the interaction between review contents and star ratings. For interaction, the CNN-CRI model, which simultaneously considers the linear and nonlinear interaction is better than the methodology of considering only linear or nonlinear interaction. Thus, the proposed study is effective in addressing the limitation of the previous study.

5. Discussion and Conclusion

We proposed a review helpfulness prediction model considering the consistency between review contents and star ratings. The previous studies have limitations in the representation capacity of star ratings and the capture of the interaction between review contents and star ratings. This study indicates the significance of simultaneously considering the linear and nonlinear relationships between information when predicting the review helpfulness.

The CNN-CRI model proposed in this study has an end-to-end structure. Therefore, the CNN-CRI can automatically filter helpful reviews to resolve the issue of information overload. Experimental results suggest that our study model indicates excellent performance than the state-of-the-art approach. Therefore, even in actual applications, it can provide better services to consumers or e-commerce.

However, there are some issues with this study that need to be addressed through further research. There is no guarantee of superior performance in other domains because this study compared performance utilizing only one dataset. Moreover, although this study can explore helpful reviews, it is also important to consider what criteria should be ranked when recommending to consumers. Simply recommending in descending order of helpfulness scores still carries the issue that reviews with high helpfulness scores have received more votes. Furthermore, the ranking holds a significant influence on the helpfulness of the review vote, as consumers only related to a portion of the review instead of the entire review when viewing it.

References

- Atkinson, P. M., and Tatnall, A. R. 1997. "Introduction Neural Networks in Remote Sensing," *International Journal of remote sensing* (18:4), pp. 699-709.
- Bilal, M., Marjani, M., Hashem, I. A. T., Malik, N., Lali, M. I. U., and Gani, A. 2021. "Profiling Reviewers' Social Network Strength and Predicting the "Helpfulness" of Online Customer Reviews," *Electronic Commerce Research and Applications* (45), p. 101026.
- Chen, C., Qiu, M., Yang, Y., Zhou, J., Huang, J., Li, X., and Bao, F. 2018. "Review Helpfulness Prediction with Embedding-Gated Cnn," *arXiv preprint arXiv:1808.09896*.
- Chen, C., Qiu, M., Yang, Y., Zhou, J., Huang, J., Li, X., and Bao, F. S. 2019. "Multi-Domain Gated Cnn for Review Helpfulness Prediction," *The World Wide Web Conference*, pp. 2630-2636.
- Dong, J., He, F., Guo, Y., and Zhang, H. 2020. "A Commodity Review Sentiment Analysis Based on Bert-Cnn Model," *2020 5th International Conference on Computer and Communication Systems (ICCCS)*: IEEE, pp. 143-147.
- Du, J., Zheng, L., He, J., Rong, J., Wang, H., and Zhang, Y. 2020. "An Interactive Network for End-to-End Review Helpfulness Modeling," *Data Science and Engineering* (5:3), pp. 261-279.
- Fan, M., Feng, C., Guo, L., Sun, M., and Li, P. 2019. "Product-Aware Helpfulness Prediction of Online Reviews," *The World Wide Web Conference*, pp. 2715-2721.
- Ghose, A., and Ipeirotis, P. G. 2010. "Estimating the Helpfulness and Economic Impact of Product Reviews: Mining Text and Reviewer Characteristics," *IEEE transactions on knowledge and data engineering* (23:10), pp. 1498-1512.
- Gottschalk, S. A., and Mafael, A. 2017. "Cutting through the Online Review Jungle—Investigating Selective Ewom Processing," *Journal of Interactive Marketing* (37), pp. 89-104.
- He, R., and McAuley, J. 2016. "Ups and Downs: Modeling the Visual Evolution of Fashion Trends with One-Class Collaborative Filtering," *proceedings of the 25th international conference on world wide web*, pp. 507-517.
- Kim, S.-M., Pantel, P., Chklovski, T., and Pennacchiotti, M. 2006. "Automatically Assessing Review Helpfulness," *Proceedings of the 2006 Conference on empirical methods in natural language processing*, pp. 423-430.
- Liu, H., Gao, Y., Lv, P., Li, M., Geng, S., Li, M., and Wang, H. 2017. "Using Argument-Based Features to Predict and Analyse Review Helpfulness," *arXiv preprint arXiv:1707.07279*.
- Liu, Y., Huang, X., An, A., and Yu, X. 2008. "Modeling and Predicting the Helpfulness of Online Reviews," *2008 Eighth IEEE international conference on data mining*: IEEE, pp. 443-452.
- Malik, M., and Hussain, A. 2018. "An Analysis of Review Content and Reviewer Variables That Contribute to Review Helpfulness," *Information Processing & Management* (54:1), pp. 88-104.

- Mitra, S., and Jenamani, M. 2021. "Helpfulness of Online Consumer Reviews: A Multi-Perspective Approach," *Information Processing & Management* (58:3), p. 102538.
- Qu, X., Li, X., and Rose, J. R. 2018. "Review Helpfulness Assessment Based on Convolutional Neural Network," *arXiv preprint arXiv:1808.09016*.
- Roy, G., Datta, B., and Mukherjee, S. 2019. "Role of Electronic Word-of-Mouth Content and Valence in Influencing Online Purchase Behavior," *Journal of Marketing Communications* (25:6), pp. 661-684.
- Salehan, M., and Kim, D. J. 2016. "Predicting the Performance of Online Consumer Reviews: A Sentiment Mining Approach to Big Data Analytics," *Decision Support Systems* (81), pp. 30-40.
- Saunya, S., Singh, J. P., and Dwivedi, Y. K. 2020. "Predicting the Helpfulness Score of Online Reviews Using Convolutional Neural Network," *Soft Computing* (24:15), pp. 10989-11005.
- Siering, M., Muntermann, J., and Rajagopalan, B. 2018. "Explaining and Predicting Online Review Helpfulness: The Role of Content and Reviewer-Related Signals," *Decision Support Systems* (108), pp. 1-12.
- Yang, S., Yao, J., and Qazi, A. 2020. "Does the Review Deserve More Helpfulness When Its Title Resembles the Content? Locating Helpful Reviews by Text Mining," *Information Processing & Management* (57:2), p. 102179.
- Zhang, Z., and Varadarajan, B. 2006. "Utility Scoring of Product Reviews," *Proceedings of the 15th ACM international conference on Information and knowledge management*, pp. 51-57.
- Zheng, L., Duffner, S., Idrissi, K., Garcia, C., and Baskurt, A. 2016. "Siamese Multi-Layer Perceptrons for Dimensionality Reduction and Face Identification," *Multimedia Tools and Applications* (75:9), pp. 5055-5073.

D2.3 Marvelous Agglutinative Language Effect on Cross Lingual Transfer Learning

Wooyoung Kim Chaerin Jo Minjung Kim Wooju Kim*

Smart System Lab¹

Department of Industrial Engineering, Yonsei University

{timothy, crjo, mjk0150, wkim}@yonsei.ac.kr

Abstract

E-Commerce Services such as Amazon and Alibaba have international consumers. The languages used in those service are very diverse. In order to provide a product search system to international consumers, it is essential to develop artificial intelligence that captures the semantic similarities among different languages. In this study, we propose a model that captures similarities between various languages as one artificial intelligence model. As for multilingual language models, it is important to select languages for training because of the curse of multilinguality. (Conneau et al., 2020). It is known that using languages with similar language structures is effective for cross lingual transfer learning (Pires et al., 2019). However, we demonstrate that using agglutinative languages such as Korean is more effective in cross lingual transfer learning. This is a great discovery that will change the training strategy of cross lingual transfer learning..

Keywords: Multilingual Language Model, Cross-Lingual Transfer Learning, Semantic Textual Similarity

Introduction

E-Commerce Services such as Amazon and Alibaba have international consumers. The languages used in those service are very diverse. In order to provide a product search system to international consumers, it is essential to develop artificial intelligence that captures the semantic similarities among different languages. In this study, we propose a model that captures similarities between various languages as one artificial intelligence model.

We propose a training strategy for cross lingual semantic similarity embeddings using Siamese Network (Reimers and Gurevych., 2019). We finetune the pretrained multilingual transformer, XLM-RoBERTa (Conneau et al., 2020). It focuses on scaling more languages and increasing model capacity, following the common semantic search method to map each sentence to a vector space so that semantically similar sentences are close.

According to Reimers and Gurevych (2019), un- finetuned BERT (Devlin et al., 2018) embeddings rather yield bad sentence embeddings. To mitigate this issue, they utilize the Siamese Network enabling

¹ <http://smartweb.yonsei.ac.kr>

* corresponding author

the semantically similar sentences to be found through cosine similarity. Since the structure of XLM-RoBERTa (XLM-R) follows the masked language model objective, similar to the one of BERT, it has the same problem. So, we finetune XLM-R through the Siamese Network based on what Reimers and Gurevych (2019) found to find the semantic similarities of cross lingual languages.

Interestingly, our model trained on only Korean dataset outperforms the model trained on English dataset in the evaluation using English test dataset. To explain this phenomenon, we propose a hypothesis that agglutinative languages such as Korean are more effective for cross lingual semantic similarity than isolated languages such as English.

Related Work

XLM-RoBERTa (XLM-R)

XLM-RoBERTa (XLM-R) is a transformer-based model pretrained on large scale multilingual data (Comneau et al., 2020). XLM-R shows remarkable results on cross lingual transfer learning. However, there is a limitation that the unfinetuned XLM-R cannot fully capture the semantic similarity of sentences. To overcome this issue, we compose XLM-R with the Siamese Network and finetune it with the combination of various languages.

Linguistic Typology

We propose a new perspective of cross lingual learning based on linguistic typology. In linguistic typology, language types are classified into three types - isolated language, inflectional language, and agglutinative language in terms of syntactic stability.² The concept of syntactic stability in language indicates that there are some transformations among languages in terms of free word order.

First, isolated languages such as English have strict word order, meaning that they have high syntactic stability because word order structure and grammar are directly connected. Second, inflectional languages such as German have intermediate characteristics between isolated and agglutinative languages. Lastly, agglutinative languages such as Korean and Turkish have low syntactic stability, meaning that they have relatively free word order. According to Choi and Schmitt (2015), the uses of Korean postpositions are different from those in English.

We assume that these grammatical differences among languages have influenced the performance of cross lingual transfer learning. Our experiments indeed demonstrate that the higher free word order, the better performance in cross language learning.

Experiments

Model Architecture

We train XLM-R by using the Siamese Network (Reimers and Gurevych, 2019). In our experiments, we use a softmax classifier head for Natural Language Inference (NLI) classification task and adopt an average pooling value without the head layer for Semantic Textual Similarity (STS) regression tasks. In order to finetune XLM-R, we construct the Siamese Network to update the weights of semantically meaningful sentence embeddings. We experiment with the following architecture and objective functions as shown in Figure 1.

² There is also incorporating language, but it is too low-resource and difficult to identify distinct characteristics. So, we exclude it from our research.

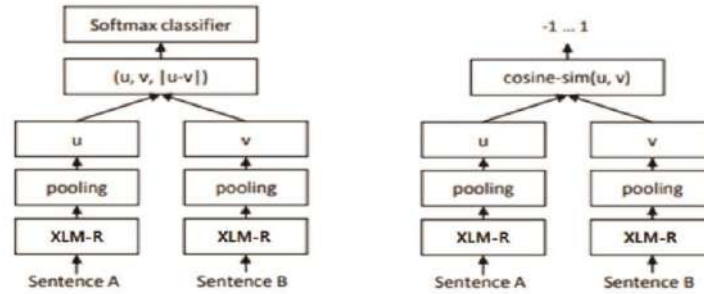


Figure 1. The architecture of XLM-R using Siamese Network. Different sentences are put into Sentence A and B as inputs. The left side is the head version, and the right side is the non-head version.

Loss Function

Henderson et al. (2017) found that Multiple Negative Ranking Loss is not only much intuitive but significantly better in producing sentence embeddings. So, we use Multiple Negative Ranking Loss. The training data for Multiple Negative Ranking Loss consists of sentence pairs $[(x_1, y_1), \dots, (x_n, y_n)]$ where we assume that (x_i, y_i) are similar sentences and (x_i, y_j) are dissimilar sentences for $i \neq j$. The goal is to minimize the distance between (x_i, y_i) while it simultaneously maximizes the distance (x_i, y_j) for all $i \neq j$. A set of k possible responses is used to approximate $P(y | x)$: one correct response and $k - 1$ random negatives. For a batch of size k , there will be k inputs $x = (x_1, \dots, x_k)$ and their corresponding responses $y = (y_1, \dots, y_k)$. Every reply y_j is effectively treated as a negative candidate for x_i if $i \neq j$.

We optimize Multiple Negatives Ranking Loss instead of cross entropy loss. The goal of training is to minimize the approximated mean negative log probability of the data.

Training and Testing Data

We train our model with only NLI dataset and test it with STS dataset, conducting zero shot learning and evaluating how well our model learns semantic textual similarity. In order to comprehend the correlation of cross learning effects, we perform our experiments on isolated language (English), inflectional language (German), and agglutinative language (Korean, Turkish). We use the following datasets in the experiments: Training Dataset consists of MNLI dataset - English, German, Turkish, and Korean. In this section, MNLI, XNLI, and KorNLI have the same meaning, so sentence pairs can be created by crossing over languages.

- MNLI: Multi-Genre Natural Language Inference corpus is crowd-sourced collection of 433k sentence pairs annotated with textual entailment information (Williams et al., 2018).
- XNLI: The pairs are annotated with textual entailment and translated into 14 languages. We select German and Turkish sentences from XLI dataset (Conneau et al., 2018).
- KorNLI: Korean NLI dataset machine-translated from existing English training sets (Ham et al., 2020).

Mono Lingual Pairs are the same as the source dataset without creating additional sentence pairs.

- En: (En, En)
- De: (De, De)
- Tr: (Tr, Tr)
- Ko: (Ko, Ko)

Cross Lingual Pairs are created by crossing over languages without mono lingual languages:

- En-De: (En, De)
- En-Tr: (En, Tr)
- En-Ko: (En, Ko)
- De-Tr: (De, Tr)
- De-Ko: (De, Ko)
- Tr-Ko: (Tr, Ko)

Mono + Cross Lingual Pairs are obtained by combining mono language and cross language pairs:

- En-De: {(En, En), (De, De), (En, De)}
- En-Tr: {(En, En), (Tr, Tr), (En, Tr)}
- En-Ko: {(En, En), (Ko, Ko), (En, Ko)}
- De-Tr: {(De, De), (Tr, Tr), (De, Tr)}
- De-Ko: {(De, De), (Ko, Ko), (De, Ko)}
- Tr-Ko: {(Tr, Tr), (Ko, Ko), (Tr, Ko)}

Whole pairs are obtained by merging Mono and Cross pairs in all languages used in our experiments:

- Whole: {(En, En), (De, De), (Tr, Tr), (Ko, Ko), (En, De), (En, Tr), (En, Ko), (De, Tr), (De, Ko), (Ko, Tr)}

STS Benchmark (STSb) Test Dataset is used for evaluating the performance of our model with the combination of various sentence pairs. Semantic Textual Similarity (STS) calculation in cross-lingual setup is used for estimating the degree of the similarity between two sentences. We measure the performance of the model on STSb dataset through cosine similarity and spearman correlation coefficient of human label scores.

- STSb_En: The similarity of two sentences is manually labeled, ranging from 0 to 5 (Cer et al., 2017).
- STSb_De: We obtain German STSb dataset from huggingface.³
- STSb_Ko: KorSTS dataset is a translation of STSb_En (Ham et al., 2020).
- STSb_Tr: We translate STS_En into Turkish by using google translation.

Multilingual Tests consist of the following combinations: (En, En), (De, De), (Tr, Tr), (Ko, Ko).

Cross Lingual Tests are conducted by changing the order of two sentences. Therefore, we use the Spearman correlation coefficient for each sentence and calculate the average for both sentences as scores. These tests consist of the following combinations: (En, De), (En, Tr), (En, Ko), (De, Tr), (De, Ko), (Ko, Tr).

Experimental Results

In mono lingual pair experiment, our model trained on only Korean dataset shows better performance on English STS test data than the one trained on English dataset. Even in Turkish dataset, our trained model performed better than the one trained on English. This similar tendency is also found in cross lingual and Mono + Cross lingual pair experiments, which include agglutinative languages in common.

In fact, it is evident in table 1 that the result of Mono + Cross Tr-Ko outperforms the one of whole pairs. This evidence supports our hypothesis that it is important to use the agglutinative languages as training data to improve cross lingual transfer learning and ultimately to avoid the curse of multilinguality.

To interpret these incredible results, we introduce the concept of linguistic typology widely used in linguistics as explained in section 2.3. According to the classification of linguistic typology, the degree of word order freedom increases in this order: isolated language, inflectional language, and

³ https://huggingface.co/datasets/stsb_multi_mt

agglutinative language. The results of our experiments demonstrate that there is a correlation between the freedom of word order and the cross lingual transfer learning effect, which means that including agglutinative language in training pairs results in better performance.

It has been commonly considered using languages with structural similarity to improve the cross lingual transfer learning. However, our results show that it is better to consider the freedom of word order, and using agglutinative languages, which have high degree of free word order, not only leads to better performance but also makes our model not fall under the curse of multilinguality.

Based on our work, we contribute to introducing a new perspective on language selection that increases the effectiveness of cross lingual learning.

Table 1 It shows the experiment results for each learned data. En(E), De(D), Ko(K), and Tr(T) are English, German, Korean, and Turkish, respectively. Performance is reported by convention as spearman correlation $\times 100$.

	E-E	D-D	T-T	K-K	E-D	E-T	E-K	D-T	D-K	T-K	Avg
XLM-RoBERTa	33.7	39.2	34.9	40.1	19.1	11.8	19.0	7.1	14.9	12.8	23.3
Mono En-En	84.1	81.2	75.1	76.8	76.7	70.0	70.9	68.7	68.3	65.7	73.7
Mono De-De	84.6	82.0	75.9	80.6	78.6	72.1	72.3	70.6	70.4	66.3	75.3
Mono Tr-Tr	85.4	82.0	77.1	81.1	78.5	73.3	73.5	71.7	71.4	68.5	76.2
Mono Ko-Ko	85.3	82.1	76.2	81.4	78.8	72.9	75.0	71.4	72.3	68.4	76.4
Cross En-De	82.8	80.5	79.5	74.0	79.6	72.8	75.3	71.8	73.6	69.6	75.9
Cross En-Tr	83.4	79.9	79.1	74.8	79.8	76.4	76.4	74.2	73.8	71.1	76.9
Cross En-Ko	82.1	79.6	80.1	73.4	79.2	73.5	78.1	71.6	75.7	70.8	76.4
Cross De-Tr	83.6	79.9	78.5	75.1	80.0	76.1	76.2	74.5	74.3	71.7	77.0
Cross De-Ko	83.6	80.6	80.5	74.3	79.8	73.9	78.3	72.4	76.3	71.4	77.1
Cross Tr-Ko	82.8	79.0	79.0	74.7	78.9	75.3	77.5	73.2	75.1	72.7	76.8
Mono+Cross En-De	84.2	82.0	80.5	75.8	80.2	73.4	75.5	72.3	73.7	69.8	76.7
Mono+Cross En-Tr	83.7	80.7	79.6	76.2	80.1	76.6	75.9	75.0	74.0	71.5	77.3
Mono+Cross En-Ko	84.0	80.9	80.9	74.8	79.8	73.8	78.6	72.3	76.1	70.9	77.2
Mono+Cross De-Tr	83.8	81.2	79.3	75.8	79.9	75.6	75.3	74.5	73.8	70.7	77.0
Mono+Cross De-Ko	83.6	81.3	80.6	75.7	79.9	73.6	77.1	73.0	76.2	71.1	77.2
Mono+Cross Tr-Ko	84.3	80.9	81.0	76.5	80.3	76.4	78.0	74.4	75.9	73.3	78.1
Whole	83.0	80.3	80.3	75.1	77.7	78.1	78.9	76.0	76.0	73.0	77.8

Additional Experiments

Reimers and Gurevych (2019) suggest that the meaning of sentences can be well captured by additionally training with STS dataset on Siamese Network. After we train the base model (NLI_En+Ko) with En, Ko MNLI, Stanford NLI (SNLI, Bowman et al., 2015; Ham et al., 2020) datasets, we create three more models by additionally training the base model with STSb_En, STSb_Ko, and STSb_En+Ko, respectively; this time, we cross-combine STSb_En and STSb_Ko to make STSb_En+Ko.

Reimers and Gurevych (2019) suggest that the meaning of sentences can be well captured by additionally training with STS dataset on Siamese Network. After we train the base model (NLI_En+Ko) with En, Ko MNLI, Stanford NLI (SNLI, Bowman et al., 2015; Ham et al., 2020) datasets, we create three more models by additionally training the base model with STSb_En, STSb_Ko, and STSb_En+Ko, respectively; this time, we cross-combine STSb_En and STSb_Ko to make STSb_En+Ko.

- (NLI_En+Ko) (Base Model)
- (NLI_En+Ko) + (STSb_En)
- (NLI_En+Ko) + (STSb_Ko)
- (NLI_En+Ko) + (STSb_En+Ko)

In this section, we use STS 2017 dataset (Cer et al., 2017) as test data. As presented in the results of additional experiments, the model trained with Korean pairs outperforms the model trained with the other pairs, which follows the tendency of results explained in the section 3.3. Given that the test dataset does not contain Korean, the cross-language transfer learning effect of the agglutinative language is a truly amazing result.

Presented in the table 3, our model achieves the better performance of XLM-R←SBERT-paraphrase which is the current state of the art model. In addition, our model shows better performance than XLM-R-nli-stsb and XLM-R←SBERT-nli-stsb models trained with only NLI and STS dataset.

Table 2. It shows the results of STS 2017 for previous studies and our additional experiments. As shown in Table 1, models containing an agglutinative language (Ko) show better performance. Performance is reported by convention as spearman correlation $\times 100$. The other results are referenced from Reimers and Gurevych (2020).

	En-En	Es-Es	Ar-Ar	Avg
Ours				
(NLI_En+Ko) (Base Model)	87.5	84.8	82.7	85.0
(NLI_En+Ko) + (STSb_En)	88.4	86.2	81.9	85.5
(NLI_En+Ko) + (STSb_Ko)	88.1	87.0	82.1	85.7
(NLI_En+Ko) + (STSb_En+Ko)	87.2	86.8	79.6	84.5
Knowledge Distillation (Reimers and Gurevych, 2020)				
XLMR-nli-stsb	78.2	83.1	64.4	75.2
XLM-R ← SBERT-nli-stsb	82.5	83.5	79.9	82.0
XLM-R ← SBERT-paraphrases	88.8	86.3	79.6	84.9
Other System				
LASER (Artetxe and Schwenk, 2019)	77.6	79.7	68.9	75.4
mUSE (Chidambaram et al., 2019)	86.4	86.9	76.4	83.2
LaBSE (Feng et al., 2020)	79.4	80.8	69.1	76.4

Table 3 It shows the results of STS2017 for previous studies and our additional experiments. As shown in Table 1, models containing an agglutinative language (Ko) show better performance. Performance is reported by convention as spearman correlation $\times 100$. The other results are referenced from Reimers and Gurevych (2020).

	En-Ar	En-De	En-Tr	En-Es	En-Fr	En-It	En-Nl	Avg
Ours								
(NLI_En+Ko) (Base Model)	73.4	84.4	71.7	82.4	80.0	79.8	84.2	79.4
(NLI_En+Ko) + (STSb_En)	71.9	86.0	71.6	80.5	80.2	79.2	83.4	79.0
(NLI_En+Ko) + (STSb_Ko)	73.3	85.9	71.4	83.7	81.5	79.7	85.2	80.1
(NLI_En+Ko) + (STSb_En+Ko)	74.4	85.4	72.2	82.6	81.5	80.2	83.7	80.0
Knowledge Distillation								
XLMR-nli-stsb	44.0	59.5	42.4	54.7	63.4	59.4	66.0	55.6
XLM-R ← SBERT-nli-stsb	77.8	78.9	74.0	79.7	78.5	78.9	77.7	77.9
XLM-R ← SBERT-paraphrases	82.3	84.0	80.9	83.1	84.9	86.3	84.5	83.7
Other System								
LASER	66.5	64.2	72.0	75.9	69.1	70.8	68.5	69.6
mUSE	79.3	82.1	75.5	79.6	82.6	84.5	84.1	81.1
LaBSE	74.5	73.8	72.0	65.5	77.0	76.9	75.1	73.5

Linguistic Interpretation to results

Our research is the first study to reveal that using the agglutinative language has a good effect on cross lingual transfer learning. We assume that relatively high word order freedom of agglutinative languages leads to the performance gains.

According to Transformational Generative Grammar initiated by Noam Chomsky, all humans have the same structures involved in processing speech and language, allowing all languages to share universal attributes. Based on these universal attributes, all languages share semantic representations, which means they all consist of deep structures. At the same time, all the languages have been transformed differently in terms of grammatical, lexical, and phonetic representations, which means they all have different degrees of transformation in surface structures. In light of this aspect, the more transformations languages have, the higher freedom of word order they have. Thus, since they share universal attributes with other languages and learn more transformations by their nature, agglutinative languages lead to better cross lingual transfer learning.

Conclusion

Multilingual language models have the curse of multilinguality. To mitigate this, it is important to select a language which has a good effect on cross lingual transfer learning.

In general, it is known that the similar linguistic structure is a key factor in performance gains of the cross lingual transfer learning. However, we have demonstrated that agglutinative languages, which allow cross language models to learn phenomenal diversity due to its free word order, are more effective in cross lingual transfer learning.

Finally, we describe some limitations and suggest directions for future work. The first one is that we have not considered all the isolated, inflectional, and agglutinative languages, so to generalize our hypothesis, the future work is required to cross validate more languages. The other limitation is that our hypothesis is attested as a correlation not as a causality; thus, this correlation should be discussed thoroughly by linguists.

Acknowledgements

“This work is financially supported by Korea Ministry of Land, Infrastructure and Transport(MOLIT) as 「Innovative Talent Education Program for Smart City」”.

References

- Artetxe, M., and Schwenk, H., 2019. Massively multilingual sentence embeddings for zero-shot cross-lingual transfer and beyond. *Transactions of the Association for Computational Linguistics*, 7, 597-610.
- Bowman, S. R., Angeli, G., Potts, C., and Manning, C. D., 2015. A large annotated corpus for learning natural language inference. *arXiv preprint arXiv:1508.05326*.
- Daniel Cer, Mona Diab, Eneko Agirrec, Inigo Lopez-Gazpio, and Lucia Specia. 2017. SemEval-2017 Task 1: Semantic Textual Similarity Multilingual and Cross-lingual Focused Evaluation. *arXiv:1708.00055*.
- Chidambaram, M., Yang, Y., Cer, D., Yuan, S., Sung, Y. H., Strope, B., and Kurzweil, R., 2018. Learning cross-lingual sentence representations via a multi-task dual-encoder model. *arXiv preprint arXiv:1810.12836*.
- Minhui Choi and Emily Schmitt. 2015. Postpositions and Word Order Variation in Korean. *Linguistic Portfolios*.
- Conneau, A., Lample, G., Rinott, R., Williams, A., Bowman, S. R., Schwenk, H., and Stoyanov, V. , 2018. XNLI: Evaluating cross-lingual sentence representations. *arXiv preprint arXiv:1809.05053*.

- Conneau, A., Khandelwal, K., Goyal, N., Chaudhary, V., Wenzek, G., Guzmán, F., and Stoyanov, V., 2019. Unsupervised cross-lingual representation learning at scale. *arXiv preprint arXiv:1911.02116*.
- Devlin, J., Chang, M. W., Lee, K., and Toutanova, K., 2018. Bert: Pre-training of deep bidirectional transformers for language understanding. *arXiv preprint arXiv:1810.04805*.
- Feng, F., Yang, Y., Cer, D., Arivazhagan, N., and Wang, W., 2020. Language-agnostic bert sentence embedding. *arXiv preprint arXiv:2007.01852*.
- Ham, J., Choe, Y. J., Park, K., Choi, I., and Soh, H., 2020. Kornli and korsts: New benchmark datasets for korean natural language understanding. *arXiv preprint arXiv:2004.03289*.
- Henderson, M., Al-Rfou, R., Strope, B., Sung, Y. H., Lukács, L., Guo, R., and Kurzweil, R., 2017. Efficient natural language response suggestion for smart reply. *arXiv preprint arXiv:1705.00652*.
- Telmo Pires, Eva Schlinger, and Dan Garrette. 2019. How multilingual is multilingual BERT?. *arXiv preprint arXiv:1906.01502*.
- Reimers, N., and Gurevych, I., 2019. Sentence-bert: Sentence embeddings using siamese bert-networks. *arXiv preprint arXiv:1908.10084*.
- Reimers, N., and Gurevych, I., 2020. Making monolingual sentence embeddings multilingual using knowledge distillation. *arXiv preprint arXiv:2004.09813*.
- Williams, A., Nangia, N., and Bowman, S. R., 2017. A broad-coverage challenge corpus for sentence understanding through inference. *arXiv preprint arXiv:1704.05426*.

D2.4 Whose words do we listen to, Robot vs. Human? The Effect of Anthropomorphism Level on Behavioral Intention Depending on Conversational Agent's Anthropomorphism Level

Yi, Eunju ^a and Park, Do-Hyung ^b

^a Graduate School of Business IT, Kookmin University

E-mail: ejde@kookmin.ac.kr

^b School of Management Information Systems / Graduate School of Business IT, Kookmin University

E-mail: dohyungpark@kookmin.ac.kr

Abstract

Machines, which could only communicate with promised words of commands in the past, are now being able to interact intuitively and conveniently with the development of User Interface/Interaction. Furthermore, as machines are capable to understand human natural language, human-machine conversations are becoming more and more like that of human-human. In Addition, beyond the aspect of human-machine communication, the appearance of the machines is becoming more and more similar to that of a human being, and those machines are called "Robot". They may have facial expressions, gestures and movements. Machines have their own characteristics and advantage as humans do contrast with machines. Then, how do machines, human-like machines and humans affect us, and by which are we reacted more susceptibly?

As prejudice engaged when humans judge people from one's appearance alone, humans tend to be biased when judging machines from their appearance as well. According to literature studies, humans trust vending machines that look like robots more than vending machines that look like normal machine, even if they are the same machine, and good-looking robots are more trusted than creepy-looking robots. CASA Paradigm explains that humans feel a sense of presence and importance to robot as they would to humans, and this is similarly applied not only by the appearance of the robot, but also by the feedback. In other words, humans regard robot's feedback as similar to humans'.

Representative examples of robot embodiment designed by human so far are largely divided into animal-like robots, non-biomimetic robot, humanoid robots, and android robots. Android robot is one of the humanoid robots and mimics

even the skin and organ tissues and skeleton of human. In this study, we employed 4 types of conversation agent (animal-like, non-biomimetic, humanoid robot and human) to compare the persuasive power that influenced to 301 participants. Additionally, we adopted 2 types of issue for conversation. One is a data-based and relatively objective conversation that requires immediate action in daily personal life (Issue Type A), and the other is about human relationships, rather subjective and not urgent in time (Issue Type B). The results of this as 4 (animal-like robot, non-biomimetic robot, humanoid robot, and human) x 2 (Issue Type A and Issue Type B) experiment are as follows.

Whereas humans have the same effects to participants' intention in both Issue type A and B, robots showed stronger effect in issue type A than B. Specifically, in Issue Type A, robots were more persuasive than human, and meanwhile, in Issue Type B, human was more persuasive than robots. When we examine the level of robot anthropomorphism and its persuasive effect, albeit there were no significant differences in issue type A, we found a direction in issue type B that the higher level of anthropomorphism, the higher level of persuasion effect and gradually reaches closer to the level of human.

The academic contribution of this study is that it can be explained through experiments that the persuasive power of robots can be stronger than that of humans and the level of anthropomorphism does work depending on the type of conversation. The industrial contribution of this study is that since the persuasiveness of robot varies depending on the conversation issue and the anthropomorphism level, project managers may recall the main purpose of the conversation agent and design its embodiment and anthropomorphism level referring this experiment.

Available studies in the future include measuring anthropomorphism level by emotional expression and conduct conversation with specific issues like motivating to learn for children, to acquire habit for adults, and to remind medication and exercise for older adults and observe its effects.

Keywords: HRI, embodiment, digital persuasion, social robot, user experiment design

D2.5 Digital Transformation of Poultry Industry

Lai, Y. I.^a, Chou, T. C.^b and Huang, C. H.^c

^a Department of Information Management,
National Taiwan University of Science and Technology
E-mail: D10509202@mail.ntust.edu.tw

^b Department of Information Management,
National Taiwan University of Science and Technology
E-mail: tcchou@mail.ntust.edu.tw

^c Graduate Institute of Technology Management,
National Taiwan University of Science and Technology
E-mail: chhuang@mail.ntust.edu.tw

Abstract

The poultry industry introduces technologies information and communications technology (ICT), Internet of Things (IoT), and Big Data Analytics (BDA), then adjusts the traditional feeding routine from different times and areas to improve its response to climate change and solve the problem of insufficient labor for aging. Hence, this study aims to explore the institutional problems in the digital poultry farms introduction process in terms of poultry farmers' information literacy. To examine the dynamic structure of technology routine interaction, this study adopts the "enactment" perspective to examine how a livestock farm makes sense of the digital transformation and the poultry feeding practices to facilitate digital transformation in the poultry industry.

Keywords: *Technology Routine Enactment, Digital Poultry Farm, Digital Transformation, Case Study*

[DAY 2]

E2 [ICEC-Paper Session]
COVID-19 & IT Applications

E2.1 Survey on the Effectiveness and Students' Attitudes of Online Education Under the COVID-19 Pandemic: A Case Study of QAU University in China

Lai, Y. Y.^a, Ding, H. Y.^a, Li, J. S.^a and Zhang, Y.^{a,b}

^aCollege of Economics and Management, Qingdao Agricultural University

lai_yuanyuan@foxmail.com, hi54dhy@163.com, ljs@qau.edu

^bSchool of Management, Wuzhou University

yimi.zy@foxmail.com

Abstract

As COVID-19 strikes, many students study at home in isolation. This calls for colleges and universities to adopt online education. Compared with in-person teaching, online education has its own inherent advantages and disadvantages. In this study, students of QAU University were selected as the survey objects. Questionnaires were used to understand the online teaching during the pandemic. The use of online teaching platforms, students' acceptance of online teaching and the effect of online teaching were analyzed. The results show that while students welcome online education, they also recognize its disadvantages, and generally do not accept online education as a long-term sole teaching method in schools. In terms of teaching effectiveness, online education also has a certain gap with in-person education. This suggests that schools should resume in-person offline teaching as soon as possible. Some areas of improvement for online education include fostering communication and interaction, enhancing the user experience and improving the teaching effectiveness. Virtual-reality technology is one of the key advancements for online education.

Keywords: COVID-19, cyberspace education, online teaching, in-person teaching, virtual reality (VR)

E2.2 Visual Analysis of Foreign Internet Hospital-Related Research Based on CiteSpace

Ma, F. Y.^a and Yu, T.^b

^a Department of Business Administration, Shanghai University of Engineering Management
E-mail: mafeya1224@163.com

^b Department of Business Administration, Shanghai University of Engineering Management
E-mail: tingyu@sues.edu.cn

Abstract

Using CiteSpace software, version 5.8.R3, the Web of Science core collection data was used as the source of information. The article related to Internet hospitals included in the Web of Science core collection database from 2012 to 2021 was analyzed to explore the current development of research in the field of Internet hospitals and to predict the frontier issues for future research. With the outbreak of the Coronavirus Disease 2019 (COVID-19), the number of publications about Internet hospitals has increased in recent years. Internet hospital research is conducted in core research countries such as the United States and the United Kingdom, and other countries are gradually increasing their research on Internet hospitals; most of the research institutions of Internet hospitals are higher education institutions. Internet hospitals and infectious diseases are the key clustering terms, and digital health is the research frontier of Internet hospitals in recent years.

Keywords: CiteSpace, internet hospital, internet, healthcare, digital health

Introduction

Internet hospital is a form of telemedicine in China. Internet hospitals are online hospitals with functions such as consultation, follow-up visits and chronic disease management, and have a physical hospital as a strong support. In recent years, with the emergence of the Coronavirus Disease 2019 (COVID-19), hundreds of Internet hospitals have gradually emerged in China. In the research related to Internet hospitals, scholars such as (El-Rashidy N, 2021) and (Huang Q, 2021) explored the field of chronic diseases, (Yu Shi, 2021) et al. proposed that Internet hospitals are beneficial to the management of chronic diseases in pediatric specialties; (Grosman-Dziewiszek P, 2021) and (Jiang X, 2021) explored the field of nursing, (Lin Sun, 2021) et al. in exploring the model of nursing consultation service in Internet hospitals, concluded that the nursing consultation service in Internet hospitals can meet the needs of all kinds of people and improve the satisfaction of people's visits as well as the sense of professional benefit of nursing staff. While Internet hospitals are actually put into application, most Internet hospitals act as a registration machine and other functions cannot be effective. In this paper, we analyze the research hotspots as well as the research frontiers of Internet hospitals to explore the next development direction of Internet hospitals. To make the Internet hospital effectively put into application and solve people's needs in the era of repeated epidemics.

Data and Methods

Data Collection

The "Web of Science Core Collection" database was used as the search source, and the subject search term was set as TS=(internet hospital), and the search period was from January 1, 2012 to December

31, 2021. The language was set to "English" and the type of document was limited to "Article", and data in plain text format (including all authors, institutions, abstracts, keywords and references, etc.) were exported for analysis. A total of 2442 documents were retrieved from Web of Science. After eliminating irrelevant or duplicate information, 2372 articles were finally obtained.

Research Methods

CiteSpace is a article analysis visualization software created by Chaomei Chen, a professor at Drexel University. It is applied to analyze the article and identify new trends and developments. This study is based on CiteSpace software (version 5.8.R3) to identify the current situation, hot spots and frontiers of Internet hospitals, and visualize and analyze them. Parameter settings: time period: 2012-2022; time cut is set to 1, i.e., 1 year is used as 1 time partition. For clustering analysis of keyword co-occurrence mapping, CiteSpace provides module value (Q value) and average profile value (S value) based on the clarity of network structure and clustering, and these two indexes are used as our basis for judging the effect of mapping. In general, Q values are generally in the interval [0, 1), with Q values greater than 0.3 indicating significant results, and S values are generally in the interval [0, 1), with S values greater than 0.5 indicating significant clustering effects. CiteSpace uses centrality to measure the centrality of keywords, and nodes with centrality greater than 0.1 are called key nodes, which reflect the importance of the nodes in the network in this study. The higher the centrality of a keyword, the more important its node is in the field.

Research Results and Analysis

Trend Analysis of Article Issuance

Trend analysis is an important measure of the state of development of a research field. Trends in publication allow one to determine when the issue under study emerged and where it is headed. Figure 1 shows the trends in the literature on Internet hospital from 2012-2021. In the last decade, the trend of publications on Internet hospital research has been increasing year by year. And in the last three years, with the recurrence of the epidemic, there are more and more studies related to Internet hospital.

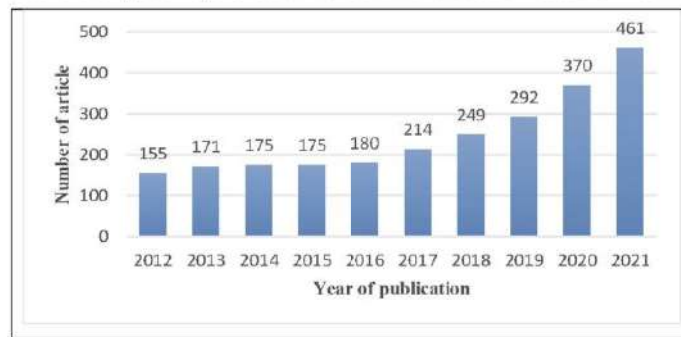


Figure 1. Internet Hospital Paper Publication Volume

Knowledge Mapping Analysis of National (Regional) Cooperation

The time slice of 1 year was selected on CiteSpace software, and the words with the threshold value of top50 were selected to form the country (region) cooperation knowledge map of Internet hospitals, as shown in Figure 2.

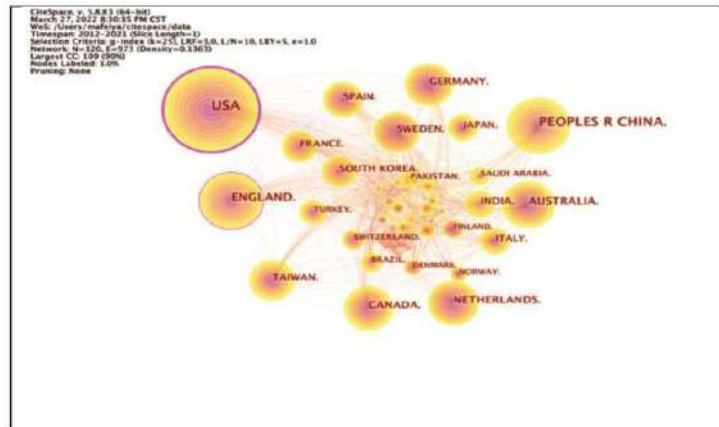


Figure 2. Knowledge Mapping of Internet Hospital Country (Region) Cooperation

As can be seen in Figure 2, the United States has the highest number of articles with 622 and the highest centrality with 0.51. It is the country that plays the most important role in the study of Internet hospitals. This is followed by China and the United Kingdom with 367 and 226 articles, respectively, and a centrality of 0.08 and 0.14, respectively, followed by Australia, Canada, and other countries or regions. In terms of Internet hospital partnerships, there are close collaborative relationships between various countries.

Knowledge Mapping Analysis of Research Institution

The type of node is selected as institution, and the threshold value is selected as top50, and the research institution knowledge graph is analyzed, as shown in Figure 3, which has 380 network nodes and 742 connected lines.

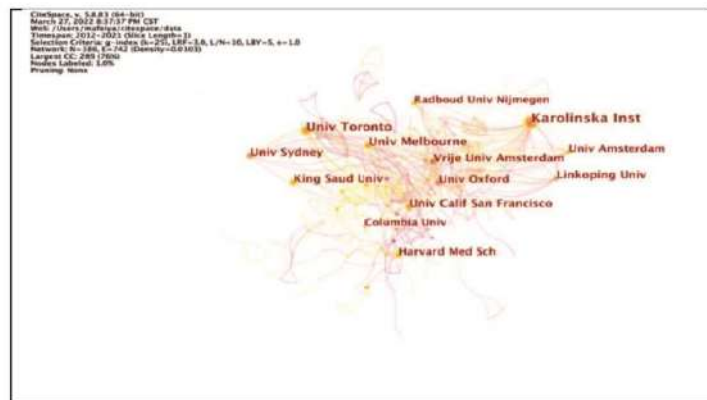


Figure 3. Knowledge Mapping of Internet Hospital Research Institution

As can be seen in Figure 3, Karolinska Institute and the University of Toronto are the institutions with more research on Internet hospitals. The Karolinska Institute published 51 articles and the University of Toronto published 35 articles. The University of Amsterdam (26 articles) and Linköping University,

Sweden (25 articles) were also among the top publishers. As can be seen from the graph, there are strong links between the institutions.

Knowledge Mapping Analysis of Keyword Co-occurrence

The type of nodes was selected as keywords, and the selection threshold was 50. The network graph of Internet hospital keywords was aggregated to obtain the top 15 keywords with the highest frequency. From Table 1, it can be seen that in the keyword co-occurrence network graph, the co-occurrence keywords with high frequency are internet, quality of life, health care, internet of thing, and hospital anxiety.

Table 1. Internet hospital keyword ranking table

Ranking	Frequency	Centrality	Keyword
1	397	0.04	Internet
2	232	0.01	Care
3	149	0.01	Impact
4	128	0.03	Management
5	126	0.02	Health
6	118	0.02	Information
7	113	0.02	Quality of life
8	113	0.03	Intervention
9	105	0.00	Internet of thing
10	102	0.03	Health care
11	101	0.02	Quality
12	92	0.02	Depression
13	91	0.01	Outcm
14	91	0.02	Hospital anxiety
15	87	0.03	System

Analysis of Internet Hospital Keyword Clustering

In CiteSpace, select the node as keyword, select the threshold as top50, and select pruning. By running CiteSpace software, the keywords were clustered to form the timeline zone of Internet hospital keyword clustering, and by analyzing the keyword clustering map of Internet hospital, the research hotspots about Internet hospital in the past 10 years were analyzed. After "pruning", Figure 5 was generated, with a total of 444 keyword nodes and 3631 connected lines. The Q value of this clustering is 0.358, which means that the structure of the associations is significant; the S value of this clustering is 0.6809, which means that the clustering effect is good.

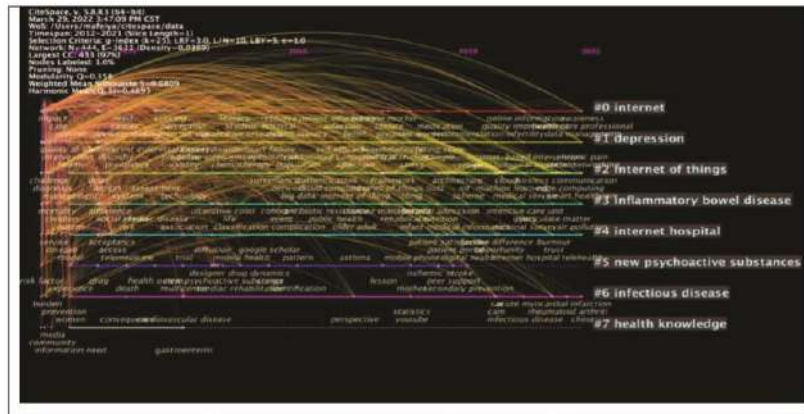


Figure 5. Keyword Clustering Mapping of Internet Hospital

The clustering terms in the Internet hospital article are the result of cluster analysis of hot keywords. The clustered terms were organized and the miscellaneous items were removed. Figure 5 shows that #1 depression, #2 internet of things, #4 internet hospital, and #6 infectious disease are the hot clusters with long duration. In terms of the disease application of Internet hospital, the main focus is on "infectious disease". Under the influence of the Coronavirus Disease 2019 (COVID-19), the number of Internet hospitals is rapidly increasing in China, however, there are still many problems to be solved in the construction of Internet hospitals.

Analysis of Internet Hospital Emergent Word

The CiteSpace software was run to generate a keyword mapping, and then the Internet hospital's emergent word mapping was retrieved, and the top 15 most significant emergent words were selected, as shown in Figure 6.

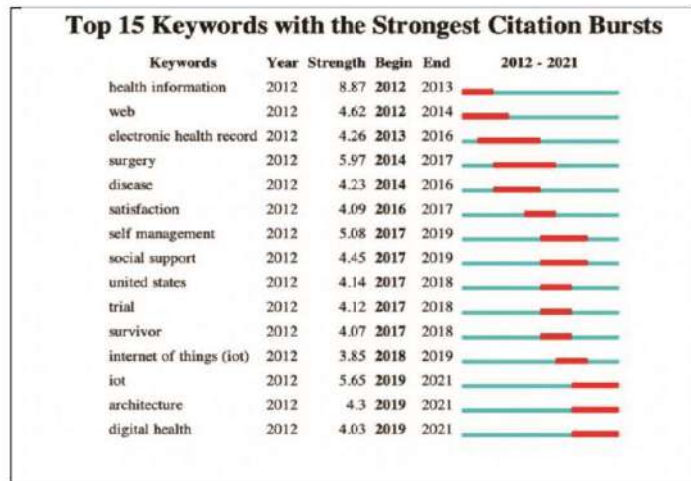


Figure 6. Mapping of Internet Hospital Emergent Word

The words that appear more frequently or are used more frequently in a short period of time can be used to determine the frontiers of research fields. Through the analysis of emergent words, the development trend and research direction of the research field can be better grasped. From Figure 6, we can see that from 2013 to 2016, the emergent words related to Internet hospitals are electronic health record; from

2016 to 2019, the related emergent words are satisfaction and social support; from 2019 to 2022, the related emergent words are IoT, architecture and digital health, architecture and digital health, etc. In recent years, there are foreign studies on Internet hospitals in areas such as IoT and digital health. Applying the advanced technology in the era of big data to the construction of Internet hospitals will make the construction of Internet hospitals possess greater development.

Discussion

Bibliometric Analysis of Internet Hospitals

Trend of Issuing Articles

The Internet hospital literature from 2012-2021 in the Web of Science core collection database was selected for analysis. In 2012, there were 155 articles about Internet hospitals. From 2012 to 2019, the number of related literature maintained a stable growth trend. In 2020, the number of article is 370, which is 78 more than that in 2019. In 2020, the Coronavirus Disease 2019 (COVID-19) starts in Wuhan, China, and the demand for Internet hospitals in China increases due to the epidemic. the number of literature about Internet hospitals in 2021 is 461, which is 91 more than that in 2020. It indicates that Internet hospitals will play a more important role in the prevention and control of infectious diseases and daily treatment in the future.

Analysis of Major Countries and Institutions

Through the analysis of the knowledge graph, the research subjects are more balanced on the fields related to Internet hospitals, with various countries participating in the research. Among them, the United States ranks first in terms of the number of publications, with the United Kingdom and Spain having more publications. In terms of research institutions, it is mainly universities in European countries, such as Karolinska Institutet in Sweden and the University of Toronto. Domestic research institutions include Shanghai Jiao Tong University and Sichuan University. Analyzed from the perspective of the impact of the issuance, the research country with the largest node centrality is the United States, indicating that the United States is leading the research contribution in the field of Internet hospitals.

Analysis of Internet Hospital Research Hotspots

"Depression" is a hot keyword in Internet hospitals, and some scholars pointed out that the consultation function of Internet hospitals should be used to reduce psychological burden(Li L, 2020). The outbreak of the Coronavirus Disease 2019 (COVID-19) epidemic has put the lives of health care workers and the public under pressure (Nochaiwong S, 2020). The quarantine measures taken by the Chinese to combat the epidemic and the lack of access to their homes have increased the psychological burden. Relevant online autonomous mental health applications are being carried out(Hensel J M, 2019).

The hot keyword for Internet hospitals is health care. The audience of Internet hospitals is mainly patients with chronic diseases (Huang Q, 2021), and in China they mainly serve patients in remote and rural areas (He C, 2018). Traditional hospitals may have long queues for visits and long distances to travel to see a doctor. Internet hospitals overcome these difficulties by saving time and providing more convenient access to quality medical resources for patients and their families. The development of Internet hospitals requires policy support. In China, the government actively encourages the development of Internet hospitals, and the Opinions of the General Office of the State Council on Promoting the Development of "Internet + Medical Health" released in April 2018 proposed to encourage medical institutions to apply information technology such as the Internet to expand the space and content of medical services. In October 2020, the "Proposal of the Central Committee of the Communist Party of China on the 14th Five-Year Plan for National Economic and Social Development and the Visionary Goals for 2035" clearly pointed out the need to actively develop Internet hospitals.

Analysis of Internet Hospital Research Frontiers

In the field of Internet hospital research, electronic health record is the frontier issue of research in 2013-2016. U.S. President Barack Obama advocated the establishment of a universal electronic health record in 2009, and the U.S. government mandated that numerous hospitals and physicians in the United States must deploy a comprehensive electronic health record and supporting technologies by 2015, and provided tens of billions of dollars in grants for doing so. Whether or not people are willing to use electronic health records, studies in the foreign literature suggest that approximately the average survey respondent is willing to pay for an electronic health record and that the potential exists to use electronic health records on a larger scale (Bujnowska-Fedak M M, 2020). Some studies have pointed out that her studies focus on experimental designs for specific populations or chronic diseases (Zanaboni P, 2020).

Digital health is a cutting-edge research issue in recent years. Using digital health systems to study the monitoring and self-management of very severe chronic obstructive pulmonary disease in comparison to clinical care in a trial, there appears to be an overall benefit in generic health status. Digital health programs, like the Internet chronic disease management have the potential to augment primary care among patients with multiple chronic diseases (Lear S A, 2021). A tertiary hospital in China used digital health technology in the Coronavirus Disease 2019 (COVID-19) epidemic (Lian W, 2020). Driven by the relevant policies and the Coronavirus Disease 2019 (COVID-19) epidemic, the number of Internet hospitals in China has increased significantly. And whether the completed Internet hospitals can be active in chronic diseases and nursing care in combination with electronic medical records and digital health technologies are such issues to be discussed.

Conclusion

This paper presents a visual analysis of Internet hospital-related research. The study shows that the number of publications of Internet hospital-related research has increased year by year, and the research countries and institutions are specifically represented by the United States, the United Kingdom and Spain as the core research countries, and higher education institutions as the main research institutions. The analysis of research hotspots and frontiers. It can be seen that the trend of Internet hospitals is on the rise. Internet hospital-related research is closely related to health care, mainly serving patients with chronic diseases and patients in remote and rural areas. Internet of things-based Internet hospital construction is a research hotspot. Big data and digital health are the frontier hotspots in the field of Internet hospitals in the future. It is predicted that more scholars will be involved in Internet hospital-related research in the era of the Coronavirus Disease 2019 (COVID-19) epidemic.

References

- Bujnowska-Fedak, M. M., & Wysoczanski, L. (2020). Access to an Electronic Health Record: A Polish National Survey. *International Journal of Environmental Research and Public Health*, 17(17), Article 6165.
- El-Rashidy, N., El-Sappagh, S., Islam, S. M. R., El-Bakry, H. M., & Abdelrazek, S. (2021). Mobile Health in Remote Patient Monitoring for Chronic Diseases: Principles, Trends, and Challenges. *Diagnostics*, 11(4), Article 607.
- Farmer, A., Williams, V., Velardo, C., Shah, S. A., Yu, L.-M., Rutter, H., Jones, L., Williams, N., Heneghan, C., Price, J., Hardinge, M., & Tarassenko, L. (2017). Self-Management Support Using a Digital Health System Compared With Usual Care for Chronic Obstructive Pulmonary Disease: Randomized Controlled Trial. *Journal of Medical Internet Research*, 19(5), Article e144.
- Grosman-Dziewiszek, P., Wiatrak, B., Jeskowiak, I., & Szeląg, A. (2021). Patients' Habits and the Role of Pharmacists and Telemedicine as Elements of a Modern Health Care System during the COVID-19 Pandemic. *Journal of Clinical Medicine*, 10(18), Article 4211.
- He, C., Zhou, Q., Chen, W., Tian, J., Zhou, L., Peng, H., Luan, S., & Wang, S. (2018). Using an Internet-Based Hospital to Address Maldistribution of Health Care Resources in Rural Areas of Guangdong Province, China: Retrospective and Descriptive Study. *Jmir Medical Informatics*, 6(4), 189-202, Article e51.

- Hensel, J. M., Shaw, J., Ivers, N. M., Desveaux, L., Vigod, S. N., Cohen, A., Onabajo, N., Agarwal, P., Mukerji, G., Yang, R., Nguyen, M., Bouck, Z., Wong, I., Jeffs, L., Jamieson, T., & Bhatia, R. S. (2019). A Web-Based Mental Health Platform for Individuals Seeking Specialized Mental Health Care Services: Multicenter Pragmatic Randomized Controlled Trial. *Journal of Medical Internet Research*, 21(6), Article e10838.
- Huang, Q., Lin, P., Dang, J., Fu, L., & Ding, L. (2021). Effect of internet-based self-management on pulmonary function rehabilitation and living quality in patients with chronic obstructive pulmonary disease. *American Journal of Translational Research*, 13(5), 5224-5231.
- Jiang, X., Xie, H., Tang, R., Du, Y., Li, T., Gao, J., Xu, X., Jiang, S., Zhao, T., Zhao, W., Sun, X., Hu, G., Wu, D., & Xie, G. (2021). Characteristics of Online Health Care Services From China's Largest Online Medical Platform: Cross-sectional Survey Study. *Journal of Medical Internet Research*, 23(4), Article e25817.
- Lear, S. A., Norena, M., Banner, D., Whitehurst, D. G. T., Gill, S., Burns, J., Kandola, D. K., Johnston, S., Horvat, D., Vincent, K., Levin, A., Kaan, A., Van Spall, H. G. C., & Singer, J. (2021). Assessment of an Interactive Digital Health-Based Self-management Program to Reduce Hospitalizations Among Patients With Multiple Chronic Diseases A Randomized Clinical Trial. *Jama Network Open*, 4(12), Article e2140591.
- Li, L., Liu, G., Xu, W., Zhang, Y., & He, M. (2020). Effects of Internet Hospital Consultations on Psychological Burdens and Disease Knowledge During the Early Outbreak of COVID-19 in China: Cross-Sectional Survey Study. *Journal of Medical Internet Research*, 22(8), Article e19551.
- Lian, W., Wen, L., Zhou, Q., Zhu, W., Duan, W., Xiao, X., Mhundu, F., Huang, W., Li, C., Cheng, W., & Tian, J. (2020). Digital Health Technologies Respond to the COVID-19 Pandemic In a Tertiary Hospital in China: Development and Usability Study. *Journal of Medical Internet Research*, 22(11), Article e24505.
- Lin Sun, Yan Jiang, Jing Lu, Aiqin Zhu, & Hanzhi Qin. (2021). Construction and operation of a nursing consultation service model based on an Internet hospital platform." *Journal of Nursing Science(in Chinese)* ,36(02), 8-11.
- Marx, W., Kelly, J. T., Crichton, M., Craven, D., Collins, J., Mackay, H., Isenring, E., & Marshall, S. (2018). Is telehealth effective in managing malnutrition in community-dwelling older adults? A systematic review and meta-analysis. *Maturitas*, 111, 31-46.
- Nochaiwong, S., Ruengorn, C., Awiphan, R., Ruanta, Y., Boonchieng, W., Nanta, S., Kowatcharakul, W., Pumpaisalchai, W., Kanjanarat, P., Mongkhon, P., Thavorn, K., Hutton, B., Wongpakaran, N., Wongpakaran, T., & Hlth Outcomes Mental Hlth Care, E. (2020). Mental health circumstances among health care workers and general public under the pandemic situation of COVID-19 (HOME-COVID-19). *Medicine*, 99(26), Article e20751.
- Rietdijk, R., Togher, L., & Power, E. (2012). Supporting family members of people with traumatic brain injury using telehealth: a systematic review. *Journal of Rehabilitation Medicine*, 44(11), 913-921.
- Yu Shi, Gongbao Lin, Guomei Shen, Jie Xu, Di Cao, & Xiaowen Zhai. (2021). Construction and exploration of a chronic disease management service model in a pediatric specialty Internet hospital. *Fudan University Journal of Medical Sciences(in Chinese)*, 48(04), 527-531.
- Zanaboni, P., Kummervold, P. E., Sorensen, T., & Johansen, M. A. (2020). Patient Use and Experience With Online Access to Electronic Health Records in Norway: Results From an Online Survey. *Journal of Medical Internet Research*, 22(2), Article e16144.

E2.3 NEW MODEL OF SMART ELDERLY CARE: ONLINE TO OFFLINE BUSINESS MODEL DESIGN OF COMMUNITY ELDERLY CARE IN CY DISTRICT OF QINGDAO UNDER COVID-19

Guo Changxin, Lai Yuanyuan*, Sun Mengjia, Liu Nuo
College of Economics and Management, Qingdao Agricultural University
NO.700 Great Wall Road, Qingdao, China, 266109
1556348395@qq.com, lai_yuanyuan@foxmail.com

Li Jinwei*
Guotai Junan Securities Co. LTD
118 Songling Road, Laoshan District, Qingdao, China, 266100
kingweilee@163.com

Li Ying
QAU at RAU Joint Institute
NO.700 Great Wall Road, Qingdao, China, 266109
ying.li@sinocampus.cn

* corresponding author

ABSTRACT

The isolation measures of COVID-19 have caused problems in elderly people's psychological, material and service access. Taking the current situation of community pension in CY District of Qingdao as an example, this paper constructed an online and offline smart pension mode based on the tripartite cooperation between the government, the community and enterprises, with the community home pension service database as the core and five service platforms as the main work.

Key words: COVID-19; Community home care; Smart pension; Online and Offline services

1. Background

With the continuous progress of information technology, network permeates into every aspect of people's life. The demand of the elderly service to the network is increasing gradually. Chen et al. (2020) believed that COVID-19 and social alienation had a great negative impact on the elderly, especially the frail elderly, when they were isolated at home. According to the data, the elderly experienced varying degrees of stress and anxiety during the epidemic. Alvarez-Garcia et al. (2019) believe that although communication technology is easily mastered and accessible for most people, the use of this technology by the elderly in vulnerable groups is still greatly restricted. Based on the data, research on the use of information technology in the elderly is still in its infancy. Ma et al., (2016) found through questionnaire research and face-to-face interview that age, educational background and economic status affect the elderly's acceptance of information technology. Meng (2021) believes that China's smart endowment presents the status quo of fast growth, large demand, technological innovation and constantly rich talent supply. However, there are still some problems, such as insufficient understanding of intelligence by the government and the public, loose cooperation network and insufficient adaptation of the elderly to information technology. Ren and Wang (2021) point out that there are still old problems such as lagging service standard and vague definition of crowd.

How to design the smart pension model? Xu and Li (2021) advocate building a home care service system with O2O platform as the core, and building a home care mechanism with "family as the basis, community as the supplement, and external medical resources as the supplement". Wang et al. (2021) believe that big data medical care should be combined with smart care, used in medical data for the elderly health care and curing. Zhao and Deng (2021) argued that applying artificial intelligence to the pension, build the wisdom of the pension system driven by artificial intelligence, use of cloud computing, big data, Internet of things for the elderly to provide accurate service. Wang (2018) maintains that based on the logic of "linkage" four clubs, Constructing the community pension model of e-commerce & public welfare not only solves the difficult problem of linkage between enterprises and communities, but also conducts the current business dilemma of community pension and promotes the sustainable development of community pension. Majumder (2017) advocates tracking the physical condition of the elderly through smart wearable devices and smart home. And enable medical staff to know the overall health status of the elderly in real time and give feedback and support.

2. Problems arise

2.1. COVID-19 poses great psychological harm to the elderly

Many elderly people, especially those living alone, are extremely sensitive and vulnerable

psychologically because they live alone for a long time. Once stimulated by the external environment, they are prone to psychological diseases. In addition, due to the existence of digital divide, many elderly people cannot flexibly use mobile phones or the Internet, receive information at a slow speed, and have few opportunities to communicate with their children and others. As a result, many elderly people are prone to loneliness and anxiety when facing home isolation alone, which promotes the breeding of psychological diseases.

2.2. The epidemic has made it more difficult for the elderly to obtain daily necessities

Offline gatherings have been largely controlled due to China's regulations on the normalization of epidemic prevention and control. During the period of severe isolation, household supplies are mainly purchased online and distributed uniformly. However, the way of purchasing daily supplies for the elderly is mainly offline procurement, not customary online procurement. This makes it more difficult for them to get supplies.

2.3. It is difficult to carry out elderly care services under the epidemic

The pension industry are suffered a stroke by the COVID-19 pandemic. However, due to the impact of home quarantine and epidemic prevention and control policies, the traditional home care and community care services cannot be carried out, for instance home service, material distribution, medical treatment, rehabilitation and other home services, and the quality and efficiency of the elderly care services cannot be guaranteed.

3. The case of CY District community home care

Chengyang (CY) District is one of the urban areas in Qingdao, China. At present, CY District has a total of 110,000 elderly people over 60 years old, 16,000 elderly people over 80 years old, 7,084 registered disabled (dementia) and semi-disabled elderly people. CY District has 19 community restaurants for the elderly and 8 residential community elderly care service centers. The community pension service centers in CY District has several functional rooms, such as a canteen for the elderly, a family doctor workstation (medical service), a bathroom, a rehabilitation physiotherapy area, and an office for public welfare organizations, which can meet the diversified needs of the elderly.

Before the outbreak of the epidemic, the elderly in the community can go to the elderly service center in the community to enjoy a series of services, and the service center can also send physiotherapists and family doctors to provide a series of physical therapy, medical treatment, rehabilitation and other services for the elderly. CY District Helping the Elderly Restaurant provides preferential dining services for the elderly in the community, among which ordinary seniors aged 60-69 enjoy a set meal price of 8 yuan, and seniors aged 70-79 enjoy a set meal price of 7 Yuan, the elderly over 80 years old enjoy the price of 6 yuan package for the elderly, and the elderly from low-income families and the elderly in extreme poverty in urban and rural areas enjoy the price of 2 Yuan package for the elderly. Before the outbreak of the epidemic, a large number of elderly people would choose to go to restaurants. Restaurants would also provide services such as food delivery for the elderly who booked in advance.

During the pandemic, the number of elderly people who went to service centers and restaurants for the elderly fell sharply as they were quarantined at home. Door-to-door services cannot be carried out. Because the elderly are not proficient in the use of computers and smart phones, it is also difficult to carry out online services. The traditional community home care service has almost stagnated, and the quality and efficiency

of the service have declined sharply. In order to solve this problem, this study designed and constructed a smart pension mode combining online and offline according to the actual situation of CY District.

4. Smart pension mode design combining online and offline

4.1. Basic structure

Based on the operating difficulties and reality of the service center and the restaurant for the aged in CY District, the "smart pension mode combining online and offline services" is designed with "online service, offline supply" and "one center, five platforms" as the main content. One center is the home care service information database, which collects basic information such as age, physical condition and home address of the elderly, so as to grasp the situation of the elderly in real time. The five platforms include 24-hour call platform, online medical platform, material distribution platform, volunteer service platform and service supervision and complaint platform. The five platforms provide online services such as medical treatment, meal ordering, entertainment and emergency contact, and cooperate with relevant logistics companies to provide contactless distribution of materials offline. Meanwhile, volunteers assist the elderly with online operations. In this manner, the government, communities, enterprises and volunteers can jointly promote the orderly operation of online and offline pension mode.

Table 1: Functional modules of a "center, five platforms"

Platform	Function
Community home care service database	1. Register the basic information of the elderly 2. Accurately understand the needs of the elderly
24 hours hotline platform	1. Emergency call to family member 2. Emergency call for an ambulance 3. Active inquiry combined with passive calling
Online medical treatment platform	1. Online registration 2. Online consultation
E-commerce and material distribution platform	1. Collecting the needs of the elderly 2. Contactless delivery of supplies for the elderly
Service Supervision Complaints platform	1. Seniors rate service quality 2. Seniors complain about grievances in services
Volunteer service provided platform	1. Assist the elderly in the community to complete functions such as material procurement, medical care and so on 2. Explain and help the issues existing in the life of the elderly

4.2. Value analysis

The normal development of this project can realize four value dimensions.

One is to address the problems of the elderly during the epidemic. Taking Renheju community in CY District as an example, the survey found that most of the elderly in the community were isolated at home during the epidemic period, and a few were even isolated at home alone. Most of the elderly are unable to skillfully use the Internet and smart phones. In the process of isolation, they cannot communicate with relatives and friends or have a single object for emotional communication, which is easy to breed

psychological problems of the elderly. In addition, A large number of elderly people do not shop online, ordering food and so on, resulting in shortages of materials. The implementation of our project can not only enrich the isolation life of the elderly, but also help them order and deliver online.

The second is to solve the burden of the community. During the epidemic, offline services of community elderly care service centers, restaurants for the elderly and other institutions cannot be carried out normally, resulting in a significant decrease in the flow of people, a shortage of funds and waste of resources in some institutions. As a result of the shortage of funds, many public welfare projects are difficult to continue to operate. The development of our project can not only promote the effective utilization and allocation of resources through online services and online food ordering, but also increase the income of the community to a certain extent. At the same time, through the cooperation between the enterprise and the community, the enterprise will earn certain profits and also give certain subsidies to the community to support the community.

Thirdly, it has opened up the market scope of the enterprise. Traditional distribution enterprises and e-commerce enterprises mainly target young people. Nevertheless, the elderly are often ignored by most relevant enterprises because their inability to be proficient or even unable to use smart phones. And we created this model, fully considering this issue. A special "elderly mode" has been set up for the elderly, and special volunteers have been equipped for one-to-one services so that the elderly can easily use smart phones to "online ordering", and for the elderly who do not have smart phones, a "special line for ordering" has been opened, so that they can also order food by calling. Through these series of measures, we have changed the situation of lack of traditional elderly customers

4.3. Operation mechanism

The mechanism mainly includes three parts: the government, the community and the enterprise. The government is responsible for a central database, and the five "platforms" are responsible and provided by the three parties respectively. Different subjects play their own roles and cooperate with each other, which plays an important role in improving the living standards of the elderly and the community living environment.

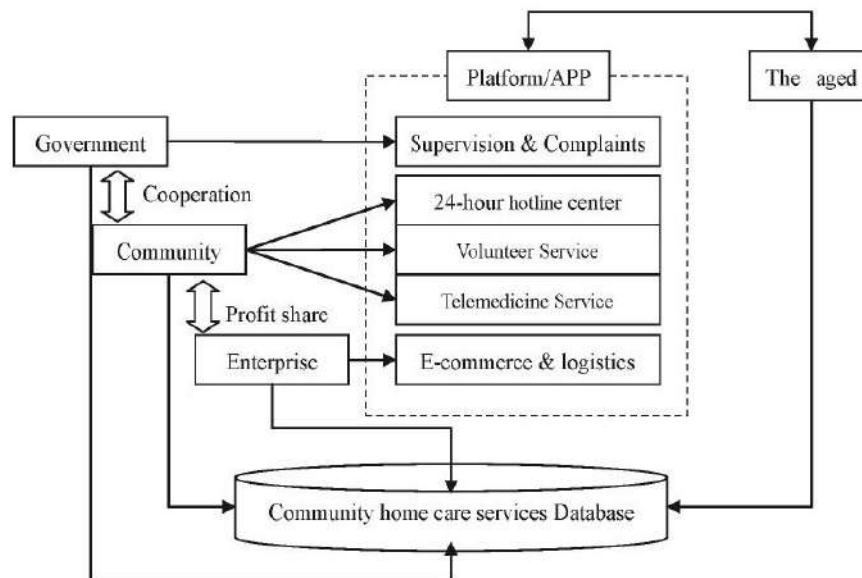


Figure 1: Community Home Service Information Platform

4.3.1. Government

The government plays a leading role in this model and is mainly responsible for the operation of "Home care Service Information database" service supervision complaint platform.

Home care service information database: As the core of this model, its operating mechanism is that the government and the community collect information such as age, family information, physical condition, contact information, home address and other information of the elderly through online surveys and offline visit, and include them in the database, and regularly review the data. when the personal information of the elderly changes, the information in the database should also be modified in real time. After collecting the information of the elderly, the government and the elderly service center will jointly manage the basic data of the elderly, the government will share information to the platforms, and the five main platforms will make decisions and policy adjustments based on these data.

Service supervision and complaint platform: It is the critical point to ensure the orderly operation of this model, which is primary composed of "government supervision" and "complaints from the elderly". Government supervision means that the government conducts online spot checks on those who are providing services, and rewards points for those who provide high-quality services and works meticulously and patiently, and deducts credit scores for those with low service quality and lack of meticulous work. Companies with high reward scores will be put on the home page of the APP or the front page of the web page to support traffic and attention, while companies with low credit scores will be invisible downgrade, and when the credit score is excessive low, they will be removed by the platform. For the removed companies, only by providing a high level of service, the reward points can be obtained to improve the credit scores. The "Complaints of the elderly" section is made by the elderly to complain about a series of

disorders in the service, such as impatient service, low service level, long delivery time, and even fraud and abuse. When a subject receives plenty of complaints, it will become the marked subject. The government conducts three surprise inspections at random times, during which a large number of credit scores are deducted if complaints do exist. If you pass each unannounced investigation from platform, it does not mean that the marked subject will be removed. Instead, there will be a three-month inspection period. If you pass each surprise inspection, the marked subject will be removed.

4.3.2. Community

The community plays a participatory role in this model. As the main body of direct contact with the elderly and services for the elderly, the community is responsible for the three functional platforms of "24-hour call platform", "volunteer service platform" and "online medical platform".

24-hour hotline platform: It is a signification method to protect the health of the elderly and prevent emergencies. The 24-hour hotline platform adopts a service model that combines active inquiry and passive calling. The platform will record the contact numbers of the elderly's family members, the contact numbers of the community and the emergency number in advance. When the elderly cannot meet some dietary and living needs The elderly can call their community or their family members, and the community or family members will distribute these materials. When seniors have urgent medical needs or emergencies, emergency calls can be prioritized. When the elderly make an emergency call, the platform will automatically notify the community and their family members. The community will firstly dispatch medical personnel to treatment according to the residential address of the elderly in the home care service information database. For the elderly who do not know how to use smart phones and the Internet, the community will take the initiative to call their phone regularly to inquire about their physical conditions and their needs for daily necessities and medical supplies.

Volunteer service platform: The volunteer service platform aims to mobilize volunteers, and volunteers are an important link between the community and the elderly. The volunteer service platform mainly consists of two parts: community mobilization volunteers and Seniors Contact Volunteers. When the community needs to collect information on the elderly, or to assist in the prevention and control of the epidemic and the distribution of materials, the community can contact and dispatch volunteers through the platform. The platform can automatically assign the most suitable tasks to the volunteers according to their location, and the community can also Manually schedule according to actual situation. During the epidemic period, volunteers should report their body temperature every day and take nucleic acid tests every 2-3 days. If the elderly encounter problems in life, for example needing psychological counseling, chatting, massage, carrying heavy objects, etc, they can call the volunteers in charge of the area. For troubles that can be solved online, volunteers can settle a matter through online video. If the problem needs to be solved offline, volunteers need to report to the platform before solving it.

Online medical platform: Online medical treatment is an important measure to ensure the health of the elderly. Communities cooperate with hospitals and medical staff to carry out health consultation, one-click registration, and other functions. Health consultation means that the platform is equipped with Telephone, E-mail and other contact information of medical staff or related practitioners. Answer the health problems of the elderly through one-on-one online Q&A. At the same time, when the elderly feel uncomfortable, they can first contact professional doctors through the online medical function. If the problems can be solved online, the doctor will prescribe medicine for the elderly treatment. If it is difficult to solve the problem

online, the doctor will help the elderly with one-click registration according to the actual situation of the elderly, or the elderly can register themselves with one-click priority. The platform will automatically register the relevant departments for the elderly according to the situation of online treatment, and arrange the corresponding examination.

4.3.3. Enterprises

Enterprises are the main providers of resources, services and funds in this mode, and the vital support to maintain the sustainable operation of this mode. In this mode, enterprises are crucial responsible for the management of e-commerce and material distribution platform.

E-commerce and material distribution platform: It is the considerable provider of life supplies and medical prevention supplies for the elderly. Government and the community will choose the high-quality daily necessities and health care products in the e-commerce enterprises, as well as the high-quality product suppliers in the platform in order to open up its special online marketing channels, the platform will conduct simple and large-character processing according to the habits of the elderly, and open up a telephone ordering channel for the elderly as well who do not use e-commerce. The elderly can choose two different situations on basis of their own circumstances. When the elderly purchase products, the system will automatically generate their consumption habits data according to their consumption products, the elderly can easily choose the commodity they often buy. When the elderly place an order, the distribution company will receive the distribution order, and the distribution company will send the deliveryman to the storage box at the door of the elderly, and contact the elderly to pick up the goods by calling or knocking on their door. If the elderly cannot be contacted temporarily, the delivery person will feedback this information to the platform, and the platform will choose a time to remind the elderly to collect their goods. There is no human contact in the whole delivery process, and the delivery personnel should report information every day and conduct nucleic acid test in time.

5. Acknowledgment

This paper is supported by the following funds:

2020 Shandong University Student Innovation and Entrepreneurship Project (S202010435043)

2021 College Student Innovation and Entrepreneurship Project of Qingdao Agricultural University

2021 Teaching reform project of "Creative integration" course in Qingdao Agricultural University (ZCJG202104)

REFERENCE

- Álvarez-García, J. et al. (2019) Older Adults and Digital Society: Scientific Coverage. *International Journal of Environmental Research and Public Health*, 16(11), 2010-2010.
- Chae, Y. M. et al. (2001) Patient satisfaction with telemedicine in home health services for the elderly. *International Journal of Medical Informatics*, 61(2), 167-173.
- Courtney, K. et al. (2008) Needing smart home technologies: the perspectives of older adults in continuing care retirement communities. *Journal of Innovation in Health Informatics*, 16(3), 195-201.
- Chen, A. T et al. (2020). Reactions to COVID-19, information and technology use, and social connectedness among older adults with pre-frailty and frailty. *Geriatric Nursing*.

- Healthcare after the COVID-19 Pandemic Using a Fuzzy Approach. *Healthcare*, 9(11), 1461-1461.
- Cola, M. C. D. et al. (2020) Teleassistance for frail elderly people: A usability and customer satisfaction study. *Geriatric Nursing*, 41(4), 463-467.
- Cotton, S. R. , &Gupta, S. S. (2004) characteristics of online and offline health information seekers and factors that discriminate between them. *Social Science & Medicine*, 59(9),1795-1806.
- George, D. et al. (2013) Older adults' acceptance of a community-based telehealth wellness system. *Informatics for health & social care*, 38(1) ,27-36.
- Hussain, A. et al. (2015) Health and emergency-care platform for the elderly and disabled people in the Smart City. *The Journal of Systems & Software*, 110 , 253-263.
- Lu, Z. (2018) A Research on Building Wisdom Endowment Service System Under the Background of Internet[J]. *Reformation & Strategy* .
- Machiko, R. &Tomita et al. (2007) Use of Currently Available Smart Home Technology by Frail Elders. *Topics in Geriatric Rehabilitation*, 23(1) , 24-34.
- Ma, Q. & Chan, A. & Chen, K. (2016) Personal and other factors affecting acceptance of smartphone technology by older Chinese adults. *Applied Ergonomics*, 54 ,62-71.
- Meng, W. (2021(03)) Positioning, Deficiencies and Development Countermeasures of Smart Elderly Care in China [J]. *Theoretical Journal*,143-149.DOI:10.14110/fj.cnki.cn-37-1059/d.2021.03.016.
- Pramanik, M. I. et al. (2017) Smart health: Big data enabled health paradigm within smart cities. *Expert Systems With Applications*,87 , 370-383.
- Ren, J. & Wang, D. (2021(05)) Research on old problems, new forms and countermeasures in smart old-age care [J]. *Lanzhou Academic Journal*,197-208
- Su, H., &Qing, Q. & Xiao, J. (2021) A survey on the mental health of middle-aged and elderly people and their influencing factors during the "COVID-19". *Psychological Monthly*,16(15),1-3+12.DOI:10.19738/fj.cnki.psy.2021.15.001.
- Sumit Majumder et al. (2017)Smart Homes for Elderly Healthcare—Recent Advances and Research Challenges. *Sensors*, 17(11) ,2496.
- Wang, D. (2018) "E-commerce + public welfare" community pension model: based on the logic of the linkage of the four societies. *E-government*,92-105.DOI:10.16582/fj.cnki.dzzw.2018.04.010.
- Wang, H., &Chai, X. &Sheng, J. & Wu, X. (2021) Research on the precise service model combining big data medical care and smart elderly care under the regional medical alliance model[J]. *Chinese Hospital*,25(12):1-3.DOI:10.19660/j.issn.1671-0592.2021.12.01.
- World Health Organization. (2020): China's top ten epidemic prevention measures.*China's Ethnic Groups*,10-13.
- Wang, L. & Rau, P. P. & Salvendy, G. (2011) Older Adults' Acceptance of Information Technology. *Educational Gerontology*, 37(12) , 1081-1099.
- Xu, L. & Li, L. (2021) Internet + Smart Elderly Care: Community Home-based Elderly Care Service Model Based on O2O Concept [J]. *Chinese Journal of Gerontology*,41(12):2675-2681.
- Yang, G. & You, H. & Hu, C. (2020(07)) Rethinking the planning of community medical care and elderly care services under the background of epidemic prevention and control. *Urban Issues*,21-27.DOI:10.13239/j.bjsshkxy.cswt.200703.

E2.4 Omnichannel Reaction to the COVID-19 Outbreak: Evidence from a Retailing Company

Lee, KangHo.^a and Lee, Dongwon.^b

^a Department of Management Information Systems, Korea University
E-mail: khl2824@korea.ac.kr

^b Department of Management Information Systems, Korea University
E-mail: mislee@korea.ac.kr

Indicate Submission Type: Research-in-Progress

Abstract

The outbreak of the COVID-19 devastated many sectors of businesses around the world. This study investigates the impact of the COVID-19 pandemic on omnichannel sales, along with moderating effects of competition between nearby same brand stores and commercial vs. residential districts. We examine this by utilizing the channel (i.e., offline and online) sales data from a South Korea's retailing company. The results indicate that a significant proportion of offline sales spilled over to online sales although social distancing issued in South Korea is less stringent than complete lockdowns. In addition, we find evidence that the number of nearby same brand stores further accelerates sales loss from the pandemic in the offline channel. In contrast, the overall pattern in the online channel remains unchanged. Under the COVID-19 situation, we find online channel more stable than offline channel in terms of moderating effect of nearby same brand competition.

Keywords: Cannibalization, Channel spillover, COVID-19, Intra-brand competition, Omnichannel

Introduction

The unprecedented shock, the COVID-19 stroke the world's retail business hard. Although the magnitude of the shock on retail business varies on the stringency of policies imposed to suppress further spread of the pandemic, offline channel stores inevitably undergo severe economic downturn. Competition between channels accelerated due to the outbreak, leaving those who failed to transition from offline to online to suffer the most (Greeven et al, 2020). In this study, we are motivated to empirically measure whether offline to online spillover effect indeed exists and further investigate how competition between the same brand stores within geographical vicinity moderates an exogenous shock on omnichannel sales.

We focus on the role of intra-brand competition for a company operating on omnichannel under the exogenous shock, the COVID-19. To account for the intra-brand competition, we implemented a new variable, "nearby same brand store-level competition (hereafter, NSBC)," using geographical information gathered from the physical addresses of individual stores. The variable consists of the number of overlapping same brand stores within a 500m radius for each store.

Same brand intra-brand competition is noteworthy because the higher number of overlapping same brand stores before the outbreak reflects the firm's strategic decision to capture more profit in regions with higher demands. However, such characteristics could have backfired and become the primary driver of sales loss for the bricks-and-mortar stores during the COVID-19 situation. The results from

our analysis suggest evidence of possible cannibalization effect in offline channel among regions with high same brand competition, as well as signs of offline to online spillover effect due to the pandemic.

Research Background and Literature Review

Our study focuses on the impact of the COVID-19 on both traditional offline channel sales and mobile-driven online channel sales by empirically investigating omnichannel franchises' sales data of a South Korea's omnichannel retailing company. While the western regions of the globe, such as the United States, issued state-level, highly stringent stay-home and lockdown orders, South Korea issued a milder form of policy, namely social distancing.

Despite the lenient restriction that social distancing imposes, we find evidence of shifts in omnichannel sales after the outbreak. Although social distancing caused minimal harm to offline channel sales in South Korea, we confirmed that the outbreak caused a regional shift from urban to suburban residential areas, similar to the findings of Kraenzlin et al. (2020). Furthermore, our analyses investigate the moderating effect of the nearby same brand competition and district type of use under the COVID-19 situation.

To account for varying levels of competition between the same brand stores, we generated a new variable based on the number of overlapping same brand stores within a 500m radius. The effect of geographical proximity between stores on sales remains controversial, whether cannibalization or synergy. Prior literature confirmed that adding a new same brand unit in the vicinity of incumbent units can cannibalize the incumbent's sales, while the addition of the same company-owned brands is associated with an increase in the incumbents' revenues (Kalnins, 2004). Pancras et al. (2012) claim that a 1-mile increase in distance between stores leads to a decrease in sales due to cannibalization by 28.1%, suggesting proximity significantly affects sales. However, critics argue that proximity by itself is not a sole determinant of revenue. An opportunity to share knowledge afforded by clustering-based proximity may or may not be realized, depending on the motivation and ability of the proximal outlets to share knowledge and the focal outlet's ability to absorb knowledge in the governance context (Butt et al., 2018).

A rich literature exists on studying the impact of introducing a new online channel to the existing offline channel. Often the most controversial topic is whether introducing or inducing customers to online channel results in a positive or negative impact on the existing offline channel sales. An experiment conducted by Luo et al. (2020) suggests that the impact of inducing customers to shop online has a close relationship with how far the customer lives from the physical store. In addition, inducing customers online has a chance of backfiring on the offline channel sales for those who live far away from the physical store (Luo et al., 2020). Lee et al. (2021) claim that integrated omnichannel promotions effectively provide incentives to previously online-oriented customers resulting in short-term channel substitution (i.e., spillover), benefiting both online and offline channels in the long term. Brynjolfsson et al. (2009) suggests that the competition between the two channels can be heightened if the online retailer sells a mainstream product similar to the brick-and-mortar retailers, whereas competition between the two channels can be nullified when the online retailer targets to sell niche products as their mainstream product. While prior literature focuses on the threats imposed to existing sales channel or incumbents by new entrants, our study is among the first to examine the reaction of the pre-existing competition between company-owned same brand franchises on the exogenous shock, the COVID-19.

Previous studies claim that the higher degree of customers' convenience orientation, in contrast to the degree of risk aversion and service orientation, encourages the selection of the online channel over the offline channel (Kollmann et al., 2012). In our study, given the high velocity of pandemic spreading, we believe sky-rocketing sales observed in online channel reflect the degree of risk aversion and service orientation to become the new primary determinant for shopping online over the convenience orientation.

Data

The dataset for this study comes from a large franchise retailing company in South Korea that owns a wide range of multinational brands. Among roughly 40 brands that a company owns, we focus on the major three focal brands, Paris Baguette, Baskin Robins, and Dunkin Donuts as the total number of stores three brands own is about 70% of total stores owned by the company. We randomly sampled 1,500 stores (1,000 stores from Paris Baguette, 282 from Baskin Robins, 218 from Dunkin Donuts) located in Seoul and Gyeonggi province, where majority of stores of the three brands are located. The data contains daily online, and offline channel transaction data of selected stores and are aggregated in weekly format. We set the time window of the data to start from January 1, 2019, to December 31, 2020, to capture the effect of the outbreak of the COVID-19 most effectively.

To account for the nearby same brand store-level competition (NSBC), we computed the number of overlapping same brand stores within a 500-meter radius range for each of 1,500 individual stores using the GoogleMapsApi. However, we acknowledged that if the level of competition is only measured using stores listed in our data, it could lead to potential bias as the actual number of stores is slightly different from what is given in the dataset. We scrapped the actual number of stores and their geographical locations for Paris Baguette, Baskin Robins, and Dunkin Donuts from their official websites to account for potential bias. Then we calculated the number of overlapping stores and matched it to our dataset. After matching, we were left with 1,411 stores, as 89 of the stores seemed to run out of business at the point of time where we scrapped the number of stores from the official websites. After preprocessing (i.e., matching stores with exact NSBC information and others), our final sample consists of online and offline channel sales data of 1,218 stores across three brands. The definition and summary statistics of key variables are provided in Table 1.

Table 1. Variable Definition and Summary Statistics

Variable	Definition	Mean	Std Dev	Min	Max
Dependent Variables					
<i>OfflineSales</i>	Log transformed offline channel sales	16.27	0.516	8.631	18.35
<i>OnlineSales</i>	Log transformed online channel sales	10.35	5.172	0	17.16
Explanatory Variables					
<i>Covid</i>	1 if the point in time is after the first confirmed case in Seoul and Gyeonggi, 0 otherwise	0.413	0.492	0	1
<i>Commercial</i>	1 if the store is in a commercial district, 0 otherwise (i.e., in a residential district)	0.374	0.484	0	1
<i>NSBC</i>	Number of same brand stores within 500-meter radius (discrete integer 0 to 5)	0.527	0.800	0	5
<i>NSBC Binary</i>	1 if NSBC is greater than 0, 0 otherwise	0.374	0.484	0	1
Control Variables					
<i>ConfirmedCase</i>	Weekly number of confirmed cases	158.0	445.7	0	3,648
Note: Number of Observation = 126,672 (Weekly)					

Methodology & Results

We applied multi-level model (MLM) for the analysis as our data consists of four-level hierarchical structures: time-series observations as Level 1, time-series observations nested within individual stores as Level 2, individual stores nested within three different brands as Level 3, and brands nested within two-different provinces as Level 4.

Prior literature points out the inefficiency of estimating multi-level structural data with OLS because the nature of multi-level structure might violate homoscedasticity and independence assumptions essential in OLS modeling (Raudenbush and Bryk, 2002). To account for heterogeneity that comes from a hierarchical structure and inefficiency of using OLS on hierarchical data, we deployed a random slope multi-level model to investigate the moderating effect of the *NSBC* on *Covid*.

Random Slope Equation NSBC Discrete Integer**Level 1: Time-series Equation**

$$\ln(\text{Outcome})_{ijkt} = \beta_{0ijk} + \beta_{1jk} \text{Covid}_{\tau(0,1)} + \theta_1 \text{ConfirmedCase}_{kt} + \epsilon_{ijkt} \quad (1)$$

Level 2: Individual Store Equation

$$\beta_{0ijk} = \pi_{0ijk} + u_{0ijk} \quad (2)$$

Level 3: Brand Equation

$$\pi_{0ijk} = \delta_{0jk} + v_{jk} \quad (3)$$

$$\beta_{1jk} = \beta_{1jk} + \beta_2 \text{NSBC}_{jk} + u_{1jk} \quad (4)$$

Level 4: Province Equation

$$\delta_{0jk} = \omega_{0k} + \gamma_k \quad (5)$$

Combined Model

$$\ln(\text{Outcome})_{ijkt} = \omega_{0k} + (\beta_{1jk} + \beta_2 \text{NSBC}_{jk} + u_{1jk}) * \text{Covid}_{\tau(0,1)} + \theta_1 \text{ConfirmedCase}_{kt} + \gamma_k + v_{jk} + u_{0ijk} + \epsilon_{ijkt} \quad (6)$$

In the random slope equation, i indicates individual stores, j indicates brands, k indicates provinces, t represents the time, and τ indicates 1 if post-Covid outbreak, 0 otherwise. Level 1 micro-equation of the multi-level model is shown in equation (1). β_{0ijk} accounts for the random intercept, and β_{1jk} captures the cross-level interaction between Level 1 predictor Covid_{τ} and Level 3 predictor NSBC as shown in equation 4. π_{0ijk} indicates brand-level fixed portion, which is affected by δ_{0jk} province-level intercept with $\theta_1 \text{ConfirmedCase}_{kt}$ attributing a varying number of confirmed cases observed in Seoul and Gyeonggi (province-level). Equation (6) is the combined model, where γ_k , v_{jk} , u_{0ijk} , and ϵ_{ijkt} accounts for a province-level random effect, brand-level random effect, store-level random effect, time-series-level random effect, and the error term clustered time-series level, respectively. As random intercept accounts for fixed portions of each level, we did not account for further controls. In the similar vein, $\theta_1 \text{ConfirmedCase}_{kt}$ was excluded from Level 4 covariate, in that it is only used to control for the weekly confirmed cases, not as a component of random slope.

The main effect Covid is shown in Table 2, implying signs of spillover from offline to online associated with a 0.55% loss in offline sales, whereas online sales increased by 141.55%. Prior to the outbreak, for an offline channel, a higher NSBC meant area is associated with higher demand reflecting a firm's strategic choice to capture higher demand. However, after the outbreak, the loss in offline sales accelerates as NSBC increments by 1-unit, indicating a cannibalization effect driven by reduced overall pie of demand and backfiring effect of NSBC, as shown in Figure 1. On the other hand, the overall pattern for online channel did not significantly change. Online channel sales sharply decrease with 4-5 nearby same brand stores, and the pattern persists even after the outbreak, not to mention an overall 134% increase in sales (see Figure 1).

Table 2. Results from MLM Analysis: Treatment Effect on NSBC (Discrete)

VARIABLES	OfflineSales	OnlineSales
<i>Covid</i>	-0.0354*** (0.001)	1.4155*** (0.024)
<i>NSBC (1)</i>	0.0137 (0.026)	0.5160 (0.396)
<i>NSBC (2)</i>	-0.0078 (0.040)	-0.6654 (0.729)
<i>NSBC (3)</i>	0.1070 (0.075)	0.0590 (1.229)
<i>NSBC (4)</i>	0.1605 (0.160)	-2.4943 (2.432)
<i>NSBC (5)</i>	0.1028 (0.378)	-10.5504** (4.197)
<i>Covid * NSBC (1)</i>	-0.0509*** (0.003)	-0.3501*** (0.042)
<i>Covid * NSBC (2)</i>	-0.1151*** (0.004)	-0.0095 (0.063)
<i>Covid * NSBC (3)</i>	-0.1459*** (0.008)	-1.0924*** (0.121)
<i>Covid * NSBC (4)</i>	-0.3276*** (0.016)	2.5374*** (0.253)

<i>Covid * NSBC (5)</i>	-0.2998*** (0.039)	-1.7005*** (0.618)
Confirmed Case Control	Yes	Yes
Constant	16.0665*** (0.138)	10.1761*** (0.692)
Observations	126,672	126,672
ICC	87.2	63.77
Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1		

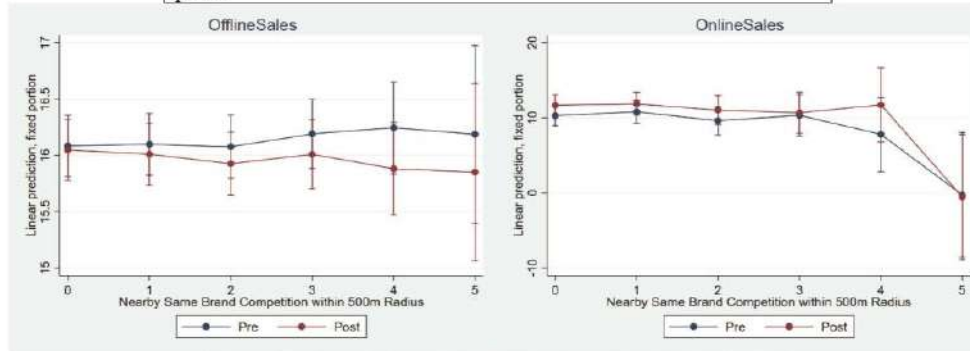


Figure 1. Results from MLM: Treatment Effect on NSBC

Next, we assess the impact of the COVID-19 on omnichannel sales of stores depending on district type of use, residential areas, and commercial districts. Consistent with our previous analysis, we observe clear signs of offline to the online spillover effect (see Table 3). Intuitively, before the outbreak, offline sales were higher in the commercial district than in residential areas, whereas online sales were higher in residential areas. However, offline sales in the commercial district decreased after the outbreak by 12.69%, whereas online sales, although insignificant, increased by 5.79%, as shown in Table 3. Evidently, offline sales loss was most significant in commercial district, whereas online sales in the commercial district was the highest, consistently providing evidence of channel spillover effect (see Figure 2).

Table 3. Results from MLM Analysis: Treatment Effect on Residential and Commercial District

VARIABLES	OfflineSales	OnlineSales
<i>Covid</i>	-0.0132*** (0.002)	1.2899*** (0.024)
<i>Commercial</i>	0.0920** (0.043)	-1.3307*** (0.397)
<i>Covid * Commercial</i>	-0.1269*** (0.002)	0.0579 (0.036)
Confirmed Case Control	Yes	Yes
Constant	16.0328*** (0.143)	10.8811*** (0.660)
Observations	126,672	126,672
ICC	87.54	63.36
Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1		

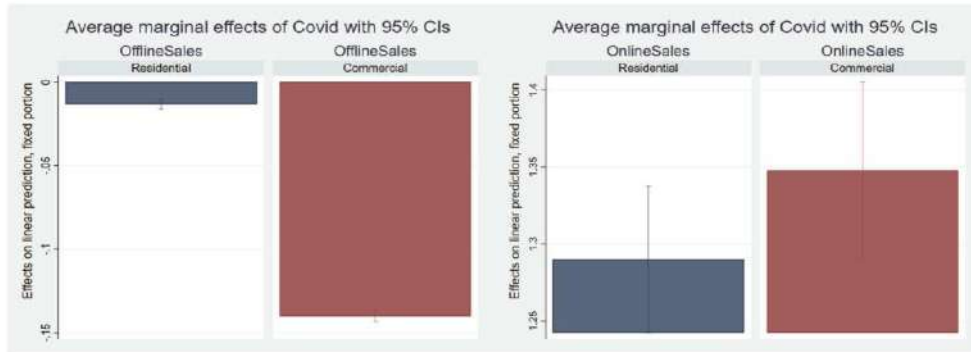


Figure 2. Results from MLM: Treatment Effect on District Type of Use

Lastly, 3-way interaction on *Covid * NSBC * Commercial* further assesses the impact of the COVID-19 outbreak on the varying types of district type use differentiating on the existence of nearby same brand competition.

Table 4. Results from MLM Analysis: 3-way Interaction

Variable	OfflineSales	OnlineSales
<i>Covid</i>	0.0288*** (0.002)	0.9894*** (0.033)
<i>NSBC Binary</i>	0.0242 (0.037)	0.0592 (0.531)
<i>Covid*NSBC Binary</i>	-0.0410*** (0.003)	-0.3728*** (0.050)
<i>Commercial</i>	0.1293*** (0.044)	-1.8461*** (0.425)
<i>Covid*Commercial</i>	-0.1066*** (0.003)	0.0567 (0.048)
<i>NSBC Binary*Commercial</i>	-0.0311 (0.054)	0.5859 (0.576)
<i>Covid*Commercial*NSBC Binary</i>	-0.0236*** (0.005)	0.1585** (0.075)
Confirmed Case Control	Yes	Yes
Constant	16.3468*** (0.173)	6.4457*** (1.136)
Observations	126,672	126,672

Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Difference-in-Differences (DID)

In this section, we used difference-in-differences (DID) settings to tease out the causal effect of the treatment, the outbreak of the COVID-19, and the social distancing policy, on the online and offline channel sales.

From our multi-level model analysis, we find that the effect of the COVID-19 is minimal among stores with zero NSBC, and it gradually increases as NSBC increase by 1-unit. In the DID model, we set the control group to stores free of nearby same brand competition and the treatment group to include stores with 1-5 NSBCs.

Table 5: Results from DID Analysis

Variable	OfflineSales	OnlineSales	OfflineSales	OnlineSales	OfflineSales	OnlineSales
<i>Covid*NSBC Binary</i>	-0.0738*** (0.008)	-0.2608* (0.156)				
<i>Covid *Commercial</i>			-0.1248*** (0.008)	0.0706 (0.156)		
<i>Covid * NSBC Binary * Commercial</i>					-0.1325*** (0.011)	-0.0726 (0.182)

Constant	16.2647*** (0.004)	7.2262*** (0.13)	16.2647*** (0.004)	7.2262*** (0.13)	16.2647*** (0.004)	7.2262*** (0.13)
Observations	126,672	126,672	126,672	126,672	126,672	126,672
Note: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1						

Consistent with our multi-level model analysis results, we observe a 7.38% decrease in offline channel sales and a 26.08% decrease in online channel sales among stores with 1-5 NSBCs compared to stores with no NSBC due to the outbreak. Offline channel sales in the commercial district significantly reduced by 12.48% in anticipation of the treatment compared to the residential district. However, the observed increase in online channel sales in the commercial district compared to the residential district is insignificant.

From the DDD result (i.e., 3-way interaction), we further validate that the negative impact of the COVID-19 is largest in the commercial district with highly competitive NSBC, whereas online channel sales decreased due to the outbreak in the competitive commercial district turned out to be insignificant.

Conclusion

Utilizing the omnichannel transaction data from South Korea's franchise retailing company, we find that an exogenous shock resulted in a channel spillover effect from offline to online. In terms of district type of use, offline channel sales in the commercial district were higher than that of residential areas before the outbreak. However, the pandemic brought most severe loss in offline sales in the commercial district, while residential area's loss was relatively mild. A partial explanation for such phenomena might directly come from reduced mobility, despite the lenient restriction social distancing policy imposed. Online channel sales for both district types of use increased significantly after the outbreak, increase in the commercial district were higher than online sales in residential area, further providing evidence of offline to online spillover.

On top of the differentiating effect of the COVID-19 on omnichannel sales in two different types of district types of use, we introduce a concept of nearby same brand competition (NSBC) within geographical vicinity. Previously, studies put more emphasis on how new entrants or introducing new online channel would affect the incumbents or pre-existing bricks-and-mortar stores. We specifically focus on the proximal intra-brand store competition for franchises that operate on omnichannel and how they have changed due to the pandemic situation. Analysis indicates that offline channel sales with a higher number of NSBCs had higher revenues before the outbreak, reflecting a firm's strategic decision to physically capture areas with greater demand. However, the pandemic caused a gradual decline in offline sales as NSBC increased by 1-unit, indicating a possible cannibalizing effect in the offline channel in areas with a higher number of same brand stores. Unlike the offline channel, online channel sales sharply decrease at 4-5 same brand stores nearby, and the pattern persists even after the outbreak, despite the overall increase, providing evidence of steepening ranking effect in the mobile environment as Ghose et al (2013) reported (Ghose et al, 2013).

The persisting patterns found in the online channel and the cannibalization effect discovered in the offline channel yield that the online channel is more stable when encountered with the exogenous threat to mobility, whereas the offline channel is directly subjected to facing a downturn due to its physical aspects. Managers and practitioners could utilize such implications to minimize the shock that comes from restrictions put on the physical characteristics and thrive through an unprecedented disaster.

References

Andersen, A. L., Hansen, E. T., Johannesen, N., & Sheridan, A. (2020, 5 12). Pandemic, Shutdown and Consumer Spending: Lessons from Scandinavian Policy Responses to COVID-19. *arXiv*.

- Bang, Y., Lee, D.-j., Han, K., Hwang, M., & Ahn, J.-H. (2013). Channel Capabilities, Product Characteristics, and the Impacts of Mobile Channel Introduction. *Journal of Management Information Systems* (pp. 101-125). M.E. Sharpe, Inc.
- Brynjolfsson, E., Hu, Y. (.), & Rahman, M. S. (2009). Battle of the Retail Channels: How Product Selection and Geography Drive Cross-Channel Competition. *Management Science* (pp. 1755-1765). informs.
- Butt, M. N., Antia, K. D., Murtha, B. R., & Kashyap, V. (2018). Clustering, Knowledge Sharing, and Intradbrand Competition: A Multilayer Analysis of an Evolving Franchise System. *Journal of Marketing* (pp. 74-92). American Marketing Association.
- Chen, H., Qian, W., & Wen, Q. (2021). The Impact of the COVID-19 Pandemic on Consumption: Learning from High-Frequency Transaction Data. *American Economic Association*, (pp. 307-311).
- Ghose, A., Goldfarb, A., & Han, S. P. (2013). How Is the Mobile Internet Different? Search Costs and Local Activities. *Information Systems Research* (pp.613-631). informs.
- Greeven, M. J., Yu, H., & Jialu, S. (2020, 6 29). *Why Some Retailers Are Thriving Amid Disruption*. Retrieved from MIT Sloan: Management Review: <https://sloanreview.mit.edu/article/why-some-retailers-are-thriving-amid-disruption/>
- Jo, H., Shin, E., & Kim, H. (2021). Changes in Consumer Behaviour in the Post-COVID-19 Era in Seoul, South Korea. *MDPI*, 13,136.
- Kalnins, A. (2004). An Empirical Analysis of Territorial Encroachment Within Franchised and Company-Owned Branded Chains. *Marketing Science* (pp. 476-489). informs.
- Kollmann, T., Kuckertz, A., & Kayser, I. (2012). Cannibalization or synergy? Consumers' channel selection in online-offline multichannel systems. *Journal of Retailing and Consumer Services* (pp. 186-194). ELSEVIER.
- Kraenzlin, S., Meyer, C., & Nellen, T. (2020). COVID-19 and regional shifts in Swiss retail payments. *Swiss Journal of Economics and Statistics* (p. 156:14). Springer Open.
- Lee, S. Y., Son, Y., & Oh, W. (2021). Effectiveness of Integrated Offline-and-Online Promotions in Omnichannel Targeting: A Randomized Field Experiment. *Journal of Management Information Systems* (pp. 484-516). Routledge.
- Luo, X., Zhang, Y., Zeng, F., & Qu, Z. (2020). COMPLEMENTARITY AND CANNIBALIZATION OF OFFLINE-TO-ONLINE TARGETING: A FIELD EXPERIMENT ON OMNICHANNEL COMMERCE. *MIS Quarterly*, (pp. 957-982).
- Pancras, J., Sriram, S., & Kumar, V. (2012). Empirical Investigation of Retail Expansion and Cannibalization in a Dynamic Environment. *Management Science* (pp. 2001-2018). informs.
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical Linear Models: Applications and Data Analysis Methods, 2nd Edition*. Thousand Oaks, CA: Sage Publications.

E2.5 A Study on COVID-19 Contact Tracing Applications

Completed Research Paper

Kim, J.^a and Wang, J.^b

^a Department of Business Administration, Pusan National University

E-mail: jkkim1@pusan.ac.kr

^b Department of Business Administration, Pusan National University

E-mail: luckyblair@pusan.ac.kr

Abstract

Evidence shows that contact tracing applications would be effective in stopping the coronavirus disease 2019 (COVID-19) only if enough people used them, which implies how important it is to motivate more people to use these applications in the future. Based on Agency Theory, we seek to examine the determinants of application use and compare the differences between these two countries. In addition, we aim to identify the moderating effects of privacy concerns and the mediating effects of implementation intention in terms of the use of COVID-19 contact tracing applications. Therefore, we conducted a survey-based cross-country field study, and we recruited samples of undergraduate and graduate students from South Korea and China separately. The current study contributes to the literature on both public health and information privacy, and more significantly, it suggests how we can motivate more people to use such applications to prevent the further spread of COVID-19.

Keywords: COVID-19 contact tracing applications, agency theory, self-regulation, government regulation, privacy concerns, implementation intention

Introduction

First documented in China, the coronavirus disease 2019 (COVID-19) has been an unprecedented challenge to global public health. According to the World Health Organization (WHO), as of March 24, 2022, COVID-19 pandemic has tragically caused 6,103,355 deaths worldwide, and what it has done to the entire human society is even more dramatic. To prevent the rapid spread of the coronavirus, countries all over the world have adopted different public health strategies (Brodeur et al., 2021). Among them, many governments have considered digital health technologies, especially contact tracing applications, as the most promising measures (Blasimme & Vayena, 2020). Compared with most European countries and the United States, Asian countries, particularly South Korea and China, have been much more successful in controlling the spread to flatten the curve (Cha, 2020).

In South Korea, a variety of contact tracing applications are available for users seeking information on infected people's movements and notifications about new cases (Suh & Li, 2021). It is worth noting that South Korea adopts a decentralized technology framework where application users have access to or control over personal data on their own devices (Li & Guo, 2020). In China, meanwhile, contact tracing applications are developed based on a centralized architecture. That is to say, it is the government that has control over the personal data collected through the application (Li & Guo, 2020). In fact, China was the first country that implemented advanced tracking and surveillance methods to develop contact tracing applications (Singh et al., 2020). The government applies the Health Code, which was developed by two platforms, Alipay and WeChat, to identify potentially infected people,

thus minimizing further transmission (Liang, 2020). It should be noted that in nearly 300 cities, it is mandatory for anyone willing to visit public spaces to use the Health Code (Mozur et al., 2020).

Contact tracing applications have been confirmed to be effective for public health. However, such use of personal data has raised significant concerns about potential violations of users' privacy in both countries. Here, we are facing a dilemma about which value we prefer to choose between health and privacy (Rowe, 2020). To date, COVID-19 contact tracing applications have gained more attention in the academic field. However, it is still at an early stage and thus there are few empirical studies addressed yet. Since many governments are considering contact tracing applications as a crucial COVID-19 exit strategy, it is important for future studies to investigate the uptake and determinants of application use (Walrave et al., 2020). As proved in the experiment by the University of Oxford, the greater the uptake, the more efficiently these applications will work. Therefore, the key question remains how to motivate people to use these applications. Furthermore, regarding the use of contact tracing applications, there is some global differentiation between voluntary and mandatory use (Dave & Gupta, 2020). But the majority of existing studies on contact tracing applications focus on voluntary use, with few attempts at mandatory use (Lee, 2021).

To fill the research gaps, therefore, drawing on Agency Theory, we seek to investigate the uptake of COVID-19 contact tracing applications in South Korea and China in this study. Specifically, we aim to examine the determinants of application use and compare the differences between these two Asian countries. Furthermore, despite more public concerns about privacy violations while using contact tracing applications, there is little literature and empirical research on the subject as of yet. We therefore aim to identify the moderating effects of privacy concerns on the intentions of using COVID-19 contact tracing applications. Also, we integrate the implementation intention to mediate the relationship between intention and behavior. The study contributes to the literature on public health and information privacy and implies how we can motivate people to use contact tracing applications in the future.

Theoretical Foundations

Agency Theory

Agency theory is regarded as one of the most well-known and prominent theories in the social science literature, and it has been applied to a wide range of disciplines (Panda & Leepsa, 2017). It dates back to the early 1970s when economists studied risk-bearing among individuals and groups and posited that the risk-bearing problem happens when partnering parties have different opinions on risk (e.g., Arrow, 1971). The Agency Theory expanded the literature to cover the agency problem as well, which arises if partnering parties' interests are conflicting (Ross, 1973). To be specific, the Agency Theory is mainly about agency relationships where the principal (one party) entrusts a task to the agent (another party) who does the task (Jensen & Meckling, 1976).

During the development process, the Agency Theory has evolved into two streams: Positivist Agency Theory and Principal Agent Theory (Jensen, 1983). On the one hand, as a descriptive agency theory, the Positive Agency Theory primarily contributes to understanding behaviors in the real world (Carnovale et al., 2019). Furthermore, positivist studies have been most concerned with the principal-agent relationships between large, public businesses' owners and managers. In a nutshell, the Positivist Agency Theory focuses on identifying the management mechanisms to address the agency problem (Jensen, 1983). On the other hand, economic scholars developed the Principal Agent Theory by using agents' bounded rationality, personal interests, and risk aversion as significant criteria for modeling this principal-agent relationship (Elmanizar et al., 2019). Principal-agent research is more interested in the general theory of principal-agent relationships, which is applicable to different kinds of agency relationships (Harris & Raviv, 1978). Although these two streams are different in terms of mathematical rigor, dependent variables, and so on, they have similar beliefs about people, information, and organizations, and they both use the contract between principals and agents as the unit of analysis (Eisenhardt, 1989). Because of its origins and perspectives, Agency Theory has been frequently applied to the organizational literature, and it has been interpreted in various ways and extended to different forms. However, the Agency Theory is applicable in a variety of settings, ranging from macro-level

issues such as regulatory policy to micro-level dyad phenomena such as expressions of self-interest (Eisenhardt, 1989).

For a long time, research on human agency has been restricted to the assumption that personal agencies function independently, but it turns out that people do have other ways to influence how they live their lives. Being an agency is to intentionally affect one's functioning and life circumstances (Bandura, 2006). Social cognitive theory applies the agentic perspective and posits that there are three different modes of human agency: personal/individual agency, proxy agency, and collective agency (Bandura, 2001). To be specific, personal agency is limited to individually controllable domains of activities. However, there are many aspects of their lives that are out of their direct control, like the COVID-19 pandemic, for instance. In such situations, people turn to proxy agencies that have the resources, knowledge, and means to achieve what they want on their behalf. Sometimes, what people desire to obtain is possible only if a group of people work together to achieve the common goal they share.

Adjusted to the research context, the Agency Theory can be interpreted as the Control Agency Theory, which offers two paths to improve our control: personal/individual control and proxy control (Xu et al., 2012). Personal/individual control is confined to the individual performing the control agency himself/herself, whereas powerful others, like the government, function as the proxy control agency. In the psychology literature, (perceived) control is generally described as one's beliefs concerning the factors that may promote or hinder behavior (Ajzen, 2001). Basically, it depends on the assessment of the current situation where factors can facilitate personal control or when individuals believe that they have no direct control, they'll give up personal control and rely on others who they think are more capable of achieving the desired results (Ng et al., 2006).

In accordance with Agency Theory, behavioral responses to protection can also be divided into two major categories based on the mode of control agency: personal/individual control mode and proxy control mode. That is to say, individuals themselves take direct control over responses associated with protection behaviors in the personal control mode. While in the proxy control mode, instead of individuals themselves, powerful forces such as industry and government regulation function as the proxy control agency to deal with protection-related responses (Xu et al., 2012). In other words, once individuals perceive weakness, they often surrender personal control and turn to others who they believe can do it better. Evidence shows that if individuals do not trust self-regulation to protect themselves, they will give up and ask for government intervention to help (Smith et al., 2011).

Previous Studies on COVID-19 Contact Tracing Applications

As an efficient COVID-19 exit strategy, contact tracing applications have received global attention in the academic field. To date, there have been a few papers analyzing and assessing COVID-19 mobile applications used in different countries. Kondylakis et al. (2020) found that mobile applications were beneficial for citizens, health professionals, and decision makers while facing pandemic challenges. They also provided a comparison of these mobile applications in terms of their main features. For instance, there were applications for information sharing, education, risk assessment, self-management of symptoms, contact tracing, home monitoring, etc., and all of these applications have been valuable tools for varying purposes to help us manage the COVID-19 pandemic. Ming et al. (2020) analyzed the contents and features of mobile applications launched during the COVID-19 pandemic. They assessed that most applications in the APP Store and the Play Store scored 4 out of 7 points and evaluated the basic functions of these applications in terms of subscription, official application maintained by health authorities, tracing/mapping, monitoring surveillance, and online consultation. They aimed to guide users to choose a suitable COVID-19 mobile application based on their needs and requirements. Singh et al. (2020) identified that the majority of COVID-19 applications were for contact tracing and symptom monitoring. They also suggested that these mobile health applications were effective only if taken up by the community. Liang (2020) mentioned that contact tracing applications have become an effective platform to detect exposure risks and focused on the Health Code applied in China. Also, he argued that such a digital platform was playing a key role in conducting health surveillance and mediating state-citizen relations in China.

On the other hand, there were some serious concerns about privacy threats and risks regarding the use of contact tracing applications. Jung et al. (2020) addressed the privacy risks of contact tracing data disclosure practices in South Korea. They assessed the information disclosure and found that most of the contact tracing data showed the gender and age of patients, as well as significant places such as home and work, sensitive information like hobbies and religion, and social relationships. They also discussed the role of identifiability in minimizing the exposure of privacy-infringing information through contact tracing. DiMoia (2020) also showed that the public health policy raised growing privacy concerns in South Korea. The study showed that South Korea made some changes to the public health law in 2015 to cope with public health crises such as MERS (Middle Eastern Respiratory Syndrome), and the law allows tracking patients' personal data, such as credit card transactions, as well as the use of information communication technologies. Even though South Korea's response to COVID-19 has received international praise, increasing voices concerning the privacy violation still cannot be ignored.

Despite increased academic interest in COVID-19 applications, as mentioned previously, it is still in the early stages, and therefore it needs more empirical studies in the future. Walrave et al. (2020) investigated factors that influence the use of COVID-19 contact tracing applications based on the Health Belief Model. They indicated that the most significant predictor was the perceived benefits of the application, as well as self-efficacy and perceived barriers. They even suggested that application developers should clarify how they will protect users' privacy. Altmann et al. (2020) investigated users' acceptability of COVID-19 contact tracing applications in five countries, i.e., France, Germany, Italy, the United Kingdom, and the United States. Through the multicountry study, they found that the main barriers to application adoption were concerns about cybersecurity and privacy, as well as a lack of trust in the government. Wnuk et al. (2020) examined that perceived threat and lack of control, negative feelings evoked by the COVID-19 pandemic, were significantly positively related to the acceptance of surveillance technologies in Poland. Their study showed that these negative feelings evoked by the global crisis could inspire positive attitudes towards surveillance technologies. Lee (2021) highlighted that, as one of the earliest countries to initiate a rapid national response to the COVID-19 pandemic, South Korea has obviously set a good example for other countries. The study examined contact tracing applications for those who were mandatorily self-quarantined by the Korean government and showed citizens' views regarding the use of self-tracing applications in South Korea. Suh & Li (2021) explored how people appraised the use of contact tracing applications in South Korea during the COVID-19 pandemic and found that once users experienced loss emotions like anger, frustration, and disgust, they were not willing to continue using the application. As a result, they proposed that application designers should consider giving users control over their applications.

Research Model and Hypotheses

Drawing on the Agency Theory, we developed a model to investigate the uptake of COVID-19 contact tracing applications in South Korea and China. Specifically, we examined and compared the determinants of application use in these two countries. Besides, we identified the moderating effects of privacy concerns on the paths from two control agencies, self-regulation and government regulation, to the intentions, i.e., intention and implementation intention. In the study, we also incorporated the implementation intention to mediate the relationship between intention and behavior.

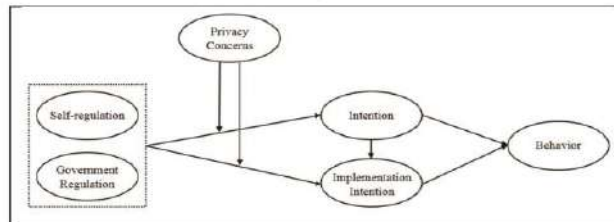


Figure 1. Research Model

In the early days, people used to believe that human nature was ordained by divine design. Throughout the course of human evolution, our ancestors gradually developed their symbolizing abilities and evolved into agentic species, allowing them to shape environments and life courses through their own powers (Bandura, 2018). As Agency Theory proposes, when there is a certain goal or problem, people have two paths to enhance their control. One is personal control, and the other one is proxy control. In particular, people would exercise direct personal control when confronted with a situation in which the control agent is themselves (Bandura, 2001). People's evolutionary cognitive capacities to comprehend, predict, and alter the course of events motivate them to act on opportunities to take control of their own lives (Bandura, 2006). However, people would turn to powerful others, such as the government, for help to achieve their initial goals when they anticipated that personal control was not enough (Xu et al. 2012). They seek to increase their control by having a proxy agency act on their behalf to secure their desired outcomes (Bandura, 2001).

From an Agency Theory perspective, we attempt to shed light on the factors that determine the uptake of COVID-19 contact tracing applications in South Korea and China. Therefore, we incorporated self-regulation as a personal control agent and government regulation as a proxy control agent. Evidence shows that the terms "self-control" and "self-regulation" are used interchangeably (e.g., Baumeister et al., 2007). Nonetheless, some researchers have clarified such subtle differences between these two terms as "self-regulation" is used more widely for goal-directed behaviors (Vohs & Baumeister, 2016).

There are two kinds of intentions commonly used in the sociopsychology literature: (goal) intention and implementation intention. Specifically, the (goal) intention is a will that individuals determine a goal for performing a particular behavior, whereas the implementation intention is similar to a state of planning in which individuals specify how to achieve the desired goal behavior by planning when, where, and how (Gollwitzer, 1993). Prestwich & Kellar (2014) proposed that implementation intention is an effective mediator to help individuals translate their intentions into behaviors, thus reducing the gap between intention and behavior. Accumulated evidence suggests that implementation intention, in comparison to (goal) intention, is a much more powerful tool for explaining and predicting actual behavior (e.g., Kim & Wang, 2020). Therefore, we hypothesize that,

H1a: Self-regulation is positively related to the intention to use COVID-19 contact tracing applications.

H1b: Government regulation is positively related to the intention to use COVID-19 contact tracing applications.

H2a: Self-regulation is positively related to the implementation intention to use COVID-19 contact tracing applications.

H2b: Government regulation is positively related to the implementation intention to use COVID-19 contact tracing applications.

H3a: Privacy concerns negatively moderate the relationship between self-regulation and the intention to use COVID-19 contact tracing applications.

H3b: Privacy concerns negatively moderate the relationship between government regulation and the intention to use COVID-19 contact tracing applications.

H4a: Privacy concerns negatively moderate the relationship between self-regulation and the implementation intention to use COVID-19 contact tracing applications.

H4b: Privacy concerns negatively moderate the relationship between government regulation and the implementation intention to use COVID-19 contact tracing applications.

H5: The intention to use COVID-19 contact tracing applications is positively related to the behavior of using COVID-19 contact tracing applications.

H6: The intention to use COVID-19 contact tracing applications is positively related to the implementation intention to use COVID-19 contact tracing applications.

H7: The implementation intention to use COVID-19 contact tracing applications is positively related to the behavior of using COVID-19 contact tracing applications.

Research Methodology

Design and Procedure

From an Agency Theory perspective, we seek to identify the determinants of the uptake of COVID-19 contact tracing applications in South Korea and China. Besides, we aim to highlight the mediating effects of implementation intention and the moderating effects of privacy concerns. Therefore, to accomplish the purposes of the study, we conducted survey-based cross-country field studies to observe the uptake of COVID-19 contact tracing applications in these two countries. Due to the COVID-19 pandemic, we distributed the survey online and offline. The measuring scales applied in the current study were adopted from existing studies to suit our research context. We used a 7-point Likert scale in the study, from 1 = strongly disagree to 7 = strongly agree. To validate the items, we first conducted pilot studies in South Korea (n = 54) and China (n = 58). After the pilot study, we dropped three invalid items and made minor changes.

We recruited samples of undergraduate and graduate students separately from South Korea and China. After removing incomplete responses, a sample of 202 in South Korea and another sample of 217 in China were finally retained. Table 1 shows the demographic characteristics of the samples. It is worth noting that there exists a large gap regarding the uptake of COVID-19 contact tracing applications in South Korea and China. There were merely about 10% (n = 21) of the Korean respondents reporting that they use the application. Only about 1% (n = 2) of Chinese respondents said they did not use any application.

Table 1. Descriptive Statistics of Respondents

Demographic variable		Frequency	Percent	
Gender	South Korea	Male	97	48.0%
		Female	105	52.0%
		Total	202	100.0%
	China	Male	115	53.0%
		Female	102	47.0%
		Total	217	100.0%
Actual Use of COVID-19 Contact Tracing Application	South Korea	Yes	21	10.4%
		No	181	89.6%
		Total	202	100.0%
	China	Yes	215	99.1%
		No	2	0.9%
		Total	217	100.0%

Analysis

First, we used Smart PLS 2.0 for a confirmatory factor analysis (CFA) of the measurement model. The Cronbach's alpha (α) for each construct was above 0.7, the composite reliability (CR) for each construct was greater than 0.7, and the average variance extracted (AVE) for each construct was higher than 0.5. These values supported the reliability and the convergent validity (Nunnally & Bernstein, 1994; Thompson et al., 1995). The square root of AVE of each construct is greater than the correlation between that construct and any other construct, which verifies the discriminant validity (Awad & Krishnan, 2006). Table 2 presents the results of reliability and convergent validity testing, and Table 3 shows the discriminant validity testing results.

Table 2. Reliability and Convergent Validity Testing Results

Variable		Item	Loading	t-value	α	CR	AVE
Self-regulation (SR)	South Korea	SR1	0.930	11.328	0.886	0.928	0.811
		SR2	0.897	9.320			
		SR3	0.873	7.461			
	China	SR1	0.955	4.271	0.912	0.889	0.731
		SR2	0.806	3.663			
		SR3	0.743	3.118			
Government Regulation (GR)	South Korea	GR1	0.943	6.377	0.890	0.926	0.808
		GR2	0.854	4.607			
		GR3	0.897	5.970			
	China	GR1	0.926	10.605	0.921	0.947	0.856
		GR2	0.919	10.188			
		GR3	0.930	12.779			
Privacy Concerns (PC)	South Korea	PC1	0.929	15.004	0.921	0.950	0.863
		PC2	0.918	17.054			
		PC3	0.940	19.166			
	China	PC1	0.831	4.333	0.886	0.922	0.799
		PC2	0.896	5.955			
		PC3	0.950	5.684			
Intention (IN)	South Korea	IN1	0.927	77.237	0.931	0.955	0.875
		IN2	0.955	93.992			
		IN3	0.924	52.983			
	China	IN1	0.934	70.628	0.935	0.958	0.885
		IN2	0.941	70.656			
		IN3	0.947	83.937			
Implementation Intention (IIN)	South Korea	IIN1	0.952	115.097	0.927	0.954	0.873
		IIN2	0.954	131.814			
		IIN3	0.896	42.409			
	China	IIN1	0.904	61.907	0.863	0.917	0.786
		IIN2	0.903	60.018			
		IIN3	0.851	25.142			
Behavior (BE)	South Korea	BE1	0.915	48.668	0.925	0.952	0.870
		BE2	0.946	100.178			
		BE3	0.935	85.956			
	China	BE1	0.859	35.148	0.872	0.922	0.799
		BE2	0.956	133.302			
		BE3	0.853	33.219			

Table 3. Discriminant Validity Testing Results

		1	2	3	4	5	6
South Korea	1. Behavior	0.933					
	2. Government Regulation	-0.095	0.899				

	3. Implementation Intention	0.588	0.090	0.934			
	4. Intention	0.414	0.047	0.359	0.935		
	5. Privacy Concerns	-0.092	-0.020	-0.168	-0.019	0.929	
	6. Self-regulation	0.089	0.020	0.153	-0.034	0.120	0.901
China	1. Behavior	0.894					
	2. Government Regulation	0.136	0.925				
	3. Implementation Intention	0.521	0.195	0.887			
	4. Intention	0.301	0.010	0.241	0.941		
	5. Privacy Concerns	-0.063	-0.337	0.002	-0.102	0.894	
	6. Self-regulation	-0.017	-0.167	0.134	-0.055	0.216	0.855

(Note: Leading diagonal shows the square root of AVE of each construct)

Then, we used structural equation modeling (SEM) in Smart PLS 2.0 to test the structural model of this study. For starters, we tested the explanatory power of the structural model by identifying the corresponding R, redundancy, and communality values (see Table 4). Provided that each redundancy value is above 0, and each communality value is higher than 0.5, the explanatory power of the model could be confirmed by the square root value of multiplying R square mean value and communality mean value. When it is above the recommended value of 0.36, 0.25, or 0.1, respectively, we assume the predictors have large, medium, or small effects on the outcome (Tenenhaus et al., 2005). Therefore, the structural model had a significant explanatory power of 0.409 (> 0.36) in the case of South Korea and 0.348 (> 0.25) in the case of China.

Table 4. The Explanatory Power of the Model

Variable	South Korea			China		
	R square	Redundancy	Communality	R square	Redundancy	Communality
BE	0.393	0.294	0.870	0.304	0.215	0.799
GR	—	—	0.808	—	—	0.856
IIN	0.193	0.007	0.873	0.133	0.029	0.786
IN	0.004	0.002	0.875	0.012	0.001	0.885
PC	—	—	0.863	—	—	0.799
SR	—	—	0.811	—	—	0.731
Mean	0.197	0.101	0.850	0.150	0.082	0.809
Explanatory Power	0.409			0.348		

(Note: BE=Behavior, GR=Government Regulation, IIN=Implementation Intention, IN=Intention, PC=Privacy Concerns, SR=Self-regulation)

Next, we proceeded to test hypotheses. The results are presented in Figure 2 (South Korea) and Figure 3 (China) in terms of path coefficient (β) values and p-values, and nonsignificant paths were dashed in the figures. In the Korean sample, the results revealed a significant relationship between self-regulation and intention (H1a) ($\beta = 0.185$, $p = 0.005$). However, the relationship between self-regulation and implementation intention (H2a) is not significant ($\beta = -0.034$, $p = 0.337$), indicating that H2a is not supported. Neither the relationship between government regulation and intention (H1b) ($\beta = 0.048$, $p = 0.270$) nor the relationship between government regulation and implementation intention (H2b) ($\beta = 0.066$, $p = 0.195$) are statistically significant. Therefore, H1b and H2b are not supported. We also found statistically significant relationships between intention and behavior (H5) ($\beta = 0.233$, $p = 0.000$), intention and implementation intention (H6) ($\beta = 0.358$, $p = 0.000$), and implementation intention and behavior (H7) ($\beta = 0.505$, $p = 0.000$). In the Chinese sample, we discovered a statistically significant

relationship between self-regulation and intention (H1a) ($\beta = 0.173$, $p = 0.092$) at a significance level of 0.1. Government regulation and implementation (H2b) have a significant relationship ($\beta = 0.247$, $p = 0.000$) as well. However, there is no significant relationship ($\beta = -0.038$, $p = 0.321$) between self-regulation and implementation intention (H2a). The relationship between government regulation and intention (H1b) is also nonsignificant ($\beta = -0.032$, $p = 0.351$). Thus, H1b and H2a are both not supported. The relationships between intention and behavior (H5) ($\beta = 0.187$, $p = 0.001$), intention and implementation intention (H6) ($\beta = 0.255$, $p = 0.000$), and implementation intention and behavior (H7) ($\beta = 0.476$, $p = 0.000$) are totally significant.

In addition, we tested the moderation hypotheses as well. As for the Korean sample, we identified the significant negative moderating effects of privacy concerns on the relationship between self-regulation and intention (H3a), with an effect size of 0.03. However, H3b, H4a, and H4b are not supported. On the other hand, as for the Chinese sample, we found that privacy concerns have statistically significant negative effects on the relationship between government regulation and intention (H3b), with an effect size of 0.04. That is to say, H3a, H4a, and H4b are nonsignificant, thus not supported.

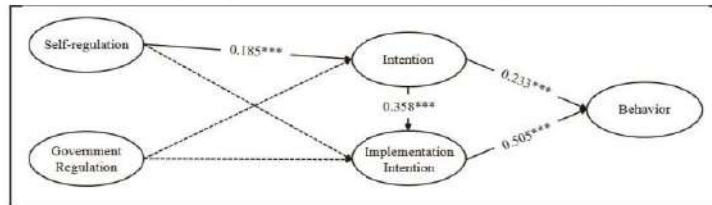


Figure 2. Hypothesis Testing Results (South Korea)

(Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; nonsignificant paths are dashed)

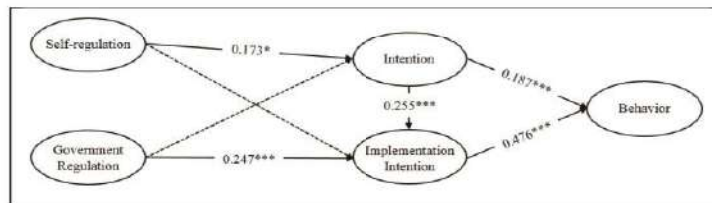


Figure 3. Hypothesis Testing Results (China)

(Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$; nonsignificant paths are dashed)

Conclusion

Based on the Agency Theory, we conducted an empirical study to investigate the uptake of COVID-19 contact tracing applications in South Korea and China. We seek to shed light on the factors that determine the use of these applications and identify the moderating effects of privacy concerns and the mediating effects of implementation intention, respectively.

In the case of South Korea, we found that self-regulation is significantly related to the intention to use COVID-19 contact tracing applications, whereas we found no significant relationship between government regulation and intention. As a matter of fact, it is totally voluntary for Korean citizens to decide whether or not to adopt COVID-19 contact tracing applications such as Co100. In contrast to China, Koreans motivate themselves to use contact tracing applications to protect themselves from the COVID-19 pandemic without any other regulations from the government or institutions. That is to say, when they perceive the need to adopt the applications, they would bring themselves to act on it. However, we were unable to discover any significant relationship between self-regulation and implementation intention, which shows that self-regulation itself was not powerful enough to drive

people to come up with further plans to start to use any applications. Besides, we identified the negative moderating effects of privacy concerns on the relationship between self-regulation and intention. Obviously, there have been public concerns about privacy threats and risks regarding the use of COVID-19 contact tracing applications in Korea, which is understandable. Since these applications basically provide location-based services, users need to share such private information to get them to work. That is, the more concerned users are, the less they intend to use such applications. Thus, according to the findings in our study, in order to motivate more people in South Korea to use COVID-19 contact tracing applications, we need to improve users' self-regulation and reduce their privacy concerns.

In the case of China, we also found that self-regulation was positively related to the intention to use contact tracing applications. Furthermore, we confirmed the significant effects of government regulation on the implementation intention of using these applications. In China, as mentioned previously, it is mandatory for people to use Health Code if they want to go to public places. Despite the fact that people have self-regulation to guide them in using the COVID-19 contact tracing application for their own benefit, the same self-regulation did not lead directly to the implementation intention at all. On the contrary, government regulation had a significant effect on implementation intention. If self-regulation fails you, there is no need to worry, because we still have government regulation. In addition, we found that privacy concerns negatively moderated the relationship between government regulation and intention. It implies that even though government regulation has proved its remarkable role in increasing the uptake of COVID-19 contact tracing applications, we cannot ignore the fact that Chinese citizens are expressing their serious privacy concerns towards the use of such applications. Just as Agency Theory proposes, there is a chance that the principal and the proxy agent would have a conflict. In this case, it is about risk preferences, i.e., the government chooses public health over privacy issues, whereas citizens are worried about potential privacy threats and risks.

In addition, we found that the behavior of using COVID-19 contact tracing applications was better explained by the implementation intention than the intention of using the application in both cases. Therefore, helping people improve their implementation intentions will be an effective way to increase the uptake of COVID-19 contact tracing applications. For instance, encouraging people to make more detailed plans, such as when and how, would enhance the implementation intention and thus increase the uptake of COVID-19 contact tracing applications.

The findings of our study have several significant implications. To start with, we extended Agency Theory into new research contexts in the information privacy and public health literature. Based on Agency Theory, we examined the factors that determine the uptake of COVID-19 contact tracing applications and identified the different predominant determinants in South Korea and China. Also, we investigated the moderating effects of privacy concerns regarding the use of these applications. We confirmed again in this study that implementation intention significantly mediates the relationship between intention and behavior, which means that behavior can be better explained and predicted by implementation intention than by intention alone. Then, we offered empirical evidence for practitioners, such as policymakers. There is no way to know when the COVID-19 pandemic will end, so we need to do everything that can help reduce its spread and put an end to this tragic but silent war. Based on our findings in two cases, i.e., South Korea and China, we can provide different strategies for these two countries to motivate more people to use COVID-19 contact tracing applications. Evidence shows that such contact tracing applications would be more efficient and effective if more people used them. Last but not least, we found that people in both countries are expressing their concerns about potential privacy risks regarding the use of these applications, and these privacy concerns could have negative effects on the uptake of contact tracing applications. We are hoping to find a solution or balance to bridge the conflicts between different agencies.

References

Ajzen, I. (2001). Nature and operation of attitudes. *Annual review of psychology*, 52(1), 27-58.

- Altmann, S., Milsom, L., Zillesen, H., Blasonc, R., Gerdon, F., Bach, R., ... & Abcler, J. (2020). Acceptability of app-based contact tracing for COVID-19: Cross-country survey study. *JMIR mHealth and uHealth*, 8(8).
- Arrow, K. J. (1971). The economic implications of learning by doing. In *Readings in the Theory of Growth* (pp. 131-149). Palgrave Macmillan, London.
- Awad, N. F., and Krishnan, M. S. (2006). The personalization privacy paradox: An empirical evaluation of information transparency and the willingness to be profiled online for personalization. *MIS Quarterly*, 30(1) 13-28.
- Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual review of psychology*, 52(1), 1-26.
- Bandura, A. (2006). Toward a psychology of human agency. *Perspectives on psychological science*, 1(2), 164-180.
- Bandura, A. (2018). Toward a psychology of human agency: Pathways and reflections. *Perspectives on Psychological Science*, 13(2), 130-136.
- Baumeister, R. F., Vohs, K. D., & Tice, D. M. (2007). The strength model of self-control. *Current directions in psychological science*, 16(6), 351-355.
- Blasimme, A., & Vayena, E. (2020). What's next for COVID-19 apps? Governance and oversight. *Science*, 370(6518), 760-762.
- Brodeur, A., Gray, D., Islam, A., & Bhuiyan, S. (2021). A literature review of the economics of COVID-19. *Journal of Economic Surveys*, 35(4), 1007-1044.
- Carnovale, S., Rogers, D. S., & Yenyurt, S. (2019). Broadening the perspective of supply chain finance: The performance impacts of network power and cohesion. *Journal of Purchasing and Supply Management*, 25(2), 134-145.
- Cha, V. (2020). Asia's COVID-19 lessons for the west: Public goods, privacy, and social tagging. *The Washington Quarterly*, 1-18.
- Dave, R., & Gupta, R. (2020). Mandating the use of proximity tracking apps during coronavirus disease 2019: ethical justifications. *Frontiers in Medicine*, 877.
- DiMoia, J. P. (2020). Contact Tracing and COVID-19: The South Korean Context for Public Health Enforcement. *East Asian Science, Technology and Society: An International Journal*, 14(4), 657-665.
- Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *Academy of management review*, 14(1), 57-74.
- Elmanizar, H. F., Nugraha, A. T., Yakub, A., & Cahyono, B. P. (2019). The application of agency theory in supply chain finance: a case of Indonesian manufacturing firms. *International Journal of Supply Chain Management (IJSCM)*, 8(3), 23-32.
- Gollwitzer, P. M. (1993). Goal achievement: The role of intentions. *European Review of Social Psychology*, 4(1), 141-185.
- Harris, M., & Raviv, A. (1978). Some results on incentive contracts with applications to education and employment, health insurance, and law enforcement. *The American economic review*, 68(1), 20-30.
- Jensen, M. C. (1983). Organization theory and methodology. *Accounting review*, 319-339.
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of financial economics*, 3(4), 305-360.
- Jung, G., Lee, H., Kim, A., & Lee, U. (2020). Too much information: assessing privacy risks of contact trace data disclosure on people with COVID-19 in South Korea. *Frontiers in public health*, 8, 305.

- Kim, J., & Wang, J. (2020). Examining Factors that Determine the Use of Social Media Privacy Settings: Focused on the Mediating Effect of Implementation Intention to Use Privacy Settings. *Asia Pacific Journal of Information Systems*, 30(4), 919-945.
- Kondylakis, H., Katchakis, D. G., Kouroubali, A., Logothetidis, F., Triantafyllidis, A., Kalamaras, I., ... & Tzovaras, D. (2020). COVID-19 mobile apps: a systematic review of the literature. *Journal of medical Internet research*, 22(12).
- Lee, C. S. (2021). Contact tracing apps for self-quarantine in South Korea: rethinking datafication and dataveillance in the COVID-19 age. *Online Information Review*, 45(4), 810–829.
- Li, J., & Guo, X. (2020). COVID-19 contact-tracing apps: A survey on the global deployment and challenges. *arXiv preprint arXiv:2005.03599*.
- Liang, F. (2020). <? covid19?> COVID-19 and Health Code: How Digital Platforms Tackle the Pandemic in China. *Social Media+ Society*, 6(3).
- Ming, L. C., Untong, N., Aliudin, N. A., Osili, N., Kifli, N., Tan, C. S., & Goh, H. P. (2020). Mobile health apps on COVID-19 launched in the early days of the pandemic: content analysis and review. *JMIR mHealth and uHealth*, 8(9).
- Mozur, P., Zhong, R., & Krolik, A. (2020). In Coronavirus fight, China gives citizens a color code, with red flags. *The New York Times*. <https://www.nytimes.com/2020/03/01/business/china-coronavirus-surveillance.html>.
- Ng, T. W., Sorensen, K. L., & Eby, L. T. (2006). Locus of control at work: a meta-analysis. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 27(8), 1057-1087.
- Nunnally J.C., Bernstein I.H. (1994) *Psychometric theory (3rd Ed.)*. New York: McGraw-Hill.
- Panda, B., & Leepsa, N. M. (2017). Agency theory: Review of theory and evidence on problems and perspectives. *Indian Journal of Corporate Governance*, 10(1), 74-95.
- Prestwich, A., and Kellar, I. (2014). How can the impact of implementation intentions as a behaviour change intervention be improved? *European Review of Applied Psychology*, 64(1), 35-41.
- Ross, S. A. (1973). The economic theory of agency: The principal's problem. *The American economic review*, 63(2), 134-139.
- Rowe, F. (2020). Contact tracing apps and values dilemmas: A privacy paradox in a neo-liberal world. *International Journal of Information Management*, 55, 102178.
- Singh, H. J. L., Couch, D., & Yap, K. (2020). Mobile health apps that help with COVID-19 management: scoping review. *JMIR nursing*, 3(1).
- Singh, H. J. L., Couch, D., & Yap, K. (2020). Mobile health apps that help with COVID-19 management: scoping review. *JMIR nursing*, 3(1).
- Smith, H. J., Dinev, T., & Xu, H. (2011). Information privacy research: an interdisciplinary review. *MIS quarterly*, 989-1015.
- Suh, A., & Li, M. (2021). Digital tracing during the COVID-19 pandemic: User appraisal, emotion, and continuance intention. *Sustainability*, 13(2), 608.
- Tenenhaus, M., Vinzi, V. E., Chatelin, Y. M., and Lauro, C. (2005). PLS path modeling. *Computational Statistics & Data Analysis*, 48(1), 159-205.
- Thompson, R., Barclay, D. W., and Higgins, C. A. (1995). The partial least squares approach to causal modeling: Personal computer adoption and use as an illustration. *Technology Studies: Special Issue on Research Methodology*, 2(2), 284-324.
- Vohs, K. D., & Baumeister, R. F. (Eds.). (2016). *Handbook of self-regulation: Research, theory, and applications*. Guilford Publications.

Walrave, M., Waeterloos, C., & Ponnet, K. (2020). Adoption of a contact tracing app for containing COVID-19: A health belief model approach. *JMIR public health and surveillance*, 6(3).

Walrave, M., Waeterloos, C., & Ponnet, K. (2020). Adoption of a contact tracing app for containing COVID-19: A health belief model approach. *JMIR public health and surveillance*, 6(3).

WHO coronavirus (COVID-19) Dashboard. <https://covid19.who.int/>.

Wnuk, A., Oleksy, T., & Maison, D. (2020). The acceptance of Covid-19 tracking technologies: The role of perceived threat, lack of control, and ideological beliefs. *PloS one*, 15(9).

Xu, H., Teo, H. H., Tan, B. C., & Agarwal, R. (2012). Research note—effects of individual self-protection, industry self-regulation, and government regulation on privacy concerns: a study of location-based services. *Information systems research*, 23(4), 1342-1363.

E2.6 A Comparative Analysis of Telemedicine Research in China Before and After the COVID-19 Pandemic based on Bibliometrics

Jiang, H.^a, Yu, T.^{b*}, Liu, S. S.^c, Qiu, Y. J.^d, and Li, B. B.^e

^a School of Management, Shanghai University of Engineering Science
E-mail: 1300301502@qq.com

^{b*} School of Management, Shanghai University of Engineering Science
E-mail: tingyu@sues.edu.cn

*Corresponding author

^c School of Management, Shanghai University of Engineering Science
E-mail: lss15939068535@163.com

^d The Wharton School, University of Pennsylvania
E-mail: louisaiqiu0712@gmail.com

^e School of Management, Shanghai University of Engineering Science
E-mail: li_bbvip@163.com

Abstract

This study employed the Difference in Difference (DID) model and the bibliometrics method with aim to novel corona virus disease (COVID-19) pandemic. This study conducted a comparative analysis based on the number of publications, co-authorship, and institutional collaborations on telemedicine literature research in China before and after the outbreak of COVID-19 (October 2017 to March 2022). The quantity, classification, and research focus of Chinese telemedicine literature was also compared based on data before the outbreak (October 2017 to December 2019) and after the outbreak (January 2020 to March 2022). The results show that the number of articles published by Chinese scholars on telemedicine research have soared after the outbreak of COVID-19, with significant emergence in the trend of co-authorship and institutional collaboration. The research hotspots focused on artificial intelligence, Wise Information Technology of Med (WITMED), and public hospitals, extending from the pre-pandemic topics including teleconsultation, internet+, and hierarchical medical system.

Keywords: Telemedicine, COVID-19 pandemic, bibliometrics, comparative analysis

Introduction

Since the global outbreak of the novel corona virus disease (COVID-19) pandemic in late 2019, telemedicine has received unprecedented favor and attention (Calton et al., 2020) and will continue to have broad development prospects in the foreseeable post-epidemic era. Long before the outbreak of the pandemic, scholars have analyzed the balanced distribution of high-quality medical resources and enhancing the operational efficiency of telemedicine operation. The topics include the telemedicine scope of application (Li et al., 2018), relevant empirical evidence (Han et al., 2018), service mode and operation mechanism (Martinez et al., 2018), current service status and improvement (Kreofsky et al., 2018), policy analysis (Choi et al., 2019) and other perspectives. Telemedicine has the advantages of relieving the pressure of medical resources shortage, promoting safety and prevention of diseases, and avoiding the risk of hospital associated infections. Therefore, scholars paid increasing attention to

telemedicine in three main areas after the COVID-19 pandemic. First, practical application of telemedicine was explored for the prevention and control of COVID-19 (Anthony, 2020). Second, the structure of the telemedicine service system was studied, with suggestions in the government strengthening the top-level design (Liu et al., 2022). Research theorized methods of stimulate telemedicine services supply, including improvement of the policy system, standardization of industry regulations, promotion of information security, and connection to medical insurance (Bajowala et al., 2020). Third, improvement of medical service quality was researched from the impact of introducing new technologies (Albahri et al., 2021). In addition, reviews on telemedicine have increased in recent years, including more qualitative studies, but there are few quantitative reviews on telemedicine and in these limited studies mainly analyzed the current situation and development trend of telemedicine (Nittari et al., 2020), but less involved the literatures analysis related to COVID-19. There is also a lack of comparative analysis of telemedicine before and after the outbreak of COVID-19 in this field of research. Since the literature research of telemedicine is an important refraction of its practical application, the practical development context of telemedicine can be explored to a certain extent through literature research. For this reason, this paper, with the research perspective of the Difference in Difference model (DID), takes December 31, 2019, as the cut-off point of the literature research, using bibliometric analysis methods by observing and analyzing the research profile of Chinese telemedicine scolars in the 2 years and 3 months before and after this cut-off point (i.e., the period from October 2017 to March 2022). This paper aims to explore the trends of telemedicine research by scholars in China before and after the outbreak of the COVID-19 pandemic and combine the analysis results with the practice of telemedicine, so as to provide theoretical reserve for further the role of telemedicine in practice.

Research Methods and Data Sources

Research Methodology

DID is mainly used in the evaluation of policy effects in sociology. The basic idea is to assess the effect of policy intervention by comparing the differences between the control group and the treatment group before and after policy intervention (Perrailon et al., 2019). With the DID perspective, this paper compares the research profiles of Chinese scholar on telemedicine before and after the outbreak of COVID-19, using December 31, 2019 as the data observation cut-off point. Meanwhile, a bibliometric approach is introduced to focus on the overall literature research before and after the outbreak of COVID-19 (October 2017 to March 2022), as well as a comparative analysis of the types of literature, collaborations, and research hotspots before (October 2017 to December 2019) and after the outbreak (January 2020 to March 2022).

Data Sources

With (SU='telemedicine'+ 'telemedical'+ 'telehealth'+ 'remote consultation'+ 'remote diagnosis'+ 'remote clinic'+ 'remote surgery'+ 'remote pathology'+ 'remote imaging'+ 'remote ECG'+ 'remote ultrasound'+ 'remote radiation'+ 'remote traditional Chinese medicine'+ 'remote rehabilitation'+ 'remote nursing'+ 'remote health care'+ 'remote monitoring'+ 'Internet+medical'+ 'Internet hospital') as the search formula, this paper retrieved the core journal literatures collected by the China National Academic Library (CNKI) from October 2017 to December 2019 and from January 2020 to March. After excluding conferences, reports, and papers not related to telemedicine, 141 and 288 papers were obtained, respectively.

Research Results

Overview of telemedicine research in China before and after the COVID-19 Outbreak

Analysis of the quantity of research published

The study collected the quantity of papers published by Chinese scholars on telemedicine research from October 2017 to March 2022. During the period, a total of 429 papers were published. The number of papers published in each year is shown in Figure 1.

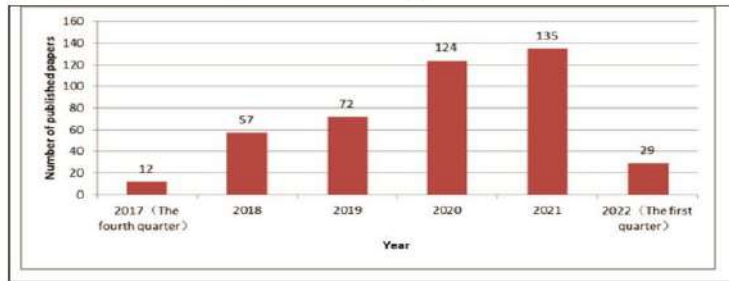


Figure 1. Number of Publications in Telemedicine Research in China (October 2017 to March 2022)

The number of published papers on telemedicine has increased substantially from 57 in 2018 to 135 in 2021, with a compounded annual growth rate of 33.3%. The growth in number of publications was the most significant in 2020 after the outbreak of COVID-19, with year over year increase of 72.22% from 2019, and 117.54% from 2018. In 2021, the number of issues in 2020 increased by 11, with the growth rate slowing down compared with previous years.

Analysis of co-authorship in publications

Authors with high numbers of publications can be regarded as core researchers in a certain research field, and analysis of core researchers can help to grasp the direction and depth of the field. Using CiteSpace software to analyze the 429 literatures selected by this paper, it was found that a group of highly published authors who collaborate with one another have emerged in the field of telemedicine research in China, as shown in Table 1.

Table 1. Ranking of Author Publications Frequencies in Telemedicine in China (October 2017 to March 2022)

	Authors	Frequencies
1	Zhai, Y.K.	30
2	Zhao, J.	24
3	Gu, H.	13
4	Yu, G.J.	9
5	Sun, D.X.	8
6	Wu, D.	7
7	Ma, Q.Q.	6
8	Lu, W.	6

It was evident from the above table that there are 8 authors with more than 6 collaborative publications, and they have published 103 papers in cooperation with other scholars. Among them,

three researchers, Zhai, Y. K., Zhao, J., and Gu, H., have published more than 10 collaborative papers. These numbers suggested that the high-publishing researchers have formed some obvious research cooperation networks in the field of telemedicine.

Analysis of Institutional Collaboration

The analysis of collaborative publications of the institutions could lead to understanding of the focus and contribution of different research institutions to a certain research topic. Using CiteSpace software to analyze the 429 papers selected for this paper, it was found that there were seven institutions with more than six collaborative publications in the field of telemedicine, as shown in Table 2.

Table 2. Ranking of Collaborative Telemedicine Research Publications by Institutions in China (October 2017 to March 2022)

	Institution	Frequencies
1	School of Management Engineering , Zhengzhou University	29
2	The First Affiliated Hospital of Zhengzhou University	22
3	National Engineering Laboratory for Internet Medical Systems and Applications	18
4	Centers for Health Policy and Management, Nanjing University	13
5	Children's Hospital of Shanghai (Children's Hospital Affiliated to Shanghai Jiao Tong University)	7
6	Institute of Healthy Jiangsu Development, Nanjing Medical University	6
7	Science and Technology School of Medicine and Health Management, Tongji Medical College of Huazhong University	6

As can be seen from the above table, there were four institutions that have published more than 10 collaborative papers on telemedicine, including Zhengzhou University School of Management Engineering, the First Affiliated Hospital of Zhengzhou University, National Engineering Laboratory for Internet Medical Systems and Applications, and Nanjing University Health Policy and Management Research. In fact, the four institutions emerged as the core of a research cooperation cluster.

Analysis of the difference in telemedicine research before and after the COVID-19 Outbreak

Comparison of the number and classifications of the publications

Overall, a total of 429 papers were published in the field of telemedicine in China before and after the outbreak of COVID-19, of which 141 and 288 were published before and after the pandemic. The publications have doubled since the outbreak, indicating telemedicine has gained significant attention through the public health crisis. The literature is further divided into five dimensions, including research level, literature category, research field, service scope, and whether new technologies were involved, and a two-by-two comparison of the relevant dimensions before and after the pandemic was carried out, as shown in Figure 2.

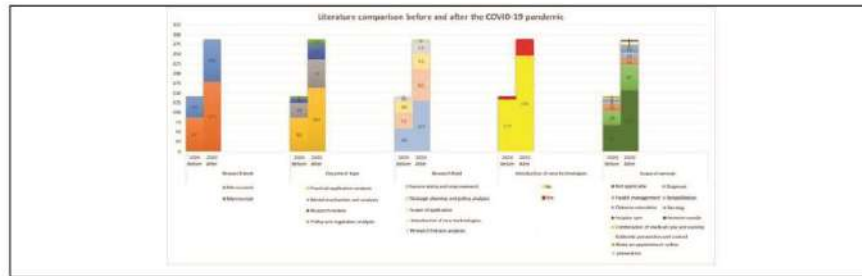


Figure 2. Comparison of the Number and Composition of Articles Published in the Field of Telemedicine in China Before and After the COVID-19 Outbreak

From a research perspective, before the epidemic, scholars have published 54 and 87 papers at the macro and micro levels, accounting for 38.30% and 61.70%, respectively. After the outbreak, the number of papers published at the macro and micro levels grew to 109 and 179, respectively, accounting for 37.85% and 62.15% respectively. The difference in numbers before and after the outbreak indicated that scholars have strengthened the research on the micro level since COVID-19 emerged. In terms of the classification of research, the number of papers published after the outbreak was 164, 72, 39, and 13 in the categories of practical applications, mechanisms and models, literature review, and policy and regulatory analysis, respectively. The numbers showed an increase of 78, 33, 29, and 7 papers, which increased 90.69%, 84.62%, 290.00%, and 116.17% respectively compared to the level of publications in the field before the outbreak. In the field of research, the number of published papers after the outbreak of COVID-19 was 129, 82, 41, 9, and 27 in the areas of the status quo and improvement of services, analysis of policies and regulations, the scope of service use, research hotspots, and new technology adoptions. The numbers represented an addition of 71, 41, 11, 7 and 17 papers published in the respective areas, increasing 122.41%, 100.00%, 36.67%, 350.00%, and 170.00% relative to the level before the pandemic. In terms of whether new technologies were involved, there were only 8 papers involving new technologies published before the outbreak, accounting for only 5.67% of the total relevant publications in the same period. Meanwhile, the number of papers involving new technologies increased to 42 after the outbreak, accounting for 14.58% of total number of publications in the same period. Therefore, since the COVID-19 outbreak, scholars have been paying more and more attention to the introduction of new technologies in telemedicine practice. These new technologies mainly involved 5G, artificial intelligence, regional chains, surgical robots, and beyond. (Zhao, 2020; Wei et al., 2021). From the perspective of service scope, in addition to tele-consultation, rehabilitation, nursing, health management, and tele-education, which had been covered before the outbreak, scholars have further expanded their focus on the scope of telemedicine services since. Epidemic prevention and control, prevention, remote ward rounds, hospice care, and online medical appointments have received more attention and investigations. However, the number of articles published in these newer areas still only accounts for less than 4.17% of the total telemedicine publications after the COVID-19 outbreak.

Comparative analysis of research hotspots

Keywords are the author's highly refined content of the full text. Therefore, research hotspots in the field of scientific research can be reflected by the frequencies of certain keywords in published literature. Applying DID perspectives, this paper uses CiteSpace software to analyze the frequencies of keywords in telemedicine research in China before (October 2017-December 2019) and after the COVID-19 outbreak (January 2020-March 2022). Table 3 was obtained through taking the top 15 high-frequency keywords.

Table 3. List of Research Hotspot and Related Keywords for Telemedicine Research in China Before and After the COVID-19

Ranking	Before COVID-19 Outbreak	After COVID-19 Outbreak
---------	--------------------------	-------------------------

1	Telemedicine	Telemedicine
2	Teleconsultation	Internet+
3	Telemedical	Telemedical
4	Hierarchical Medical System	Overview
5	Internet +	Teleconsultation
6	Remote Rehabilitation	Remote Rehabilitation
7	Overview	Rehabilitation
8	Medical Resources	Stroke
9	Stroke	Artificial Intelligence
10	Applications	Influencing Factors
11	Influencing Factors	Hierarchical Medical System
12	Health Education	Medical Alliance
13	Health Poverty Alleviation	WITMED
14	Medical Alliance	Public Hospitals
15	Operation Mechanism	Medical Insurance Payment

The table above compared the similarities and differences of research hotspot and related keywords in the field of telemedicine research in China before and after the COVID-19 outbreak. The following three features are found to be worthy of analysis. First, the scholars emphasized telemedicine services and improvement both before and after the outbreak. The telemedicine services mainly involves high-frequency keywords such as "telemedicine", "remote consultation", "telerehabilitation", and "stroke", while "influencing factors" points to the relevant service improvement (Jiang et al., 2020). Secondly, the scholars also emphasized the construction of the organizational model of telemedicine services both before and after the outbreak. This mainly involves the two high-frequency keywords of "hierarchical medical system" and "medical alliance" before the outbreak. After, more attention was paid to the role of "public hospitals" as the main figure in the promotion of telemedicine. This may be related to the fact that medical institutions, mainly public secondary and tertiary hospitals, have launched Internet Hospitals and online medical services after the COVID-19 outbreak (Jiao et al., 2021). Third, the integration of technologies in telemedicine became a rising research hotspot since the outbreak. Although "Internet +" was ranked 5th among the high-frequency keywords before the outbreak, the concept grew to rank second after "telemedicine". The rising high-frequency keywords such as "artificial intelligence" and "WITMED"(Wise Information Technology of Med) reflects the trend of integration of telemedicine and new technologies.

Discussion

Telemedicine service functions needs to be further strengthened and extended in post-pandemic era

Strengthening the disease prevention function of telemedicine

From the existing research results of telemedicine, the scope of services mainly focuses on diagnosis and treatment, rehabilitation, and nursing. The scholars have begun to further explore the scope of services after the COVID-19 outbreak, extending to epidemic prevention and control, prevention, remote ward rounds, hospice care, and online medical appointments. Yet, telemedicine is still not adequately involved in prevention. It is recommended to use the advantages of non-contact telemedicine services in the prevention of both infectious diseases and non-infectious diseases.

Enriching the types of rehabilitation services in telemedicine

Tele-rehabilitation provides value through accessibility at home, timesaving, convenience for patients with limited mobility. It is expected to play a significant role in improving the health level of the population. However, the existing tele-rehabilitation services mainly focus on stroke patients with motor dysfunction, cardiopulmonary rehabilitation, and speech function rehabilitation. Less attention is paid to physical function rehabilitation, cognitive impairment, pain, and beyond, thus restricting the effectiveness of telemedicine in rehabilitation services to a certain extent. Relevant parties should consider expanding the types of rehabilitation services in telemedicine to promote population health.

Expanding the scope of telemedicine diagnosis and treatment services

Constrained by policies of COVID-19 prevention and control, the medical demand of Chinese residents for diagnosis and treatment services have not been effectively met since the outbreak. Existing diagnosis and treatment services mainly focuses on remote imaging, remote ECG, remote surgery and other fields. Limited by policies, lack of offline testing sites, and other factors, patients faced challenges to directly obtain online medical treatment and services. Therefore, it is necessary to improve the wearable devices in collecting patient health data, so that online doctors can obtain relevant information more efficiently. On the other hand, the service mode and process can also be optimized so that the telemedicine service can gradually transform from B2B to B2C mode or B2B2C mode.

Active Construction of Support Conditions that Promote the Application of Telemedicine

Strengthen application through new technologies

The COVID-19 outbreak has attracted more scholars to study the application of new technologies such as 5G, blockchain, and artificial intelligence in telemedicine. Yet, such studies only accounted for 14.58% of total papers published in the selected period (see Figure 2 for details), suggesting that the application of new technologies in telemedicine is still emerging and deserves further attention in both the practical and theoretical fields.

Strengthen the support from medical insurance payment

As an emerging service, telemedicine has the characteristics of low service cost and improved accessibility of medical resources. Therefore, both social medical insurance and commercial insurance institutions would benefit from increasing investment and support while further expanding the telemedicine coverage. Establishing and improving the "Internet +" medical insurance system, the insurance payers have the responsibilities to set corresponding service standards as well as regulate service pricing, quality, and effect for optimal coverage radiation.

Conclusion

Overall, Chinese scholars have published a total of 429 papers on telemedicine before and after the COVID-19 outbreak, including 141 papers before and 288 papers after the outbreak. Seven authors published six or more papers in collaboration, who were also involved in publishing 103 collaborative papers. There were four institutions which have published ten or more collaborative papers, with 82 collaborative papers published in total. There have been an apparent trend of author cooperation clusters and institutional cooperation clusters. Comparing before and after the COVID-19 outbreak, Chinese scholars have paid increasing attention to telemedicine research since the outbreak, with the number of published papers has increased by 147. In terms of research hotspots, the scholars focused on topics such as artificial intelligence, WITMED, and public hospitals after the outbreak in addition to previously well-explored topics, including teleconsultation, Internet +, and hierarchical medical system.

It should be noted that it has been less than three years since the COVID-19 outbreak in late 2019; the limited time period has constrained the size of literature samples in this study to a certain extent. In

addition, this article only focuses on comparing the results obtained by Chinese scholars longitudinally in the field of telemedicine before and after the COVID-19 outbreak, without taking the international research results of other scholars during the same period into consideration. Therefore, the research results have certain limitations and are mostly relevant for the future application considerations of telemedicine in China.

References

- Albahri, A. S., Alwan, J. K., Taha, Z. K., Ismail, S. F., Hamid, R. A., Zaidan, A. A., and Alsalem, M. A. 2021. "IoT-based telemedicine for disease prevention and health promotion: State-of-the-Art," *Journal of Network and Computer Applications* (173), p.102873.
- Anthony, B. 2020. "Use of Telemedicine and Virtual Care for Remote Treatment in Response to COVID-19 Pandemic," *Journal of Medical Systems* (44:7), p. 132.
- Bajowala, S. S., Milosch, J., and Bansal, C. 2020. "Telemedicine Pays: Billing and Coding Update," *Current Allergy and Asthma Reports* (20:10), p. 60.
- Calton, B., Abedini, N., and Fratkin, M. 2020. "Telemedicine in the Time of Coronavirus," *Journal of Pain and Symptom Management* (60:1), pp. 12-14.
- Choi, W. S., Park, J., Choi, J. Y. B., and Yang, J. S. 2019. "Stakeholders' resistance to telemedicine with focus on physicians: Utilizing the Delphi technique," *Journal of Telemedicine and Telecare* (25:6), pp. 378-385.
- Han, G. S., Cui, N., and Li, Z. G. 2018. "The Development Model of Telemedicine in Developing Countries and the Enlightenment for China (in Chinese)," *China Health Service Management* (35:09), pp. 641-643.
- Jiang, Z. Q., Li, T., Wang, J., Gu, Y. L., Zhang, X. Y., Lou, J. L., Zhang, X., and Chen, J. Q., 2020. "Cognition of remote consultation of pneumoconiosis and analysis of influencing factors on its use intention (in Chinese)," *Occupational Medicine in China* (47:01), PP. 62-66.
- Jiao, Y. L., Zuo, K. Q., Chen, Z., Wu, Y. M., and Jin, Y., 2021. "Practice and Exploration of the Construction of Intelligent Medical System in the Whole Process of Outpatient Service (in Chinese)," *Chinese Hospital Management* (41:05), PP. 39-42.
- Kreofsky, B. L. H., Blegen, R. N., Lokken, T. G., Kapraun, S. M., Bushman, M. S., and Demaerschalk, B. M. 2018. "Sustainable Telemedicine: Designing and Building Infrastructure to Support a Comprehensive Telemedicine Practice," *Telemedicine and E-Health* (24:12), pp. 1021-1025.
- Li, H. J., Zhang, Y., Zhang, B. B., Zhang, H. Y., Yu, Z. J., and Wang, R. H. 2018. "Application of telemedicine in cancer patients health management (in Chinese)," *China Health Education*, (34:04), pp. 355-359.
- Liu, M. Q. 2022. "Dilemma and Legislative Countermeasures in the Development of the Internet Medical Service in China—And Commenting on Measures for the Administration of Internet Diagnosis and Treatment (for Trial Implementation) and Two Other Documents (in Chinese)," *Journal of Southwest University (Social Science Edition)* (48:02), PP. 37-48.
- Martinez, K. A., Rood, M., Jhangiani, N., Kou, L., Rose, S., Boissy, A., and Rothberg, M. B. 2018. "Patterns of Use and Correlates of Patient Satisfaction with a Large Nationwide Direct to Consumer Telemedicine Service," *Journal of General Internal Medicine* (33:10), pp. 1768-1773.
- Nittari, G., Khuman, R., Baldoni, S., Pallotta, G., Battineni, G., Sirignano, A., and Ricci, G. 2020. "Telemedicine Practice: Review of the Current Ethical and Legal Challenges," *Telemedicine and E-Health* (26:12), pp. 1427-1437.
- Perrailon, M. C., Lindrooth, R., and Welton, J. M. 2019. "Difference-in-Difference Research Designs," *Nursing Economics* (37:6), pp. 328-331.
- Wei, M. Y., Chen, M., Yu, J. B., Xu, D. J., Wang, S., and Yu, G. J. 2021. "Design and Practice of Internet Hospital Cloud Pharmacy Platform based on blockchain (in Chinese)," *China Health Resources* (24:03), PP. 219-222.
- Zhao, F., Sun, X. L., Hu, Y. B., and Min, G. Y. 2020. "Discussion on the Application of 5G Technology in the Medical Field (in Chinese)," *China Medical Equipment* (35:11), pp. 158-161+165.

[DAY 2]

A3 [Junior Faculty/Researcher]
Junior faculty/researcher Seminar

A3.1 In-store shopping with location-based retail apps: perceived value, consumer response, and the moderating effect of flow

Kim, Eunhye ^a

^a Data Consulting Group, Samsung SDS
E-mail: eunhye890@naver.com

Abstract

Bricks-and-mortar retailers have recently begun to utilize mobile applications delivering location-based services (LBS) as part of their omni-channel strategy to provide consumers with new in-store experiences. In light of this trend, this study examined how consumers' value perception influences their intention to use LBS in the store and their behavioral responses as well as the moderating effect of flow on the relationships between the perceived benefits/costs and the perceived value of LBS usage. The results indicated that benefits (perceived usefulness and perceived enjoyment) and costs (perceived complexity and perceived privacy risk) were influential antecedents shaping consumers' value perception of LBS, which in turn impacted their intention to use LBS and behavioral responses (search and purchasing using LBS). Also, we found that the negative relationship between the perceived costs and perceived value was attenuated in high flow states than in low flow states

Keywords: Mobile location-based service, Omni-channel strategy, Perceived value, Flow, Consumer response

A3.2 Heaven or Hell for Artists in NFT : A Social Exchange Theory Perspective

Yang, Ji-Hoon^a and Yoon, Sang-Hyeak^b

^a Korea Culture & Tourism Institute

E-mail: yangjh@kcti.re.kr

^b School of Industrial Management, KOREATECH

E-mail: yoonsh@koreatech.ac.kr

Abstract

NFTs, which guarantee ownership of digital files by using blockchain technology, are the new field for digital art in the art world. The NFT provided new opportunities for artists to freely trade digital artworks without going through auctions or galleries. Additionally, collectors and investors can safely and easily own their works without the threat of illegal copy. Since only a limited number of artists are participating in the NFT market, there needs to be an influx of various artists and a process of popularization for this market to grow and develop into the main stage. However, research on NFT has been limited, and the understanding of the drivers of artists choosing to participate in NFT is insufficient. Thus, we developed a research model of the antecedents of artists participating in NFT that builds on social exchange theory.

By applying a mixed methodology, we derive the benefits and costs of artists participating in NFT through a theoretical approach and interviews. We then conduct a survey on artists to verify the influence of each factor. Through this, we can suggest that management implications to reduce the risks and costs of participating in NFTs are needed to encourage the participation of artists. It will also provide insight into ways to develop the NFT art market.

Keywords: NFT, Artist, Social exchange theory, Mixed methodology, NFT art market

Introduction

“The NFT art market will grow more than 100 times in 10 years, and it will become a bigger market than the actual art market.” Messari, a market research institute, made such a forecast in a report published in early 2022 (Messari 2022). Indeed, the statement was a forecast on data research conducted by a company dealing with cryptocurrency. Yet, this forecast reflects the trends and changes of the market size of NFTs, which has been rapidly growing throughout the 2020s. NFT trading volume exceeded \$10.67 billion in the third quarter of 2021, recording an increase of 704% in the previous quarter, and a 38,060% growth rate compared to the previous year (Forbes 2022).

This phenomenon begs the question, why exactly is so much capital being poured into the NFT art market and continuing to grow? NFT stands for ‘Non-Fungible Token’ and is a crypto asset certificate using blockchain technology (Chalmers et al. 2022). Ownership, copyright, transaction history can be recorded in a unique address (token), so even if the product is copied indefinitely, the original owner can easily be identified (Wang et al. 2021). According to the characteristics of blockchain technology, anyone can check transaction information, thus making transactions more transparent and less susceptible to illegal distribution (Morkunas et al. 2019). In other words, NFTs led to the expectation that the problems of the traditional art market can be solved, and thus, more investments have been made on NFTs. Typically, these properties are best applied in digital art. The biggest problem with

digital art has been that it can be copied without permission online. Accordingly, the scarcity value of the original artwork is low. On the other hand, in NFTs, the ledger is recorded through blockchain technology so that ownership can be permanently recognized. Essentially, no matter how many copies are made, the original owner can be easily identified, and scarcity is guaranteed (Wang et al. 2021). Additionally, in art market transactions, there were many cases where transactions were made by influential artists, curators, galleries, museums, and collectors, such as 'invisible hands'. However, in NFTs, due to the unique characteristics of the blockchain, transactions can be made freely without the intervention of an intermediary (Taylor and Sloane 2021).

As expectations and interest in NFT have increased, some related studies have been conducted. However, the number of studies on NFTs is still limited, and existing studies have only focused on the investment and portfolio of NFTs (Aharon and Demir 2021; Ko et al. 2022; Maouchi et al. 2021; Umar et al. 2022; Yousaf and Yarovaya 2022) or macro-market impacts (Chalmers et al. 2022; Chohan and Paschen 2021). In addition, in order for the NFT market to be activated in earnest, the number of collectors, which is the buyer side, must be sufficiently secured. However, artists who can be called suppliers must also be secured. It is important to note that most studies are focused on the NFT market itself (Chalmers et al. 2022; Chohan and Paschen 2021; Karim et al. 2022; Umar et al. 2022), research has been conducted only on the buyer side (Vasan et al. 2022), and research on the artist as a supplier is extremely scarce. Consequently, in this study, we focus on NFT artists and aim to determine optimal strategies that can incentivize artists to participate in NFTs.

Conceptual Background

NFT is a type of technology that has emerged in early 2010 (Chen 2018), but has only recently started to attract massive public attention. After several attempts, the digital artist Bipple's NFT work in 2021 achieved monumental transactions exceeding 69 million dollars. Having this as a catalyst for the NFT industry, transactions have thereafter exploded and an industrial aspect of NFTs has begun to be established (Pinto-Gutiérrez et al. 2022). Indeed, research related to NFTs is still in the early stages, and more studies are vital.

One of the most active areas of NFT study pertain to the finance field, which deals with investment and return portfolios (Ko et al. 2022; Maouchi et al. 2021; Umar et al. 2022; Yousaf and Yarovaya 2022). Yousaf and Yarovaya (2022) used the TVP-VAR framework to identify returns and volatility between NFTs, Defi assets and other assets (oil, gold, bitcoin and S&P 500), Karim et al. (2022) investigated the extreme risk of the blockchain market using the quantile connectivity technique under median, extreme low, and extreme high volatility conditions. In addition, the finance field paid attention to the NFT function as a new financial and investment vehicle (Ko et al. 2022), and warned about the extreme liquidity and speculative nature of NFTs (Maouchi et al. 2021).

Furthermore, some studies on the market influence and marketing implications of NFTs have begun to emerge. For instance, Chalmers et al. (2022) explored the value and impact of NFTs as a digital ownership mechanism on creative industrial entrepreneurs. According to the study's findings, while NFTs provide creative entrepreneurs with value that enables them to capture value in their digital creations, they also raise concerns about the prevalence of speculation and fraud. In addition, Chohan and Paschen (2021) specifically explained NFT by applying the AIDA (awareness, desire, action, and recurring action) hierarchical model modified through a marketing approach. The study highlighted the unique characteristics of NFTs, such as scarcity, non-fungibility, proven authenticity, proof of ownership, royalties, and direct distribution infrastructure, to be exploited in marketing.

Prior studies also tried to identify the properties of the NFT market through quantitative analysis. Representatively, Nadini et al. (2021) investigated Ethereum and WAX blockchains between June 23, 2017 and April 27, 2021. Data on 6.1 million NFT transactions were analyzed through machine learning to identify factors that shape the price of NFT works. Based on the study's results, the sales history and visual function of each work are predictors that can determine the price. Moreover, Vasan et al. (2022) identified more than 48,000 works in Foundation, an NFT platform, to examine the network characteristics of works that succeed in NFT, and characterized the network patterns that form artistic success. Through this, it was also discovered that the artist-collector relationship is important on the

NFT, and the unexpected result was found that it was receiving disproportionate and repeated investment from a small group of collectors. Further, a study was also conducted to analyze the performance and dynamics of play-to-earn tokens on the metaverse, a market highly related to NFT. Vidal-Tomás (2022) quantitatively analyzed 174 play-to-earn tokens. It was revealed that the play-to-earn revenue on the metaverse has no significant correlation with the NFT function.

As demonstrated in the studies, research on NFTs is still limited, and studies on artists who are suppliers of NFTs have not yet been conducted. In this study, a mixed methods approach will be used to identify factors that allow or prevent artists from participating in NFTs. Based on our study's findings, we aim to suggest strategies that promote their participation.

Research Methodology

This study is based on a mixed methods design that combines quantitative and qualitative analyses to answer our research questions. According to Venkatesh et al. (2013), a mixed-methods model offers rich understanding of the phenomenon. To reach this study's goal, we developed and tested a research model for the first stage as quantitative study. We then conducted in-depth interviews as a qualitative study with NFT experts for obtaining complementary inferences. The study design and procedure for this study is shown in Figure 1. The study utilized a sequential mixed methods approach for complementary purposes (Venkatesh et al. 2013, 2016).

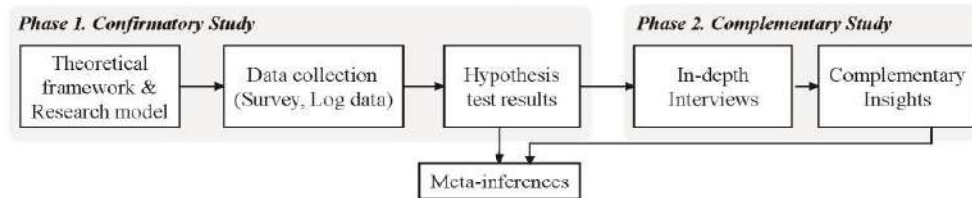


Figure 1. Research Procedure

Stage 1: Quantitative Study

Theoretical framework and Research Model

Social exchange theory is a psychological theory that explains an individual behavior and implements a cost-benefit analysis for discovering risks and advantages (Blau 1968; Cook and Emerson 1987). According to the social exchange perspective, people devote their resources (e.g., time and money) to maximize their worth. Thus, the social exchange theory has been widely used to explain human decisions and behaviors (e.g., Kim et al. 2018; Wang et al. 2019). For this reason, we adopt social exchange theory (Blau 1968; Cook and Emerson 1987) to interpret the benefits and cost factors of the NFT market and understand the relationship among various factors from the artist's point of view.

We developed the theoretical framework based on the social exchange theory and prior research on blockchain along with the unique attributes of the NFT market (see Appendix A). According to the social exchange theory, the overall worth of a social exchange is assessed by calculating the difference between its expected benefits and costs. To derive the benefits and costs of the NFT market, we utilized a previous study on blockchain as a guide and added factors relevant to the adoption of general technology.

We now describe how we define the benefit and cost factors of NFTs. *Transaction efficiency of NFT* indicates that the minimizing the transaction costs, including time, effort, and money, in the interactions between the artist and the buyer (North and Wallis 1994). *Disintermediation of exhibition and sales* indicate the removal of the intermediary or the middleman from any NFT exhibition and transaction (Marszalek 2016). *Transparency of NFT information* refers to the open flow of any NFT information

for decision-making and taking the right action (Hosseini et al. 2018). *Technical Complexity to create NFT* indicates the required technological level for creating and uploading NFT arts (Tani and Cimatti 2008). *Anxiety of NFT market* refers to the feelings of tension and discomfort associated with using NFT technologies (Pfaffinger et al. 2020). *Security risks of NFT* indicate an artist's perception of risks that affect the data security and transaction safety in the NFT context (Ackermann et al. 2012).

Based on the theoretical framework, we propose the research model shown in Appendix B to explain the Artist's perceived worth in the NFT market. We expect that the three factors related to the benefit of the NFT market (i.e., *Transaction efficiency of NFT*, *Disintermediation of exhibition and sales*, and *Transparency of NFT information*) positively impact an artist's perceived NFT worth. By contrast, we postulate that the three cost factors of the NFT market (i.e., *Technical Complexity to create NFT*, *Anxiety of NFT market*, and *Security risks of NFT*) negatively impact an artist's perceived NFT worth. In addition, if artists perceive positive net benefits from the NFT market, they would increase their intention to behavior, i.e., the intention to create NFT. Therefore, we posit the following hypotheses:

H1: *Transaction Efficiency of NFT has a positive effect on Perceived NFT Worth*

H2: *Disintermediation of Exhibition and Sales has a positive effect on Perceived NFT Worth*

H3: *Transparency of NFT Information has a positive effect on Perceived NFT Worth*

H4: *Technical Complexity to create NFT has a negative effect on Perceived NFT Worth*

H5: *Anxiety of NFT Market has a negative effect on Perceived NFT Worth*

H6: *Security Risks of NFT has a negative effect on Perceived NFT Worth*

H7: *Perceived NFT Worth has a positive effect on Intention to Create NFT*

Instrument Development and Data Collection

The instrument of this study was developed by adapting existing, validated scales wherever possible. The adaptation was done to fit the context of the NFT market. To measure *Transaction efficiency of NFT*, we adapted the scales from Moore and Benbasat (1991). Scales for *Disintermediation of exhibition and sales* were modified from Malik et al. (2021). To assess *Transparency of NFT information*, we adapted the scales from Teo et al. (2003).

We adapted the scales from Moore and Benbasat (1991) to measure *Technical Complexity to create NFT*. Scales for *Anxiety of NFT market* were modified from Meuter et al. (2003). To assess *Security risks of NFT*, we adapted the scales from (Casaló et al. 2007).

Lastly, scales for *perceived NFT worth* and *intention to create NFT* were adapted from Kim et al. (2018) and Dodds et al. (1991) respectively. The final survey items are shown in Appendix A. They were assessed on seven-point Likert scales (1 = strongly disagree; 7 = strongly agree).

For the data collection, we conducted an online survey of artists. To verify that our respondents were truly artists, at the beginning of the survey, we asked them if they had any experience in monetarily profiting from their own creations (e.g., picture, music, and video). We also confirmed whether the respondents knew what an NFT is. Only artists who knew what an NFT is and have sales experience in their own creations were considered valid survey participants. We offered US\$5 worth of coffee coupons to all respondents as an incentive for people to participate in the survey. The survey was conducted over a period of one week.

We obtained n=107 valid and complete responses (see Appendix C). Descriptive statistics of our respondents show that most of them are in their 30s (63.6%). The occupational field with the highest proportion of respondents is music (40.2%) and video (31.8%). In terms of frequency to visit a NFT market, more than half of the participants have no experience in the NFT market. In terms of gender, there were 67.3% males and 32.7% females.

Data Analysis and Results

We used SPSS 24 to conduct an exploratory factor analysis (EFA) through principal components analysis with varimax rotation. For the subjective constructs with multiple items, we found eight factors with eigenvalues greater than 1.0. All item loadings except for one item (TCC 1) on the intended factors exceeded 0.6. The one item (i.e., TCC 1) was dropped from further analysis. The eight factors explained 86.75% of total variance.

For the confirmatory factor analysis (CFA), we used SmartPLS 3.0 which is one of the partial least square (PLS) application. As shown in Appendix D, the standardized path loadings were all significant (t-value > 1.96), and most loadings were greater than 0.7. The average variance extracted (AVE) for each construct was greater than 0.5. The composite reliability (CR) and Cronbach’s values for all constructs exceeded 0.7. The convergent validity of the measurement instrument was thus supported (Hair et al. 2006).

We next assessed the discriminant validity of our measurement model. As shown in Appendix E, the square root of AVE for each construct exceeded the correlation coefficient between the construct and other constructs. Hence, the discriminant validity of the measures was established (Hair et al. 2006). We also computed the variance inflation factors (VIF) to assess multicollinearity because some correlation coefficients exceed 0.7. The VIF scores of all variables were less than 10 (highest value of 3.52), indicating that multicollinearity is not a concern (Alin 2010).

We used SmartPLS 3.0 to examine structural models for hypothesis testing to analyze multiphase models (Gefen et al. 2000). We tested our structural model by applying a bootstrapping resampling technique with 107 samples, 5,000 bootstrap samples, and no significant change option (see Figure 2).

The test results indicate that transaction efficiency of NFT (H1), disintermediation of exhibition and sales (H2), and transparency of NFT information (H3) have positively significant effects on the perceived NFT worth. By contrast, security risks of NFT (H4), and security risks of NFT (H6) have negatively significant effects on the perceived NFT worth. The hypotheses test results also indicate that perceived NFT worth (H7) have significant effects on the intention to participate NFT project. Therefore, H1, H2, H3, H4, H6 and H7 were supported. However, we did not find a significant effect of anxiety of NFT market on the perceived NFT worth (H5 was not supported). Overall, the model had an explanatory power (R^2) of 65% for the DV and 70% for perceived NFT worth.

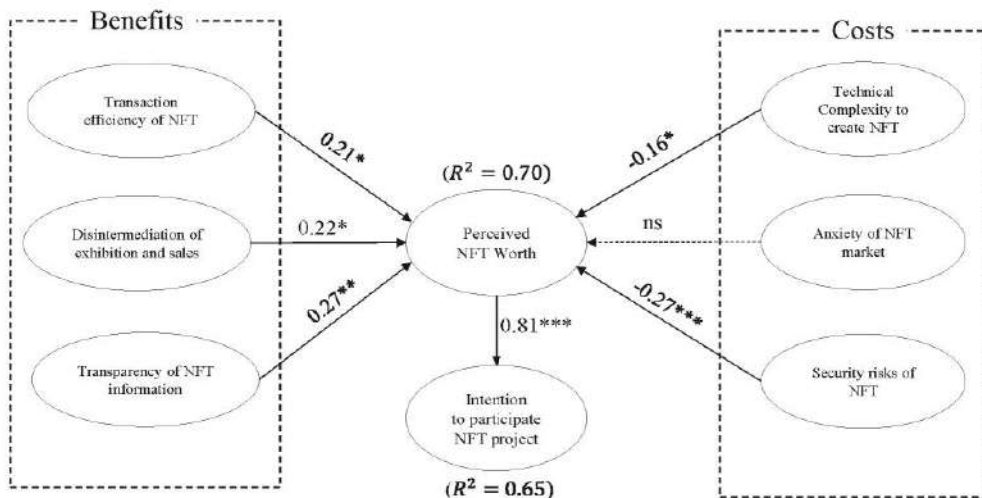


Figure 2. Hypotheses Test Results

(* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, ns = insignificant at the 0.05 level)

Stage 2: Qualitative Study

Research methods

For the second stage of this study, in-depth interviews were conducted by experts from NFT-related industries, academia, and research fields. Interviews are a reliable way to understand the essence of a phenomenon from the perspective of the interviewees (Yin 2009). In particular, in social science research, expert interviews are used in many studies as they are an effective means to obtain in-depth content in a relatively short time (Bogner et al. 2009). Experts provide practical detailed knowledge, reducing the need to interview a wider range of participants (Bogner et al. 2009). In other words, expert interviews are favorable in developing practical value as they can be executed 'quickly, easily, and safely' (Meuser and Nagel 2009). In this study, an expert in-depth interview analysis methodology was adopted to effectively derive in-depth contents in the current situation in which there is little public understanding on NFTs. And to further promote artists' participation in NFTs, methods and insights on how to increase NFT benefits and reduce costs were derived through the following research procedure.

First, a literature search was performed and reviewed. Questionnaire items suitable for the purpose of the study were constructed. To review the appropriateness of the developed questionnaire items, we sought advice from experts who are non-interviewees and incorporated their feedbacks into the questionnaire items, ensuring the validity of the contents. In addition, to derive systematic interview results, the interviewees were divided into separate groups for industry, academia, and research circles. Each of them consisted of experts who had experience in conducting NFT-related research or projects. The selected experts were contacted by phone and were asked for their intention and consent to participate. The interview schedule was thereafter negotiated. Further, to increase participants' understanding of in-depth interviewees, prior to the interview, a phone call session was held to explain the specific research purpose of the study. The questionnaire was then delivered via e-mail in advance. Prior to the in-depth interview, we first informed all participants of the background and purpose of the study, reviewed all research questions, and obtained consent to recording and recording. Subsequently, one-on-one in-depth interviews were conducted in a free environment for more than 90 minutes each to derive in-depth and specific results.

We conducted a semi-structured interview, as we needed to ensure that they were covering the same topic: 'artists' participation in NFTs and their personal interpretations or concrete insights (Boyce and Neale 2006). The interviewer tried to obtain the necessary results in depth while maintaining a systemic process by using the questionnaire prepared in advance. Additional questions were asked if more information was needed. After the in-depth interview, a separate context flow classification process was conducted, which classified only those recorded in accordance with the research topic. To secure reliability and validity while minimizing intervention of researcher bias, a cross-validation process was performed by academic experts and researchers. The research team discussed the results of the analysis for each item, drew relevant strategies and insights, and underwent a final agreement and review process. Finally, the study results were summarized by interpreting and integrating the interview results. Based on the results, an in-depth interview result report was prepared.

Results

The insights derived from expert interviews are as follows. First, since it is not a difficult process for artists to NFT their work through the NFT platform, it is necessary to change the perception of NFTs by providing artists with ample opportunities to experiment with NFTs. In fact, many artists are unable to try NFTs due to psychological barriers. Yet, in actuality, it is not a difficult process for artists to

upload their work through the NFT platform. Therefore, for many artists, providing guidance on how to use NFTs and reassurance that they are user-friendly is crucial. It will also be important to highlight the fact that the upload process is also easy and can be an effective means of growing the market. Second, it is necessary to develop an effective means of exposing and connecting the artist's NFT works to various collectors. It is easy for an artist to upload their work to the NFT platform, but it is relatively difficult for an artist to connect with collectors or buyers who may be interested in their work. Therefore, NFT artists who succeeded in the early stage actively utilized social network services or online communities to promote their works and discover collectors themselves. It will be important to develop a means to promote collector-artist matching, such as applying an official customized curation system or introducing works by category in detail on the platform.

Third, artists need to focus on developing new values using NFT properties rather than uploading existing works to the NFT platform. Early NFT works mainly consisted of works with low meaning in terms of NFT, simply by digitally scanning real physical works and uploading them to NFT through block chain technology. Moreover, many projects are the same today. However, NFT art needs to develop around works that utilize the properties of NFT. This is because NFTs can create an artistic title that can replace the traditional art market and suggest a new direction for digital art in the long run. Fourth, the NFT industry is still in its introductory stage and is expected rise amid trials and errors. The NFT industry would be equipped with a self-cleaning ability and by repeating these industrial problems and solutions, the industrial maturity can be increased. Indeed, the current NFT technology is still incomplete, rife with unreasonable transactions, and unstable due to speculative forces. However, as the Internet revolution occurred after the collapse of the dot-com bubble, there is much room for development into a stable market as it continues to mature and build trust through trial and error.

Lastly, it is necessary to promote the influx of various non-mainstream artists by informing them that the NFT art market offers new opportunities for artistic activities, given there are individualized collectors with various tastes. For artists, the NFT art market has a structure that allows artists to showcase their work and sell it through individual appreciation and evaluation without an intermediary evaluation. Accordingly, it is imperative to promote a win-win market structure by marketing these attributes, revitalizing the influx of artists from various levels, and giving the value of artistic diversity to the NFT art market.

Conclusion

The purpose of this study was to identify various factors that incentivize or encourage artists to participate in NFTs. Based on the study's findings, we aimed to suggest strategies for increasing artists' participation in NFTs. To this end, we first derived benefits and costs factors when artists participate in NFT through the Social Exchange Theory and previous studies. We then conducted a survey on artists. Our results demonstrated that Transaction Efficiency of NFT, Disintermediation of Exhibition, and Transparency of NFT Information affect the Perceived NFT Worth in a positive (+) direction, and Technical Complexity to create NFT and Security Risks of NFT in a negative (-) direction. On the other hand, we did not find a significant effect of Anxiety of NFT Market on the Perceived NFT Worth. Additionally, we conducted expert interviews based on these factors to derive strategies that can promote artists' participation in NFTs.

The academic implications of this study are as follows. First, NFT-related research is in its infancy, and previous NFT-related studies are limited to quantitative research examining the potential of NFTs from an investment perspective, or exploratory research examining the concept or properties of NFT. On the other hand, this study aimed to analyze quantitative data by conducting a survey on artists who are likely to participate in the actual NFT, while examining development strategies and insights through in-depth interviews with industry, academia, and research experts. Considering the rapid growth of the recent NFT art market, research on the NFT market is expected to grow in the future. Major factors presented in this study will likely contribute to future research. In terms of methodology, most previous studies conducted only quantitative research or independently conducted qualitative research methodologies. However, in this study, a mixed-methods approach was applied. We performed

quantitative analysis on artists, who can be called research subjects, and applied a methodology of mixing qualitative analysis through expert interviews (Duan et al. 2021). This approach is significant in that it not only overcomes the limitations of a single research method, but also comprehensively analyzes and collects opinions (O'Halloran et al. 2018). Further, it can be argued that the mixed methodology is highly relevant, as it requires an approach from various perspectives when the technology is in the early stages of introduction, such as the NFT dealt in this study.

This study suggests a strategy that can increase the participation of artists, who are part of the supplier side, in NFTs. This area of research has gained increasing attention over the years. It is true that NFT lacked study for practical activation compared to the development of the industry. Given the lack of practical solutions to revitalize the influx of artists through the provision of practical value to artists, this study aimed to suggest practical strategies for the NFT market, such as expanding educational opportunities and developing a system that connects artists to collectors.

Nevertheless, this study has several limitations as follows. First, it is necessary to research more diverse artists. We surveyed 107 artists, including painters, musicians, videographers, photographers, and cartoonists. However, for a more sophisticated and systematic investigation, it is necessary to expand the investigation to more diverse subjects. Further, the survey was conducted only with Korean artists. Future studies should expand the target participants to various nationalities as the NFT market involves various countries and engages people all over the world.

Reference and Appendix

https://docs.google.com/document/d/1_qx6CL0ldiNKUROxCCXZ_tmUgb0hZnhQ-Sg2kKlTC3A/edit?usp=sharing

A3.3 Who Clicks on the Advertisement of Metaverse Platform Service?

Kim, Han-Min^a, Ko, Suyoung^b, and Lee, Soonam^c

^a Institute of Management Research, Sungkyunkwan University

E-mail: hanmin8809@gmail.com

^b PLIKA, Inc

E-mail: suyoung.karas@gmail.com

^c PLIKA, Inc

E-mail: soonamlee85@gmail.com

Abstract

September of 2021 was a time when the term 'Metaverse' was frequently introduced in media as the next thing on the internet, and it became popular enough to turn some of the Metaverse-related books as bestsellers in bookstores. In addition, the outbreak of COVID-19 inevitably limited the hosting of offline events in multi-purpose facilities. The attention to Metaverse is continuously increasing as an information technology that can replace the offline space. Many companies that want to service the Metaverse platform are constantly increasing, and they are promoting their own Metaverse platform. However, there are a few empirical research on Metaverse platform. This study conducted an advertisement exposure experiment that reflected cost, function, and content aspects through three studies. As a result of Study 1, men were more interested in Metaverse advertisements that emphasized cost than women. In the advertisement that emphasized the function of Study 2, the ad click rate of men and women was the same. On the other hand, in the advertisement that emphasized content of Study3, it was found that women clicked more Metaverse platform advertisement than men. In addition, we found that people in their 30s and 40s were more interested in Metaverse advertisements than those in their teens and 20s.

Keywords: Metaverse, Advertisement Click, Cost, Functions, Contents

A3.4 Effects of Popularity Cues on Impulse Purchase in Live Streaming Commerce

Lou, L.^a and Koh, J.^{b*}

^a College of Economics and Management, Ningbo University of Technology
E-mail: alexlou87@hotmail.com

^b Department of Business Administration, Chonnam National University
E-mail: kjoon@chonnam.ac.kr

* Corresponding author

Abstract

In the context of live streaming commerce, popularity cues including streamer popularity and product popularity are tactically created and utilized to improve product sales. However, research on live streaming commerce that investigates the effects of popularity cues on purchase is scarce. This study aims to reveal the role of popularity cues in promoting consumers' impulse purchase. Based on a stimulus–organism–response framework, this study tends to survey more than 500 customers and empirically demonstrate that streamer popularity and product popularity can trigger consumers' impulse purchase by not only simultaneously decreasing perceived consumption risk but also enhancing perceived streamer reputation and perceived competition, respectively. This study contributes to a better understanding of the working mechanism of popularity cues and offers practical insights into utilizing atmospheric cues to increase product sales.

Keywords: Live streaming commerce, popularity cues, internal states, impulse purchase

Introduction

The emergence of live streaming technology as a novel marketing tool is increasingly used to facilitate streamers (broadcasters) to fully display and introduce products to persuade consumers (Lu and Chen, 2021; Park and Lin, 2020). Compared with traditional e-commerce, live streaming commerce has two unique characteristics: (1) streamers could better interact with consumers (viewers) by showing different characteristics of products, answering customer questions in real time, and organizing live activities that entertain and encourage customers to buy on the spot (Sun et al., 2019; Wongkitrungrueng and Assarut, 2020); (2) consumers can better interact with streamers through a public scrolling text screen, by asking questions, liking, commenting, and rewarding the streamer with virtual gifts (Li, Li, and Cai, 2021; Li et al., 2021). These significant advantages have made live streaming commerce a mainstream online shopping channel. According to eMarketer (2021), China has 824.5 million online shopping consumers, of which more than 320 million make at least one purchase from a live streaming commerce platform in 2021.

Notwithstanding, the growing research on live streaming commerce (e.g., Kang et al., 2021; Lu and Chen, 2021; Park and Lin, 2020; Sun et al., 2019; Wongkitrungrueng and Assarut, 2020; Zhang et al., 2022), studies on its working mechanism have been insufficient thus far because live streaming commerce is a complex system. For example, one of the most visible phenomena in live streaming commerce is that managers present the real time numbers of viewers, viewers' engagement behaviors (i.e., liking, commenting, sharing, subscribing, and rewarding), and product sales information in the public scrolling text screen (Fei et al., 2021). Why do they perform these activities? What are the effects of these activities? Previous research has neither focused on this phenomenon nor systematically answered these questions. To overcome this research gap, this study proposes that marketers attempt to

send marketing signals related to the streamer and product to consumers to stimulate their internal and behavioral reactions. Based on He and Oppewal (2018), Jin and Phua (2014), and Kao, Hill, and Troshani (2021), these signals can be further identified with the popularity concept and divided into streamer popularity and product popularity.

Meanwhile, according to Chan, Cheung, and Lee (2017) and Liu, Li, and Hu (2013), approximately 40% of all online consumer expenditure is attributed to online impulse purchase, which suggests that online impulse purchase has become an epidemic. Because impulse purchase significantly contributes to increasing product sales (Jeffrey and Hodge, 2007), this study examines whether popularity cues can trigger consumers' impulse purchase to reveal the significance of creating and utilizing popularity cues. Prior research on impulse purchase has widely adopted the stimulus–organism–response (S-O-R) framework to justify how situational stimuli affect impulse purchase by introducing several organism-related factors (Chan, Cheung, and Lee, 2017). Following the S-O-R framework, this study deems streamer popularity and product popularity as situational stimuli associated with live streaming commerce. Regarding the organism-related factors, this study suggests that consumer's perceived consumption risk, perceived streamer reputation, and perceived competition could duly represent consumers' internal states while encountering streamer popularity and product popularity cues, respectively. Summarily, this empirical study contributes to the live streaming commerce literature specifically focusing on the impacts of popularity cues. The insights gained from this study can guide firms and streamers on how to effectively utilize the live streaming commerce to increase sales.

Literature Review

Live Streaming Commerce

The live streaming commerce research reflects interdisciplinary characteristics. The development of technology is a prerequisite of live streaming commerce. Some prior studies have focused on the technical perspectives to reveal the working mechanism of live streaming commerce. For example, Sun et al. (2019) adopt the information technology (IT) affordance theory to demonstrate the effects of technical characteristics on consumers' purchase intention. Kang et al. (2021) focus on the technology-enabled interactivity characteristics of live streaming and confirm its effects on customer engagement behavior, based on the S-O-R framework. Li, Li, and Cai (2021) and Zhang et al. (2022) further adopt the socio-technical perspective to investigate the impacts of social and technical characteristics on consumers' stickiness and continuance intention.

To optimize the marketing strategies of live streaming commerce, some prior studies have concentrated on the impacts of marketing stimuli on consumers' internal and behavioral reactions. For instance, Wongkitrungrueng and Assarut (2020) integrate the value and trust theories to examine the effects of customer value on customer trust and customer engagement. Park and Lin (2020) use the fit theory to investigate the effects of keeping fit on consumers' internal evaluation and intention to buy. Gao et al. (2021) apply the elaboration likelihood model (ELM) to explain the central and peripheral factors that influence consumer perceived persuasiveness and behavioral response. Further, Lu and Chen (2021) and Guo, Zhang, and Wang (2022) reveal the impacts of streamers' characteristics on consumers' psychological and behavioral responses from the uncertainty reduction perspective and source characteristic perspective, respectively.

Summarily, previous research reveals that technology- and marketing-related characteristics can lead live streaming commerce to become a mainstream online shopping channel. Given the importance of live streaming in promoting consumption, this study further explores the working mechanism of live streaming commerce from a new perspective, which differs from prior research in the following two aspects: (1) as the live streaming commerce technology is especially adept at creating and sending popularity signals to facilitate streamers to introduce products, this study focuses on streamer popularity and product popularity as marketing stimuli and aims to explore their effectiveness; (2) considering that prior studies have not yet explored the impulse purchase issue in the context of live streaming commerce, this study attempts to link the relationships between popularity cues and consumers' impulse purchase.

Popularity Cues

Creating and utilizing popularity cues is a popular approach for marketers because of their significant influence on consumers' evaluation and behavior (Dean, 1999; Kim, 2018). In the social media marketing field, an increasing number of research has addressed the role of popularity cues, wherein popularity cues are divided into three components, namely, product popularity, celebrity (streamer) popularity, and post (content) popularity. With respect to product popularity, it plays an increasingly important role in consumers' purchase decisions because most consumers are affected by how other consumers think and feel about a product in the online shopping context (Ahn, 2007). Luo et al. (2014) define deal popularity as "the visually displayed information of the cumulative number of deals sold to other consumers" (p. 20), and further propose that deal popularity could influence purchase through signaling the deal worth. Mou and Shin (2018) confirm that product popularity could enhance consumer trust, perceived product quality, and perceived value. In addition, Kao, Hill, and Troshani (2021) find interesting results that while high online deal popularity could increase individualistic (Australian) consumers' psychology risk, it could decrease collectivistic (Taiwan) consumers' risk perception, which then influences their purchase intention.

Celebrity popularity refers to the number of followers a celebrity has, and this has the potential to improve marketing performance, including source credibility and buying intention (Jin and Phua, 2014). Ladhari, Massa, and Skandrani (2020) demonstrate that vlogger popularity can lead to viewers' positive behavioral intentions. With regard to post popularity, the number of likes and comments could be indicators of post popularity (Swani and Milne, 2017). Chang, Yu, and Lu (2015) confirm that post popularity could lead to users' usefulness perception of and preference for posts, which then enhances users' contribution behaviors. Similarly, Yang, Kim, and Tanoff (2020) demonstrate that post popularity could enhance consumer trust, which in turn promotes consumers' purchase intention.

Notwithstanding the important role of popularity cues, they have not been given much attention in live streaming commerce research. Given that streamer popularity and product popularity cues are the most visible stimuli in the live streaming commerce (Fei et al., 2021), they are worth investigating to achieve a better understanding of the occurrence of impulse purchase.

Impulse Purchase

Impulse purchase refers to consumers' unplanned, compelling, and hedonically complex product buying behavior, whereby consumers fail to carefully consider all the relevant information and quickly make purchase decisions (Stern, 1962). Impulse purchase was first studied in the brick-and-mortar store consumption context. Based on a concept of atmospherics (Kotler, 1973), psychology and consumer behavior researchers have arrived at a consensus on impulse purchase via suggesting that in-store stimuli could generate consumers' impulse purchase via affecting internal reactions (Spangenberg, Crowley, and Henderson, 1996).

With the tremendous growth of e-commerce, it is quite common for consumers to perform online impulse purchase because shopping online frees consumers from the constraints that they might experience in physical stores (Chan, Cheung, and Lee, 2017; Liu, Li, and Hu, 2013). On the one hand, technology-related website cues are important antecedents of impulse purchase. For example, website characteristics, including task- and mood-relevant cues could stimulate consumers' internal reactions and impulse purchase (Parboteeah, Valacich, and Wells, 2009). Similarly, Liu, Li, and Hu (2013) adopt the S-O-R framework to examine the effects of website attributes (i.e., product availability, visual appeal, and website ease of use) on consumers' internal evaluations and impulse purchase. On the other hand, marketing-related cues could also lead to impulse purchase. For instance, the information quality of advertisement and the number of "Like" in Chen, Su, and Widjaja (2016); recommender- and product-related signals in Chen et al. (2019); and limited-quantity and limited-time scarcity in Wu et al. (2021) have been confirmed to have effects on online impulse purchase.

Factors related to e-commerce's technology and marketing cues are confirmed to elicit impulse purchase in abovementioned previous research. As a new online shopping mode, live streaming commerce is evidently believed to be conducive to impulse purchase. As little live streaming commerce research has investigated impulse purchase, this study aims to reveal how consumers' impulse purchase occurs after being exposed to streamer popularity and product popularity cues.

Hypotheses Development

Activating Internal Reactions: Stimuli of Popularity Cues

Combining the definitions of popularity in prior research with live streaming commerce characteristics, this study identifies popularity cues that include streamer popularity and product popularity. Streamer popularity refers to the visually displayed information of consumers' behaviors of positively interacting with a streamer, such as viewing, liking, commenting, sharing, subscribing, rewarding, and so on. Product popularity refers to the visually displayed information of the cumulative number of products sold to consumers. Regarding internal reactions, this study establishes consumer's perceived consumption risk, perceived streamer reputation, and perceived competition as organism-related constructs. There are three reasons for these decisions: first, since consumers generally perceive more risk when shopping online compared to offline, the popularity cue could be used as a risk-reduction strategy to eliminate shopping uncertainty (Kao, Hill, and Troshani, 2021; Wu and Lee, 2016). Second, the streamer in live streaming commerce has been facing increasingly fierce competition because of the increase in streamer volume, such that streamer reputation could be considered as one of the most important intangible assets for a popular streamer in a competitive environment, based on Su et al. (2016). Finally, competition refers to a purchase situation where one would need to compete with other consumers to achieve the goal of buying a product (Nichols, 2012), thereby suggesting that competition is a situation-dependent transitory state that may exist in live streaming commerce owing to the popularity of the product. The relationships are inferred as below.

Perceived consumption risk is often defined as the uncertainty in product performance and/or negative anticipation in consumption consequences, which could be alleviated by product popularity cues (Kao, Hill, and Troshani, 2021; Wu and Lee, 2016). Based on the signal theory, high demand of product signals high product performance and then makes consumers perceive low level of consumption risk (Kukar-Kinney and Xia, 2017). Similarly, He and Oppewal (2018) confirm that product popularity is likely to make consumers believe it is of high quality. Such findings contribute to deducing that perceived consumption risk is negatively related to product popularity. At the same time, streamer popularity could also be deemed as an antecedent of perceived consumption risk. The reasons are twofold: first, drawn from the signal theory, streamer popularity somewhat implying a streamer is of expertise, authenticity, and homophily can enhance consumer trust in this streamer, consequently eliminating consumers' quality uncertainty perceptions of recommended products (Kim and Kim, 2021; Lu and Chen, 2021). Second, a streamer who reaches a certain level of popularity achieves a celebrity status, which suggests the trust is paramount in his/her success, consequently making consumers have confidence in his/her recommendations (Pittman and Abell, 2021). As such, this study proposes the following hypotheses:

H1: Streamer popularity has a negative effect on perceived consumption risk.

H2: Product popularity has a negative effect on perceived consumption risk.

The reputation concept has been well developed in previous research. For instance, supplier reputation refers to the extent to which a supplier is honest and concerned about its customers (Pera, Viglia, and Furlan, 2016). Brand reputation refers to the extent to which a brand has the ability to provide high quality services (Sengupta, Balaji, and Krishnan, 2015). Based on prior research, this study defines perceived streamer reputation as consumers' confidence level of a streamer who is honest and concerned about them. Reputation is a relative concept, and it depends on the comparison between different competitors and their performance (Deephouse and Carter, 2005). This statement suggests that the perceived streamer reputation could be enhanced by streamer popularity through two ways. First, following the signal theory, popularity cues could be used to signal that a product has superior quality (Dean, 1999), a deal is worthy (Luo et al., 2014), and a brand post is useful (Chang, Yu, and Lu, 2015). In the same way, streamer popularity could signal that a streamer has an ability and willingness to serve consumers well to promote their shopping performance, which is likely to enhance consumer perceived streamer reputation. Second, popularity cues could be represented by consumers widely buying a brand (Kim, 2018) and consumers positively rating a product (Ahn, 2007; Mou and Shin, 2018), suggesting that a brand or product is more superior than competitor brands or products. Similarly, a streamer with

a high level of popularity indicates he/she is more superior than other streamers, which is likely to make consumers perceive more reputation. Accordingly, this study proposes that:

H3: Streamer popularity has a positive effect on perceived streamer reputation.

Following Nichols (2012), perceived competition refers to one's belief that one would need to compete with other buyers to achieve a goal of buying products in the live streaming commerce situation. According to the signal theory (Dean, 1999), the product popularity can be a diagnostic cue that influences consumer perceived competition through indirect and direct ways. Regarding the indirect way, product popularity can signal a product with superior quality and value for consumers (Dean, 1999; Luo et al., 2014), and it has the potential to not only make consumers believe this product is worth buying but also stimulate them to infer that others would also want to buy it. Concerning the direct way, product popularity, as the term suggests, signals that a product is liked and widely bought by many consumers (Kao, Hill, and Troshani, 2021; Mou and Shin, 2018), consequently stimulating a consumer to perceive that he or she is endeavoring to gain what others are attempting to gain simultaneously. Accordingly, this study has the following hypothesis:

H4: Product popularity has a positive effect on perceived competition.

Relationships between Internal Reactions and Impulse Purchase

Chaiken (1980) proposes a heuristic versus systematic information processing model to distinguish between an individual's decision formation. In detail, systematic information processing emphasizes the role of information-based cognitions in mediating decision-making, whereas heuristic information processing deemphasizes detailed information processing and focuses on the role of simple rules in mediating persuasion (Chaiken, 1980). Based on this model, it could be implied that impulse purchase is driven by one's heuristic information processing because the impulse purchase decision process is simple and involves low cognitive effort (Stern, 1962). Chen, Su, and Widjaja (2016) and Chen et al. (2019) reveal that information quality of advertisements and interpersonal trust in social commerce could act as a heuristic cue in decreasing consumers' cognitive efforts in decision-making, thereby triggering more impulse purchase. Given that the impulse purchase process is characterized by a lack of cognitive deliberation (Chan, Cheung, and Lee, 2017; Chen et al., 2019), this study argues that how perceived consumption risk, perceived streamer popularity, and perceived competition affect impulse purchase can be better explained by heuristic versus systematic information processing.

According to Vonkeman, Verhagen, and van Dolen (2017), impulse purchase usually occurs with diminished regard for consequences, whereas perceived consumption risk potentially leads to cognitive evaluations of a shopping situation. Consequently, the increased consumption risk perception is likely to reduce the occurrence of impulse purchase. Also, Sharma, Sivakumaran, and Marshall (2014) confirms when perceived risk is lower, the likelihood of impulse buying is greater. These findings imply that perceived consumption risk makes consumers invest more cognitive effort to process information, thereby decreasing the occurrence of impulse purchase. These lead to the following hypothesis:

H5: Perceived consumption risk has a negative effect on impulse purchase.

Following Meilatinova (2021), a streamer who has high reputation is generally considered to be reliable and honest. Meanwhile, as Chaiken (1980) suggests, when people employ a heuristic information processing strategy, source characteristics might generate greater impacts on persuasion than information characteristics. Combining these logics, when consumers perceive a streamer to have good reputation, they may relinquish the thoughtful process of deliberating product-related information and instead thoughtlessly decide to buy a product by trusting the streamer. In other words, perceived streamer reputation can help consumers simplify the decision-making process, consequently facilitating the occurrence of impulse purchase. Accordingly, this study has the following hypothesis:

H6: Perceived streamer reputation has a positive effect on impulse purchase.

The presence of rivalry, scarcity, and win-lose performance anxiety are three major elements of competition (Nichols, 2012). Although little research has addressed the effects of competition on consumers' behavior, extensive research has explored the impacts of rivalry, scarcity, and performance

anxiety information on consumers' reactions. For example, scarcity information has been confirmed to raise the urgency of buying because it could lead consumers to employ a heuristic information processing rather than the systematic information processing to make a quick judgment (Aggarwal, Jun, and Hu, 2011). Furthermore, limited-quantity scarcity accompanied by perceived rivalry could make consumers feel that they are in direct competition with other consumers, thereby making an impulse purchase decision simply and immediately under pressure (Wu et al., 2021). Meanwhile, time restrictions could make consumers experience a performance anxiety about wasting opportunities, whereof a possible consequence is buying relevant products impulsively (Swain, Hanna, and Abendroth, 2006). Based on the heuristic information processing theory and relevant prior studies, this study posits the relationship between perceived competition and impulse purchase as follows:

H7: Perceived competition has a positive effect on impulse purchase.

This study seeks to reveal the working mechanism of popularity cues in a live streaming commerce context, based on the S-O-R framework. Figure 1 depicts the conceptual model for this study.

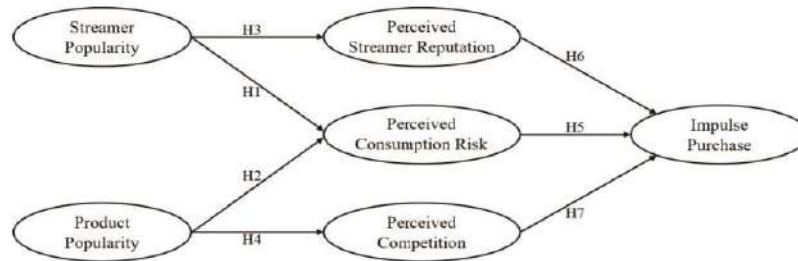


Figure 1. Research Model

Research Methodology

This study will conduct an empirical study using a survey method for data collection and hypothesis test. The unit of analysis is the individual level (i.e., consumers who view live streaming and purchase products impulsively). Survey instruments of the six research variables in Figure 1 will be drawn from prior studies and slightly modified to ensure their appropriateness for this study. All the constructs will be measured with multiple items based on a seven-point Likert scale. More than 500 samples will be collected and analyzed.

Conclusion

This study adopts the S-O-R framework as the overarching theory to validate the relationships among popularity cues, internal states, and impulse purchase. By doing so, it offers new insights into how live streaming commerce can improve product sales. The anticipated findings contribute to enriching literature via (1) extending the impulse purchase research setting to the live streaming commerce, (2) providing a richer understanding that the streamer and product popularity cues are equally important marketing atmospherics, and (3) identifying consumers' psychological processes underlying both popularity cues.

Acknowledgements

This work was supported by the Humanity and Social Science Foundation of Ministry of Education of China (Grant No. 21YJC630091).

References

Aggarwal, P., Jun, S.Y., and Hu, J.H. (2011). Scarcity messages: A consumer competition perspective. *Journal of Advertising*, 40(3), 19-30.

- Ahn, H.J. (2007). Utilizing popularity characteristics for product recommendation. *International Journal of Electronic Commerce*, 11(2), 59-80.
- Chaiken, S. (1980). Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology*, 39, 752-766.
- Chan, T.K.H., Cheung, C.M.K., and Lee, Z.W.Y. (2017). The state of online impulse-buying research: A literature analysis. *Information & Management*, 54, 204-217.
- Chang, Y.-T., Yu, H., and Lu, H.-P. (2015). Persuasive messages, popularity cohesion, and message diffusion in social media marketing. *Journal of Business Research*, 68(4), 777-782.
- Chen, J.V., Su, B.C., Widjaja, A.E. (2016). Facebook C2C social commerce: A study of online impulse buying. *Decision Support Systems*, 83(3), 57-69.
- Chen, Y., Lu, Y., Wang, B., and Pan, Z. (2019). How do product recommendations affect impulse buying? An empirical study on WeChat social commerce. *Information & Management*, 56, 236-248.
- Dean, D.H. (1999). Brand endorsement, popularity, and event sponsorship as advertising cues affecting consumer pre-purchase attitudes. *Journal of Advertising*, 28(3), 1-12.
- Deephouse, D., and Carter, S. (2005). An examination of differences between organizational legitimacy and organizational reputation. *Journal of Management Studies*, 6(March), 3-23.
- eMarketer (2021). *Over 45% of China's digital shoppers will buy via livestream in 2023*. Retrieved from <http://www.emarketer.com/content/over-45-of-china-s-digital-shoppers-will-buy-via-livestream-2023>. Accessed October 30, 2021.
- Fei, M., Tan, H., Peng, X., Wang, Q., and Wang, L. (2021). Promoting or attenuating? An eye-tracking study on the role of social cues in e-commerce livestreaming. *Decision Support Systems*, 142, 113466.
- Gao, X., Xu, X.-Y., Tayyab, S.M.U., and Li, Q. (2021). How the live streaming commerce viewers process the persuasive message: An ELM perspective and the moderating effect of mindfulness. *Electronic Commerce Research and Applications*, 49, 101087.
- Guo, Y., Zhang, K., and Wang, C. (2022). Way to success: Understanding top streamer's popularity and influence from the perspective of source characteristics. *Journal of Retailing and Consumer Services*, 64, 102786.
- He, Y., and Oppewal, H. (2018). See how much we've sold already! Effects of displaying sales and stock level information on consumers' online product choices. *Journal of Retailing*, 94(1), 45-57.
- Jeffrey, S.A., and Hodge, R. (2007). Factors influencing impulse buying during an online purchase. *Electronic Commerce Research*, 7(3), 367-379.
- Jin, S.-A.A., and Phua, J. (2014). Following celebrities' Tweets about brands: The impact of Twitter-based electronic word-of-mouth on consumers' source credibility perception, buying intention, and social identification with celebrities. *Journal of Advertising*, 43(2), 181-195.
- Kang, K., Lu, J., Guo, L., and Li, W. (2021). The dynamic effect of interactivity on customer engagement behavior through tie strength: Evidence from live streaming commerce platforms. *International Journal of Information Management*, 56, 102251.
- Kao, K.C., Hill, S.R., and Troshani, I. (2021). A cross-country comparison of online deal popularity effect. *Journal of Retailing and Consumer Services*, 60, 102402.
- Kim, J.H. (2018). Effect of brand popularity as an advertising cue on tourists' shopping behavior. *Journal of Destination Marketing & Management*, 10, 78-86.
- Kim, D. Y., and Kim, H.-Y. (2021). Trust me, trust me not: A nuanced view of influencer marketing on social media. *Journal of Business Research*, 134, 223-232.
- Kotler, P. (1973). Atmospherics as a marketing tool. *Journal of Retailing*, 49(4), 48-64.
- Kukar-Kinney, M., and Xia, L. (2017). The effectiveness of number of deals purchased in influencing consumers' response to daily deal promotions: A cue utilization approach. *Journal of Business Research*, 79, 189-197.
- Ladhari, R., Massa, E., and Skandrani, H. (2020). YouTube vloggers' popularity and influence: The roles of homophily, emotional attachment, and expertise. *Journal of Retailing and Consumer Services*, 54(May), 102027.
- Li, R., Lu, Y., Ma, J., and Wang, W. (2021). Examining gifting behavior on live streaming platforms: An identity-based motivation model. *Information & Management*, 58, 103406.

- Li, Y., Li, X., and Cai, J. (2021). How attachment affects user stickiness on live streaming platforms: A socio-technical approach perspective. *Journal of Retailing and Consumer Services*, 60, 102478.
- Liu, Y., Li, H., and Hu, F. (2013). Website attributes in urging online impulse purchase: An empirical investigation on consumer perceptions. *Decision Support Systems*, 55(3), 829-837.
- Lu, B., and Chen, Z. (2021). Live streaming commerce and consumers' purchase intention: An uncertainty reduction perspective. *Information & Management*, 58, 103509.
- Luo, X., Andrews, M., Song, Y., and Aspara, J. (2014). Group-buying deal popularity. *Journal of Marketing*, 78(March), 20-33.
- Meilatinova, N. (2021). Social commerce: Factors affecting customer repurchase and word-of-mouth intentions. *International Journal of Information Management*, 57, 102300.
- Mou, J., and Shin, D. (2018). Effects of social popularity and time scarcity on online consumer behaviour regarding smart healthcare products: An eye-tracking approach. *Computers in Human Behavior*, 78, 74-89.
- Nichols, B.S. (2012). The development, validation, and implications of a measure of consumer competitive arousal (CCAr). *Journal of Economic Psychology*, 33, 192-205.
- Parboteeah, D.V., Valacich, J.S., and Wells, J.D. (2009). The influence of website characteristics on a consumer's urge to buy impulsively. *Information Systems Research*, 20(1), 60-78.
- Park, H.J., and Lin, L.M. (2020). The effects of match-ups on the consumer attitudes toward internet celebrities and their live streaming contents in the context of product endorsement. *Journal of Retailing and Consumer Services*, 52, 101934.
- Pera, R., Viglia, G., and Furlan, R. (2016). Who am I? How compelling self-storytelling builds digital personal reputation. *Journal of Interactive Marketing*, 35, 44-55.
- Pittman, M., and Abell, A. (2021). More trust in fewer followers: Diverging effects of popularity metrics and green orientation social media influencers. *Journal of Interactive Marketing*, 56, 70-82.
- Sengupta, A.S., Balaji, M.S., and Krishnan, B.C. (2015). How customers cope with service failure? A study of brand reputation and customer satisfaction. *Journal of Business Research*, 68, 665-674.
- Spangenberg, E.R., Crowley, A.E., and Henderson, P.W. (1996). Improving the store environment: Do olfactory cues affect evaluations and behaviors? *Journal of Marketing*, 60(4), 67-80.
- Stern, H. (1962). The significance of impulse buying today. *Journal of Marketing*, 26(2), 59-62.
- Su, L., Swanson, S. R., Chinchanchokchai, S., Hsu, M. K., and Chen, X. (2016). Reputation and intentions: The role of satisfaction, identification, and commitment. *Journal of Business Research*, 69, 3261-3269.
- Sun, Y., Shao, X., Li, X., Guo, Y., and Nie, K. (2019). How live streaming influences purchase intentions in social commerce: An IT affordance perspective. *Electronic Commerce Research and Application*, 37, 100886.
- Swain, S.D., Hanna, R., and Abendroth, L.J. (2006). How time restrictions work: The roles of urgency, anticipated regret, and deal evaluations. *Advances in Consumer Research*, 33(1), 523-525.
- Swani, K., and Milne, G.R. (2017). Evaluating Facebook brand content popularity for service versus goods offerings. *Journal of Business Research*, 79, 123-133.
- Sharma, P., Sivakumaran, B., and Marshall, R. (2014). Exploring impulse buying in services: Toward an integrative framework. *Journal of the Academy of Marketing Science* 42, 154-170.
- Vonkeman, C., Verhagen, T., and van Dolen, W. (2017). Role of local presence in online impulse buying. *Information & Management*, 54(8), 1038-1048.
- Wongkitrungrueng, A., and Assarut, N. (2020). The role of live streaming in building consumer trust and engagement with social commerce sellers. *Journal of Business Research*, 117, 543-556.
- Wu, L., and Lee, C. (2016). Limited edition for me and best seller for you: The impact of scarcity versus popularity cues on self versus other-purchase behavior. *Journal of Retailing*, 92, 486-499.
- Wu, Y., Xin, L., Li, D., Yu, J., and Guo, J. (2021). How does scarcity promotion lead to impulse purchase in the online market? A field experiment. *Information & Management*, 58, 103283.
- Yang, K., Kim, H. M., and Tanoff, L. (2020). Signaling trust: Cues from Instagram posts. *Electronic Commerce Research and Applications*, 43, 100998.
- Zhang, M., Liu, Y., Wang, Y., and Zhao, L. (2022). How to retain customers: Understanding the role of trust in live streaming commerce with a socio-technical perspective. *Computers in Human Behavior*, 127, 107052.

A3.5 Establish a Model for Detecting Fake News Using Machine Learning; Focusing on User Behaviors and Social Networks

Minjung Park.^a and Sangmi Chai.^b

^a Department of Business Administration, Ewha Womans University
E-mail: mjpark6767@ewha.ac.kr

^b Department of Business Administration, Ewha Womans University
E-mail: smchai@ewha.ac.kr

Abstract

The acceptance and spread of fake news continue to increase due to the recent social media algorithms. It continuously recommends fake news to the users once they read it, regardless of their intentions. Accordingly, fake news in social media has become a serious social problem, and various studies related to it are being conducted these days actively. Most previous studies have established a model for detecting fake news by only focusing on the linguistic or text characteristics of the news (e.g., source or author indication, full-length of a message). However, this approach has limitations in that it is hard to reflect the characteristics of users who accept fake news and networks where fake news spreads in real-time. Moreover, AI Chatbots, automatically generate fake news, that can look like as same as actual news, so the accuracy of its detection model only focusing on the composition or text of fake news is bound to decrease. Therefore, we aim to improve the detection performance rate by proposing a user-centered fake news classification prediction model that reflects user behaviors and the features of social networks. We present a final prediction model with the highest performance rate using five machine learning classification algorithms (Logistic Regression (LR), Neural Network (NNET), Random Forest (RF), Support Vector Machine (SVM), Classification and Regression Trees (CART)) to detect fake news.

Keywords: Classification algorithms, Fake news, Fake news detection, Prediction algorithms, Predictive models, Social Media Algorithms, Social Networks

[DAY2]

B3 [Special Session] Virtual Humans

B3.1 GAN생성 경영교육 콘텐츠의 학습효과에 대한 연구

동혁희
경희대학교 경영학과
dyxdh712@khu.ac.kr

동혁희
경희대학교 경영학과
dyxdh712@khu.ac.kr

권오병
경희대학교 경영대학
obkwon@khu.ac.kr

Abstract - 최근 GAN과 같은 생성형 AI는 동영상의 제작의 효과성을 높일 수 있는 좋은 방법으로 인식되고 있다. 더욱이 AI의 클라우드화 또는 웹 프로그램화는 누구든지 쉽게 AI에 접근하여 동영상 콘텐츠 제작을 할 수 있게 하고 있다. 그런데 아직도 AI 창작 능력의 수준에 대한 의심이나 AI에 의하여 창작된 콘텐츠에 대한 부정적인 태도 등 AI 생성 콘텐츠에 대한 평가와 수용성에 대한 논의가 있기 때문에 이에 대한 검증이 필요하나 아직 많이 수행되지 못했다. 본 연구의 목적은 경영 교육을 위해 생성형 인공지능 기술을 응용하는 것이 가치가 있는지를 검토하는 것이다. 특히 AI생성 강의 동영상에 일반 강의 동영상에 비해 미치는 교육 효과의 차이가 있는지 검토한다. 이를 위해 설문 조사를 실시하였다. 본 연구의 실험은 2 (콘텐츠 생성기: 사람 vs 인공지능) x 3(정보 전달 방식: 테스트 vs 오디오 vs 비디오) x 3(콘텐츠 주제: 지식적 vs 감성적 vs 의지적)의 혼합 주제 설계이다. 실험 결과를 보면, 콘텐츠 생성기와 정보 전달 방식은 학습자 태도 변화에 영향을 미치는 것을 알 수 있다.

Key Terms - AI 생성 콘텐츠, 학습자 만족도, 학습자 태도 변화

이 논문 또는 저서는 2020년 대한민국 교육부와 한국연구재단의 지원을 받아 수행된 연구임 (NRF-2020S1A3A2A02093277)

I. 서론

최근 GAN과 같은 생성형 AI기술이 발달되면서 인간의 모습을 매우 닮은 현실감이 높은 가상 휴먼 제작이 상용화의 단계까지 진전하였다. 특히 AI의 클라우드화 또는 웹 프로그램화는 누구든지 쉽게 AI에 접근하여 동영상 콘텐츠 제작을 할 수 있게 하고 있다. 가상휴먼 모델로 광고나 간단한 드라마를 촬영하고, 기업 소개를 하며 SNS에서 인플루언서의 역할을 수행하기도 한다. 아울러 최근에는 교육훈련을 위한 강사나 조교의 형태가 등장하기도 했다 (Wang, 2021). 오늘날의 가상휴먼 기술은 AI기술의 도움으로 인간과 흡사한 감정을 표현하는 등 발전을 거듭하고 있다(Treal et al.,

2021). 그러므로 가상휴먼에 의하여 교육훈련용 강의 동영상을 구현하는 것은 어려운 일이 아닐 뿐더러, 비용면에서 우수하고 학습자가 강사의 특성을 선택할 수 있는 장점도 있을 것이다. 다만, AI에 의하여 생성된 가상휴먼에 의한 강의에 대한 교육 효과는 아직 검증된 적이 없다. 더구나 AI 창작 능력의 수준에 대한 의심이나 AI에 의하여 창작된 콘텐츠에 대한 부정적인 태도 등 AI 생성 콘텐츠에 대한 평가와 수용성에 대한 논의가 있기 때문에 이러한 검증은 본격적인 가상휴먼의 강의 채택 이전에 필요한 것이다.

따라서 본 연구의 목적은 AI 가상휴먼에 의하여 제작된 강의 콘텐츠의 효과를 실험을 통해 실증하는 것이다. 본 연구의 실험은 2 (콘텐츠 생성기: 인간 vs 가상휴먼) x 2(정보 전달 방식: 오디오 vs 비디오) x 3(콘텐츠 주제: 지식적 vs 감성적 vs 의지적)의 혼합 주제 설계이다. 구체적으로 교육 효과를 강의 내용에 대한 태도의 변화 및 지식의 변화의 두 가지로 보고, 먼저 AI 가상휴먼에 의한 강의와 실제 인간 강사에 의한 강의의 차이가 있는지, 강의 토픽(WHAT: 개념, 실천 호소:WHY, 추진 노하우: HOW)별로 차이가 있는지, 그리고 전달방식(동영상, 음성)별로 차이가 있는지를 실증한다.

II. 방법

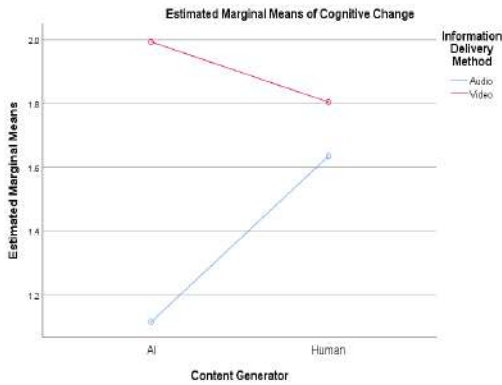
실험에서 피험자에게 전달한 강의콘텐츠는 주제에 의해 3가지로 나누었다. 첫 번째는 설명적 주제인 콘텐츠이며, 두 번째는 감성적 주제인 내용이고, 세 번째는 의지적 주제인 내용이다.

본 실험은 중국의 설문조사 전문 기관 (<https://wj.qq.com/>)의 패널들에게 온라인으로 배포하고, 2 (human vs. AI) * 2 (audio vs. video) * 3 (Explanatory vs. Sensitive vs. volitional) 그룹으로 랜덤하게 나누었다. 각 주제에 대한 내용은 오디오나 비디오 방식으로 전달되었다. 각 참가자는 PC나 핸드폰을 통해서 오디오나 동영상을 시청하게 하고 설문에 답하게 했다. 설문을 했을 때, AI 생성 콘텐츠를 제공한 경우, 해당 콘텐츠가 AI가 생성한 콘텐츠임을 밝혔다. 본 연구는 실험대상을 모집하기 위해 중국의 직장인 859명에게 설문을 실시하였다. 응답자의

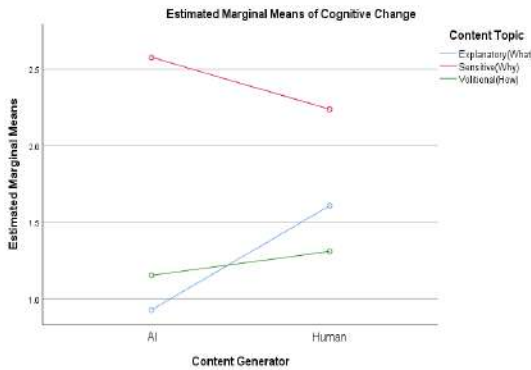
연령대에 대한 빈도분석 결과를 보면, 50대 이상은 28.2%로 1위를 차지하였고, 40대는 26.2%로 그 뒤에 있었고, 30대와 20대는 각각 24.4%와 21.2%로 3위와 4위를 차지하였다. 응답자 성별의 비율을 보면, 남성은 51.5%이고, 여성은 48.5%이다.

III. 결과

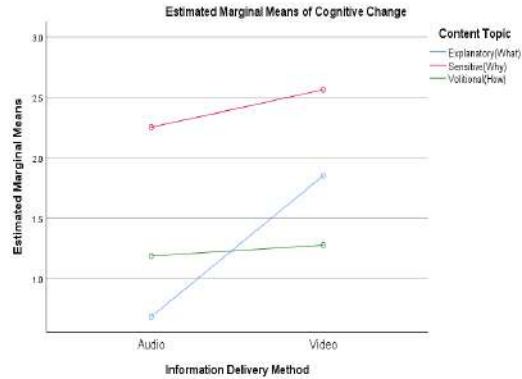
실험 결과 콘텐츠 생성기와 정보 전달 방식, 콘텐츠 생성기와 콘텐츠 주제, 정보 전달 방식과 콘텐츠 주제 사이에 상호작용이 존재하는 것을 알 수 있다.



<그림 1> 콘텐츠 생성기 * 정보 전달 방식



<그림 2> 콘텐츠 생성기 * 콘텐츠 주제



<그림 3> 정보 전달 방식 * 콘텐츠 주제

IV. 결론

실험 결과, AI콘텐츠 생성기에 의해 제작된 가상 휴먼의 경우 정보전달방식은 오디오이든 비디오이든 상관없이 각 주제(설명적, 감성적, 의지적)가 지식변화에 미치는 영향이 차이가 있는 것을 보여주었다. 따라서 앞으로의 연구에서 AI 생성 학습 콘텐츠가 주제에 따라 학습효과에 미치는 영향이 어떤 차이가 있는지를 파악할 수 있고 더 나아가 어떤 내용으로 AI 생성 학습 콘텐츠를 만든다면 학습자의 학습효과를 높일 수 있는지도 파악할 수 있다면 다양한 AI기술 기반의 학습 플랫폼의 진보를 추진할 수 있다.

V. 참고문헌

Treal, T., P. L., Jackson, J., Jevrey, N., Vignais, and A. Meugnot, "Natural Human Postural Oscillations Enhance the Empathic Response to a Facial Pain Expression in a Virtual Character," Scientific Reports, (2021). 11(1), 1~10.

Wang, K., C., Gou, Y., Duan, Y., Lin, X., Zheng, and F. Y. Wang, "Generative Adversarial Networks: Introduction and Outlook," IEEE/CAA Journal of Automatica Sinica, (2017), 4(4), 588~598.

B3.2 가상 인간 콘텐츠의 매체풍부성과 진정성이 만족감에 미치는 영향 연구

공 리
경희대학교 경영학과
gongli01@khu.ac.kr

배수진
경희대학교 경영대학
luvkybsj@khu.ac.kr

권오병
경희대학교 경영대학
obkwon@khu.ac.kr

Abstract - 인공지능 기술(AI)로 동영상 생성하는 방식으로 교육 방식과 온라인 교육 체험을 개선하는 사람들이 늘고 있다. 지금까지 이전 연구의 대부분은 인공지능 기술(AI) 생성 동영상의 화질과 자연스러움 등을 탐구하는 것이었다. 하지만 교육 분야에서 인공지능 기술(AI)을 활용해 생성 학습 동영상에 대해 진정성을 지각하는 것이 학습자 체험 및 만족도와 깊은 관련이 있는지 여부의 연구는 여전히 소수였다. 따라서 본 연구의 목적은 학습자가 인간과 인공지능 기술(AI)로 만든 교육 비디오와 교육 동영상에 대한 진정성(authenticity) 지각이 학습자의 체험과 교육 만족도에 미치는 영향을 실증하는 것이다.

Key Terms - 만족도; 가상인간; 진정성; 체험경제 이론

이 논문 또는 저서는 2020년 대한민국 교육부와 한국연구재단의 지원을 받아 수행된 연구임 (NRF-2020S1A3A2A02093277)

I. 서론

인공지능 기술(AI)의 급속한 발전에 따라 딥러닝 기술로 텍스트를 토대로 동영상을 생성하는 방식은 각 분야에서 널리 응용되고 있다. 특히 COVID-19 대유행이 시작한 후에 가상 학습과 온라인 교육에 대해 수요가 증가하고 있다. 이에 따라 인공지능 기술(AI)로 동영상 생성하는 방식으로 교육 방식과 온라인 교육 체험을 개선하는 사람들이 늘고 있다. 지금까지의 연구들은 인공지능이 생성하는 동영상의 화질과 자연스러움 등을 탐구하는 위주였다. 하지만 서비스에 사용되는 가상 인간의 경우 화질과 자연스러움 외에도 가상 인간 체험의 질과 그 체험이 서비스 만족도 등 성과로도 연결되어야 한다. 특히 강사나 인플루언서 등 영향력 있는 신분으로 가상 인간이 등장하려면 외모나 음성, 동작 등에서 진정성(authority)이 발현되어야 그 효과가 더할 것이다. 그러나 아직 교육 분야에서 인공지능형 가상 인간을 활용해 생성 학습 동영상에 대해 진정성을 지각하는 것이 학습자 체험 및 만족도와 깊은 관련이 있는지 여부의 연구는 거의 없는 실정이다.

따라서 본 연구의 목적은 학습자가 인간과 인공지능 기술(AI)로 만든 교육 비디오와 교육 동영상에 대한 진정성(authenticity) 지각이 학습자의 체험과 교육 만족도에 미치는 영향을 실증하는 것이다. 이를 위해 매체풍부성 이론과 진정성 이론을 근간으로 하여 연구모형 및 가설을 수립하였다.

II. 진정성

진정성이란 어떤 대상이 진짜(real) 또는 참(true, original)이라고 보는 생각이다(Chalmers, 2007). 진정성은 구체적인 실체를 증명하기는 어려우나 일관되게 인지되어지는 서비스 마케팅에서 중요한 개념이다. 그러나 최근까지도 마케팅 분야에서의 진정성은 하나의 개념으로 이해되고 있다.

하지만 심리학에서 진정성은 여러 차원으로 소개되고 있다. 진정성 구조의 객관적 진정성(objective authenticity), 구성적 진정성(constructive authenticity)과 실존적 진정성(existential authenticity) 3가지 분야를 통해 학습자의 생성 동영상에 대한 진정성 감각을 평가하였다. 이처럼 본 연구결과는 인공지능 기술(AI)을 활용해 생성 학습 동영상에 대해 진정성을 지각하는 것은 학습자의 체험 및 학습자 교육 만족도에 긍정적인 영향을 미치면서 학습자 체험 및 학습자 교육 만족도를 높이는 데 두드러진 역할을 발휘하는 것을 알 수 있기 때문이다.

학습자의 학습 콘텐츠에 대한 만족도는 중요한 성공 요소이자(Goh, Chin 등, 2017) 학습 성과다(Ertl and Mandl, 2008). 만족도는 AI가 생성하는 교육 콘텐츠의 효과에도 중요한 역할을 할 것이다. 만족도는 학습자가 AI가 생성하는 교육 콘텐츠를 수용하는 정도와 관련되므로, AI가 생성하는 교육 콘텐츠의 효과에 큰 영향을 미칠 것이다. 최근의 연구는 경영 교육 학습자의 만족을 형성하는데 진정성의 중요성을 확인하였다(Lu et al., 2015; Nguyen & Cheung, 2016).

진정성은 교육의 학습 성과와 만족도에 미치는 요인으로 알려져 있다(Lee et al., 2016; Nguyen & Cheung, 2016). 마찬가지로 진정성의 구체적인 세 가지 개념인 객관적, 구성적, 및 실존적 등의 개념에서도 AI 강사가 제공하는 교육의

만족감과 교육효과에 대한 자기효능감 간의 인과성이 존재할 것으로 본다.

III. 방법

본 연구는 제안된 연구 구조가 양적 연구 방법으로 실증 분석을 하고 중국의 설문조사 전문기관의 패널들에게 온라인으로 배포하고 2 (human vs. AI) × 2 (audio vs. video) 그룹으로 랜덤하게 나눴다.

본 연구는 설문지를 통해 분석을 위한 자료를 수집했고 설문지에서 리커트 7점 척도를 사용하였다. 연구모형에 등장하는 변인에 대해 관련 선행 연구로부터 획득한 설문 문항을 참고하여 본 연구 사항에 맞춰 수정해 설문 도구를 제작했다. 특히 언어적 인간 유사도는 "교육 동영상 속에서 AI가 생성한 강사가 말하는 강의 내용은 완전하다고 느꼈다" (Gorla, 2010) 등으로, 시각적 인간 유사도는 "교육 동영상에 속에서 AI가 생성한 강사가 진짜 사람처럼 느껴졌다." (Lalicic, 2017) 등의 문항이 포함되었다. 체험경제요소 관련 설문 문항은 선행 연구 결과들을 기반해(McMahan, 2012; Quadri-Felitti, 2013) 본 연구 상황에 맞춰 구성하였다. 마지막으로 학습자 만족감은 "AI가 생성한 교육 동영상을 통한 학습이 나의 발전에 도움이 될 것이라고 생각한다." 등 기존 문헌의 설문 문항 (Chen et al., 2011; Stokes, 2011)을 수정 보완해 본 연구를 위한 척도로 삼았다. 개발된 설문 문항에 대해서 척도의 신뢰성을 확보했다.

IV. 결론

본 연구의 결과로 학습자가 가상 휴먼 강사에 대해 느끼는 시각 및 언어적 차원의 인간 유사도가 인간의 체험 및 만족도에 긍정적인 영향을 미치는 것을 확인하였다. 본 연구는 학습자의 체험과 만족감을 동시에 향상시키기 위해 무엇을 중시해야 하는지에 대해 유용한 시사점을 제공했다. 체험경제 모형을 기반으로 사람들은 가상 휴먼 교육 콘텐츠에 대한 시각 및 언어 차원의 인간 유사도 지각이 사람 체험의 향상에 도움이 되고 사람들의 만족감에 대한 긍정적인 기여를 미치는 것을 알 수 있었다. 따라서 향후 가상 휴먼의 인간 유사도(시각, 언어)가 올라가면 AI가 생성하는 교육 콘텐츠와 교육 체험의 만족감에 도움이 될 것으로 기대할 수 있다.

V. 참고문헌

Gorla, N., T.M., Somers, and B. Wong, "Organizational Impact of System Quality, Information Quality, and Service Quality," The Journal of Strategic Information Systems, Vol.19, No.3, 2010, 207-228.

Lalicic, L., and C. Weismayer, "The Role of Authenticity in Airbnb Experiences," Information and Communication Technologies in Tourism 2017 (pp. 781-794). Springer, Cham, 2017.

McMahan, R. P., D. A., Bowman, D. J., Zielinski, and R.B. Brady, "Evaluating Display Fidelity and Interaction Fidelity in a Virtual Reality Game," IEEE Transactions on Visualization and Computer Graphics, Vol.18, No.4, 2012, 626-633.

Quadri-Felitti, D. L., and A. M., Fiore, "Destination Loyalty: Effects of Wine Tourists' Experiences, Memories, and Satisfaction on Intentions," Tourism and Hospitality Research, Vol.13, No.1, 2013, 47-62.

Chen, M. L., Z. Y., Su, T. Y., Wu, T. Y., Shieh, and C.H. Chiang, "Influence of Dentistry Students' Learning Satisfaction: A Questionnaire Survey," Journal of Medical Systems, Vol.35, No.6, 2011, 1595-1603.

Stokes, S. P., "Satisfaction of College Students with the Digital Learning Environment: Do Learners' Temperaments Make a Difference?," The Internet and Higher Education, Vol.4, No.1, 2001, 31-44.

Chalmers, T. D. Advertising Authenticity: Resonating Replications of Real Life. ACR European Advances, 2007.

B3.3 가상 인간에 의한 ESG교육의 효과 측정 연구

유가에
경희대학교 경영학과
liujiarui0303@khu.ac.kr

배수진
경희대학교 경영대학
luvkybsj@khu.ac.kr

권오병
경희대학교 경영대학
obkwon@khu.ac.kr

Abstract - 본 연구의 목적은 AI가 생성 기술로 제작된 학습 동영상의 ESG 교육 효과에 미치는 영향을 실증하는 것이다. 이 연구 시작하기 전에 Synthesia 서비스에서 ESG 경영 지식에 관한 텍스트를 입력해서 인공지능 기반 기술을 통해 가상 인물 강사가 ESG 경영의 개념, 필요성, 실천 방법을 소개하는 동영상 제작하였다. 또 비슷한 내용으로 실제 강사가 ESG 경영 지식을 소개하는 동영상을 녹화했다. 이를 통해 AI가 생성한 동영상이 실제 교수자가 녹화한 동영상보다 학습자의 교육효과 및 학습 만족도 더 높을 수 있는지를 검증하였다. 향후 Synthesia와 같은 서비스에서 text를 입력하면 사실적인 인물이 그것을 설명하는 인공지능 기반 시스템을 만들어 실제로 서비스하고 있고 향후에는 이러한 서비스가 이러닝 교육 분야 등에 더욱 많아질 것이다.

Key Terms - Attitudinal Change; Credibility; Satisfaction; Understandability; Video Generation

이 논문 또는 저서는 2020년 대한민국 교육부와 한국연구재단의 지원을 받아 수행된 연구임 (NRF-2020S1A3A2A02093277)

I. 서론

글로벌 경영환경 변화로 ESG경영에 대한 중요성이 상승하면서 기업체 근무자들에 대한 ESG경영 교육이 필요해지고 있다. ESG경영 교육은 기업의 ESG 경영에 대한 수용도 증대 및 성공적인 전략 수립에 유용하다. 특히 근로자들의 개인 특성별로 동일한 ESG경영 학습 콘텐츠에 대해서 다른 반응을 보일 수 있기 때문에, 바람직하기는 개인화된 학습 콘텐츠를 제공하는 것이다. 이런 관점에서 AI Video generation에 의하여 학습 동영상을 생성하게 되면 개인화된 ESG경영 학습을 제공하는 것을 비용효율적으로 수행할 수 있을 것이다.

본 연구의 목적은 AI가 생성 기술로 제작된 학습 동영상이 ESG 교육 효과에 미치는 영향을 실증하는 것이다. 이 연구 시작하기 전에 Synthesia 서비스에서 ESG경영 지식에 관한 text를 입력해서 인공지능 기반 기술을 통해 가상 인물 강사가 ESG 경영의 개념, 필요성, 실천 방법을 소개하는 동영상

제작하였다. 또 비슷한 내용으로 실제 강사가 ESG경영 지식을 소개하는 동영상을 녹화했다. 이를 통해 AI가 생성한 동영상이 실제 교수자가 녹화한 동영상보다 학습자의 교육효과 및 학습 만족도 더 높을 수 있는지를 검증하였다. 향후 Synthesia와 같은 서비스에서 text를 입력하면 사실적인 인물이 그것을 설명하는 인공지능 기반 시스템을 만들어 실제로 서비스하고 있고 향후에는 이러한 서비스가 이러닝 교육 분야 등에 더욱 많아질 것이다.

II. 동영상 생성 기술

가상 인간은 동영상 생성 기술에 의하여 제작된다. 동영상 생성(Video generation)은 머신러닝 및 컴퓨터 비전 분야에서 난이도가 높은 과제 중 하나이다. 인간은 자연어 문장을 듣거나 읽을 수 있고, 설명되는 것을 상상하거나 시각화할 수 있으므로, 자연어 문장으로부터의 동영상 생성은 인공지능 분야의 매력적인 목표이다(Mazaheri, 2021).

동영상 생성은 몇 가지 전략으로 시도되고 있다. 먼저 이미지 정보로부터의 비디오 합성(Image-to-Video Synthesis)로서, 이전 비디오 정보를 프레임 단위로 분리한 후 이를 학습하여 이후에 발생하는 장면을 예측하는 예측(video prediction)이다(Finn et al., 2016).

둘째, 텍스트 정보를 통해 동영상을 합성하는 텍스트로부터의 비디오 합성(Text-to-Video Synthesis, T2V)기술이다(Balaji et al., 2019)[14]. 예를 들어 GAN(Generative Adversarial Network)과 같은 딥러닝 알고리즘을 활용하여 텍스트(text)와 비디오(video) 사이의 관계성을 학습하여 몸짓 표정과 같은 시각적 요소(visual feature)를 추론하고 이를 기반으로 비디오를 생성하고 있다. 이를 위해 기본적인 GAN부터, DCGAN(Deep convolutional GAN), WGAN, BiGAN, SelfGAN 등 다양하게 시도되고 있다.

그러나 지금까지의 연구는 얼마나 자연스럽게 실감나게 비디오를 생성할 수 있는지에 대한 기술적 목표에 집중하고 있으며(Balaji et al., 2019), 생성된 동영상물에 대해서 사용자들이 어떻게 인지하고 수용하는지에 대한 사회과학적 논의는 아직 거의 이루어지지 않았다.

III. 방법

설문 수집을 위해서 먼저 실험 도구인 AI가 생성한 가상 휴먼 강사의 교육 동영상을 제작하기 위해 AI 가상 휴먼 제작이 가능한 Synthesia 저작 도구를 활용했으며(<https://www.synthesia.io/>), <그림 2>와 같이 제작했다. 본 저작 도구는 먼저 가상 휴먼의 특징을 선정하고, 가상 휴먼이 말할 수 있는 텍스트인 강의 내용의 텍스트를 올리면 단어의 발음과 의미에 맞게, Synthesia의 AI가 말투와 표정에 따라 동영상을 생성하게 된다.

본 연구에서는 중국의 직장인을 대상으로 기업윤리 교육을 하고자 (1) ESG의 개념 (2) ESG의 중요성 (3) 경영활동에서 ESG 원칙을 어떻게 준수하는가에 관련해 세 가지 주제의 강의 텍스트를 중국어로 제작한 후에 AI에 적용했다. AI에 의해 생성된 실험 동영상은 3가지 주제별로 각 1분 정도였고, 응답자는 이중 랜덤으로 선택된 한 가지 주제에 대해 수강을 하고 설문에 응답했다.

교육 효과는 강의 내용에 대한 이해도 변화 및 ESG경영에 대한 태도 변화를 위주로 평가했다. 이를 위해 실험 전에 ESG경영에 대한 사전 지식을 묻는 질문과 ESG경영에 대해서 가지고 있는 평소의 태도를 물었으며, 설문 후에 동일한 질문을 다시 하여 그 변화량을 교육의 효과로 보았다.

IV. 결과

주제 간 효과 검정 결과를 보면, 콘텐츠 생성기($F(1,847) = 3.237, P = 0.072 > 0.05$)에 따라 지식변화에 미치는 효과가 유의한 수준에 달하지 않는 것으로 나타났다. 이는 가상 인간에 의한 ESG교육이 인간에 의한 교육에 미흡하지 않음을 보이는 것으로서 좀 더 비용 효과적인 가상 인간 활용의 가능성을 보여주는 것이다.

그 이외의 정보전달방식($F(1,847) = 32.403, P = 0.000 < 0.05$), 콘텐츠 주제($F(2,847) = 71.636, P = 0.000 < 0.05$), 콘텐츠 생성기와 정보전달방식 간의 상호작용($F(1,847) = 14.814, P = 0.000 < 0.05$), 콘텐츠 생성기와 콘텐츠 주제 간의 상호작용($F(2,847) = 10.417, P = 0.000 < 0.05$), 정보전달방식과 콘텐츠 주제 간의 상호작용($F(2,847) = 12.661, P = 0.000 < 0.05$), 콘텐츠 생성기와 정보전달방식과 콘텐츠 주제 간의 상호작용($F(2,847) = 3.928, P = 0.02 < 0.05$)이 학습자의 지식변화에 대한 효과가 통계적으로 유의미한 것으로 나타났다.

또한 태도변화의 경우 쌍대 비교 분석과 단일 변량 분석의 결과에 의거, 정보 전달 방식이 오디오일 때 그리고 콘텐츠 주제가 설명적인 경우($F(1,847) = 5.796, P = 0.016 < 0.05$), AI 콘텐츠 생성기인지 인간 콘텐츠 생성기인지에 따른 태도변화의 차이(평균 차이(AI - Human) = $-0.370, P = 0.016 < 0.05$)가 유의한 수준인 것으로 나타났다. 그 외의 상황에서는 가상 인간과 실

제 인간의 성과 차이가 통계적으로 유의하지 않았다. 이로써 ESG경영의 개념을 설명하는 지식 전달을 오디오로 하는 경우를 제외하고는 가상 인간에 의한 ESG경영 교육의 성과가 인간에 의한 것과 결코 뒤지지 않는 것임을 알 수 있었다.

V. 결론

본 연구의 결과로 학습자가 가상 휴먼 강사에 대해 느끼는 시각 및 언어적 차원의 인간 유사도가 교육 효과 차이가 없음을 확인하였다. 도리어 가상 인간에 의한 방법은 매우 효율적인 것이어서 장차 가상 인간을 교육 동영상에 등장시키는 방안이 실용적으로도 의미 있음을 알 수 있었다.

향후 가상 휴먼의 인간 유사도(시각, 언어)가 더 개선되면 AI가 생성하는 교육 콘텐츠와 교육 체험의 만족감에 도움이 될 것으로 기대할 수 있다. 한편, 가상인간 저작 도구를 더 다양화하여 연구의 일반화를 꾀할 필요가 있다.

VI. 참고문헌

Mazaheri, A., and M. Shah, "Video Generation from Text Employing Latent Path Construction for Temporal Modeling," arXiv preprint arXiv:2107.13766, 2021.

Finn, C., Goodfellow, I., & Levine, S., "Unsupervised learning for physical interaction through video prediction," Advances in neural information processing systems, Vol.29, 2016.

Balaji, Y., Min, M. R., Bai, B., Chellappa, R., & Graf, H. P., Conditional GAN with Discriminative Filter Generation for Text-to-Video Synthesis, In

IJCAI (Vol. 1, p. 2), Aug. 2019.

B3.4 가상휴먼과 메타휴먼의 사용 만족감 차이에 영향을 미치는 요인

배수진
경희대학교 경영대학
luckybsj@khu.ac.kr

권오병
경희대학교 경영대학
obkwon@khu.ac.kr

Abstract - 가상휴먼의 등장은 기업의 광고, 마케팅, 서비스의 다변화로 그 역할이 확대되고 있다. 이러한 가상휴먼을 모델링하는 기술은 기존의 가상휴먼과 최근 인간 유사도가 높은 메타휴먼까지 빠르게 발전해 나가고 있다. 휴먼로봇과 같은 인간을 닮은 개발 연구에서는 인간 유사도와 친숙도와 관련한 언캐니밸리이론을 적용한 연구가 지속되고 있다. 이에 본 연구의 목적은 인간 유사도가 높은 메타휴먼이 기존의 가상휴먼과 언캐니밸리를 느끼는 정도의 퀄리티를 살펴보고, 사용 만족감의 차이를 실증하는 것이다.

Key Terms - 가상휴먼, 메타휴먼, 인간유사도, 친밀감, 사용 만족감

이 논문 또는 저서는 2020년 대한민국 교육부와 한국연구재단의 지원을 받아 수행된 연구임 (NRF-2020S1A3A2A02093277)

I. 서론

실감 콘텐츠의 등장으로 인해 기존의 인간-기계 상호작용을 더욱 몰입감을 주고 상호작용하며 현장감 있게 할 것으로 기대되고 있다. 실감 콘텐츠는 현재 공연, 관광, 교육, 전자상거래 등 인간-기계 상호작용이 필요한 다양한 분야에서 새로운 기술로 채택 및 확산될 것으로 기대되고 있다. 이러한 인간-기계 상호작용에 중요한 매개로 가상휴먼이 그 역할을 할 것으로 예측하고 있다. 가상휴먼은 실제 사람과 매우 흡사한 형태로 사람의 얼굴이 닮은 모습으로 사람의 언어까지 구사해서 하는 기술로 흥미롭다(Dean, 2013). 가상휴먼을 제작하기 위한 다양한 시뮬레이션 도구들이 개발되어 소개되었다(Gaisbauer et al., 2020). 이러한 가상휴먼의 적용은 위험스러운 상황에서 실제 작업자 대신 가상의 인간을 통해서 다양한 데이터를 획득하기 위한 목적도 있다(Gawand, 2020; Mohammed et al., 2020).

언캐니밸리(Uncanny valley) 이론에 의하면 인간 유사도와 친숙도 사이에는 일종의 비선형이 존재한다고 알려져 있다. 가상휴먼이 실제 인간의 모습과 유사해질수록 친숙도가 높아지다가 어느

순간에 급격히 기이하다는 느낌을 주어 친숙도가 급격히 감소하는 구간이 있다는 것이다(Mori, 1970).

IT 제품 또는 IT서비스에 대해 사용자가 느끼는 친숙도는 그 제품 또는 서비스를 사용하려고 하는 의도의 발생에 긍정적 영향을 준다. 이러한 현상은 전자결제(Pei et al., 2021), 온라인 예약 서비스(Kim et al., 2020) 등에서 일관되게 나타난다. 마찬가지로 메타휴먼에 대해 느끼는 친숙도는 실제로 그것을 사용하려는 데 의지를 가지게 할 것이다.

이러한 이유로 본 연구에서는 인간 유사도 성능의 차이를 보이는 일반적인 가상휴먼과 메타휴먼의 사용 만족감에 차이를 보이는 요인을 알아보고자 한다. 언캐니밸리이론에서 설명하는 인간 유사도와 친숙도, 그리고 사회적 실재감과 사용 만족감을 중심으로 가상휴먼과 메타휴먼의 차이를 살펴보고자 한다. 이러한 차이 요인을 통해 실감 콘텐츠 분야에서 가상휴먼을 적용할 때, 사용자의 만족감을 위해 반영해야 할 주요 요인에 대해 학술적 및 실무적 시사점을 제공하고자 한다.

II. 방법

본 연구의 설문 조사는 전문 조사 기관을 통해 2021년 5월에 조사 기관의 패널을 대상으로 온라인 설문을 수행했다. 본 연구의 진행을 위하여 일반적인 가상휴먼과 메타휴먼의 시뮬레이션 동영상 중 하나를 무작위로 먼저 시청하게 했다. 동영상 시청 이후 자신이 경험한 동영상 속 디지털 휴먼을 기억하고 설문에 응답하게 했다. 불성실 응답을 제거하고, 최종적으로는 280개 샘플을 분석 대상으로 삼았다. 응답자의 특성을 구체적으로 살펴보면, 여성 48.9%, 남성 51.1% 응답했고, 연령대는 20대 30%, 30대 30%, 40대 22.1%, 50대 이상 17.9%가 응답했다. 일반적인 가상휴먼을 시청한 응답자는 49.6%, 메타휴먼을 시청한 응답자는 50.4%로 확인했다.

<표 1> 실험 대상별 요인의 차이 분석

Variables	Type	n	M	SD	t	df	p
인간 유사도	가상휴먼	139	3.76	1.31	-10.706 ***	276.800	0.000
	메타휴먼	141	5.40	1.25			
사회 존재감	가상휴먼	139	2.96	1.26	-6.960 ***	277.813	0.000
	메타휴먼	141	4.00	1.24			
신기성	가상휴먼	139	4.25	1.39	-4.681 ***	278.000	0.000
	메타휴먼	141	4.96	1.15			
친숙도	가상휴먼	139	3.00	1.18	-4.052 ***	278.000	0.000
	메타휴먼	141	3.62	1.39			
사용 만족감	가상휴먼	139	4.01	1.30	-4.058 ***	277.889	0.000
	메타휴먼	141	4.65	1.30		277.680	0.026

Note: *p<0.05, **p<0.01, ***p<0.001

III. 결과

가상휴먼과 메타휴먼별 인간 유사도, 사회 존재감, 신기성, 친숙도, 및 사용 만족감의 차이는 독립 T 검정을 통해 <표 1>과 같이 확인했다. 결과를 확인하면, 사용 만족감(t = -4.058, p = 0.026), 인간 유사도(t = -10.706, p = 0.000), 사회 존재감(t = -6.960, p = 0.000), 신기성(t = -4.681, p = 0.000), 친숙도(t = -4.058, p = 0.000) 등 메타휴먼과 가상휴먼의 유의한 차이를 보였다. 그리고 모든 변수에 대해 메타휴먼이 가상휴먼보다 높은 평가를 하는 것을 확인했다. 특히 인간 유사도에서 메타휴먼의 평가가 가장 높았고, 신기성이 그 다음으로 확인했다.

IV. 결론

본 연구의 결과를 통해 먼저, 사용 만족감과 메타휴먼과 가상휴먼의 유의한 차이를 확인했다. 그리고 인간 유사도와 친숙도, 신기성, 친숙도도 모두 유의한 차이를 확인했고, 메타휴먼이 더 높게 평가한 것을 통해 메타휴먼의 퀄리티가 높다는 것을 확인할 수 있었다. 현재 가상휴먼의 성능 발전에 관심과 기술 개발이 지속되고 있는데, 인간 유사도가 높은 메타휴먼의 사용 만족감이 더 높게 평가받은 것처럼, 언캐니밸리를 지난 상태이기를 기대한다. 이처럼, 언캐니밸리이론을 적용해 가상휴먼과 메타휴먼의 주요 요인으로 살펴봤다는 학술적 시사점이 있다. 그리고 본 연구에서 비교한 요인들을 바탕으로 기술이나 콘텐츠 개발에 적용을 고려할 것을 제시했다는 실무적 시사점이 있다.

V. 참고문헌

Dean, Roger T. "A meta-pianist serial music improviser." (2013).

Gaisbauer, Felix, et al. "Combining heterogeneous digital human simulations: presenting a novel co-simulation approach for incorporating different character animation technologies." *The Visual Computer* 37.4 (2021): 717-734.

Gawand, Mihir Sunil, and H. Onan Demirel. "A design framework to automate task simulation and ergonomic analysis in digital human modeling." *International Conference on Human-Computer Interaction*. Springer, Cham, 2020.

Kim, Jinkyung Jenny, Bee-Lia Chua, and Heesup Han. "Mobile hotel reservations and customer behavior: Channel familiarity and channel type." *Journal of Vacation Marketing* 27.1 (2021): 82-102.

Mohammed, Ayman R., et al. "Ergonomic analysis of a working posture in steel industry in Egypt using digital human modeling." *SN Applied Sciences* 2.12 (2020): 1-8.

Pei, Yanli, Shan Wang, and Norm Archer. "Reputation, familiarity and use intention for e-payment services: a comparison of pure-play and click-and-mortar e-payment services." *International Journal of Services Technology and Management* 27.1-2 (2021): 72-103.

Reed, Matthew P., et al. *The humosim ergonomics framework: A new approach to digital human simulation for ergonomic analysis*. No. 2006-01-2365. SAE Technical Paper, 2006.

Rekswinkel, Sander. "Sounds familiar: The effect of music familiarity on radical innovation adoption." (2020).

[DAY 2]

C3 [KIISS-Paper Session] Big Data Platform

C3.1 장애인 지역사회 통합돌봄 정보시스템 개선 방안 도출

배영현
국립재활원
건강보건연구과
researcher2018@korea.kr

최예지
국립재활원
건강보건연구과
chldp7@korea.kr

김주희
국립재활원
건강보건연구과
juhee09@korea.kr

호승희*
국립재활원
건강보건연구과
hsh7@korea.kr

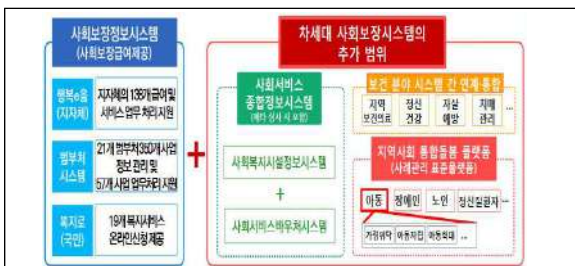
Abstract - 본 연구는 장애인 지역사회 통합돌봄 선도사업 업무프로세스 및 개선사항을 분석하고 이를 통해 차세대 사회보장정보시스템의 표준 사례관리 프로세스를 기반으로 장애인 지역 사회 통합돌봄 정보시스템의 개선방안을 도출 하여 향후 사회보장정보시스템 고도화의 기초자료로 활용되고자 한다. 개선방안 도출을 위해서 장애인 지역사회 통합돌봄 선도사업 지자체 사례분석 및 문헌조사, 업무프로세스 분석하여 개선 방안을 도출하였다. 도출된 개선방안은 보건복지시스템 연계, 시스템자원 연계, 장애특이적 요소가 반영된 시스템 개발 연계였다. 본 연구를 통해, 장애 특이적 요소가 반영된 지역사회 통합돌봄 공공 및 민간의 정보시스템 연계와 정보시스템간 보건 및 복지자원 체계적 연계를 제시 하였고, 이를 통해 장애인의 지역사회 통합돌봄을 위한 보건복지 자원을 통합적으로 등록 및 관리하게 되어 가용한 자원을 신속하고 효율적으로 탐색하여 수요자 에게 제공하거나 중앙정부와 지자체의 지역기반 돌봄 공동체가 협력을 통한 통합·효율·효과적 서비스 제공이 가능할 것으로 생각된다.

Key Terms - 장애인 지역사회 통합돌봄, 업무프로 세스, 정보 시스템 개선방안

본 연구는 국립재활원 재활연구소 건강보건연구과 내부연구사업(21-H-03)으로 수행함.

I 서론

보건복지부는 공공과 민간이 역할을 분담하여 돌봄 시각지대의 해소, 접근성 향상, 사회적 유대 강화를 지향하며 재가 및 지역사회 중심의 돌봄서비스 제공하는 지역사회 통합돌봄 선도사업을 추진하고 있다.



〈그림 1〉 차세대 사회보장 정보시스템 개편(안)

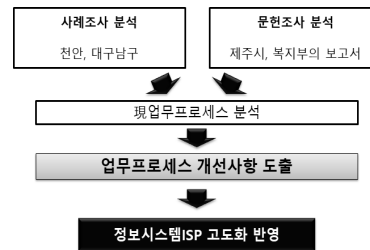
이울러 사회보장정보시스템을 전면 개편하여 기존 사회보장시스템보다 연계범위를 확대하여 지역보건 시스템과의 연

계를 고도화하여 보건 정보도 파악할 수 있으며 통합돌봄을 위한 민·관 협력 공동 사례관리 플랫폼으로 확대할 예정이다. 이러한 노력에도 불구하고 여전히 다양한 특성을 보이는 장애인을 위한 지역사회 통합돌봄 사례관리 업무프로세스 및 정보시스템은 부재한 상황이다(그림 1).

따라서 장애인 지역사회 통합돌봄 선도사업 업무프로세스 및 개선사항을 분석하고 이를 통해 차세대 사회보장정보시스템의 표준 사례관리 프로세스를 기반으로 장애인 지역 사회 통합돌봄 정보시스템의 개선방안을 도출 하여 향후 사회보장 정보시스템 고도화의 기초자료로 활용 되고자 한다

II 방법

본 연구는 장애인 지역사회 통합돌봄 정보시스템 개선 방안을 도출하기 위하여 아래 연구 절차(그림 2)로 연구를 수행하였다.



〈그림 2〉 연구절차

III 결과

1) 장애인 지역사회 통합돌봄 업무프로세스 분석



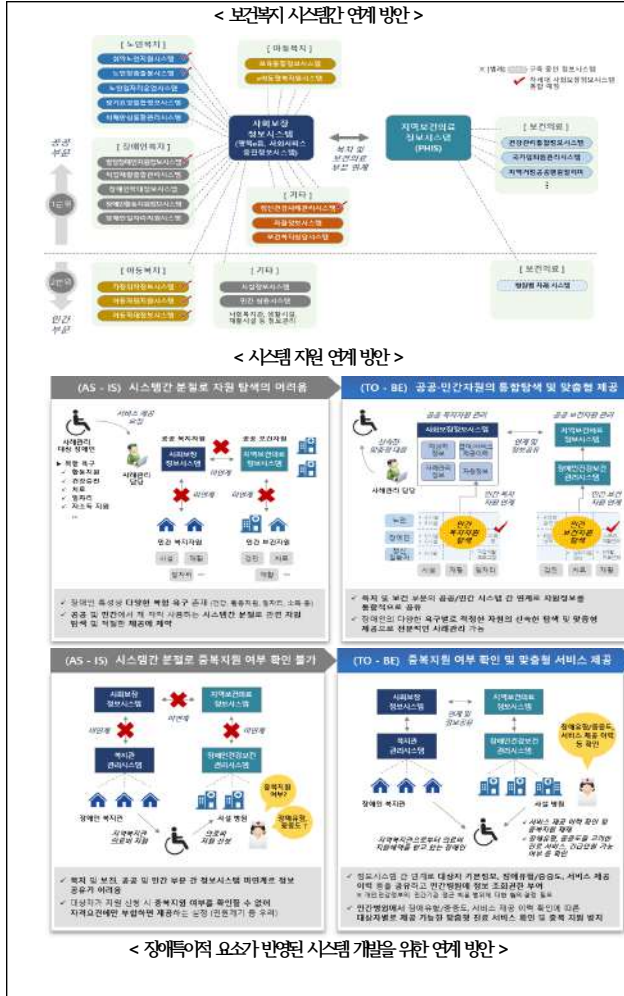
〈그림 3〉 업무프로세스 사례분석

2) 장애인 지역사회 통합돌봄 업무프로세스 개선사항 분석



〈그림 4〉 업무프로세스 개선사항 분석

3) 장애인 지역사회 통합돌봄 정보시스템 개선방안 도출



< 장애특이적 요소가 반영된 시스템 개발을 위한 연계 방안 >

업종	대상자군	자료 DB	지자체, 보건소, 지역센터	사회보장정보부	실명	통계청	지방자치단체	국민건강보험공단	정보시스템
지역별 통합돌봄	연령	○	○	○					●
	장애정도/장애유형	○	○	○					●
지역별 통합돌봄	장애정도/장애유형	○	○	○					●
	장애정도/장애유형	○	○	○					●
지역별 통합돌봄	장애정도/장애유형	○	○	○					●
	장애정도/장애유형	○	○	○					●
지역별 통합돌봄	장애정도/장애유형	○	○	○					●
	장애정도/장애유형	○	○	○					●
지역별 통합돌봄	장애정도/장애유형	○	○	○					●
	장애정도/장애유형	○	○	○					●
지역별 통합돌봄	장애정도/장애유형	○	○	○					●
	장애정도/장애유형	○	○	○					●
지역별 통합돌봄	장애정도/장애유형	○	○	○					●
	장애정도/장애유형	○	○	○					●
지역별 통합돌봄	장애정도/장애유형	○	○	○					●
	장애정도/장애유형	○	○	○					●
지역별 통합돌봄	장애정도/장애유형	○	○	○					●
	장애정도/장애유형	○	○	○					●
지역별 통합돌봄	장애정도/장애유형	○	○	○					●
	장애정도/장애유형	○	○	○					●
지역별 통합돌봄	장애정도/장애유형	○	○	○					●
	장애정도/장애유형	○	○	○					●

〈그림 5〉 정보시스템 개선방안 도출

IV 결론

본 연구를 통해 장애 특이적 요소가 반영된 지역사회 통합돌봄 정보시스템 개선방안으로 공공 및 민간의 보건과 복지 지원 정보시스템간 체계적 연계를 제시 하였고, 이를 통해 장애인의 지역사회 통합돌봄을 위한 보건의료 지원 통합적으로 등록 및 관리하게 되어 가용한 자원을 신속하고 효율적으로 탐색하여 수요자에게 제공하거나 중앙정부와 지자체의 지역기반 돌봄 공동체가 협력을 통한 통합·효율·효과적 서비스 제공이 가능할 것으로 생각된다.

참고문헌

고려대학교 산학협력단 (2019) 중앙 및 지역 장애인 보건의료센터 건강 정보시스템 구축을 위한 정보전략수립 개발 연구. 국립재활원 재활연구개발용역사업 최종보고서.

단국대학교 산학협력단 (2020) 지역사회 장애인의 통합 사례관리 모형 개발 연구.

제주연구원 제주사회복지연구센터 (2020) 통합복지하나로 시범사업 업무매뉴얼.

C3.2 공간 빅데이터를 활용한 지방도 포장보수 우선지역 예측 서비스

이민영
(주)선도소프트
mylee@sundosoft.co.kr
손수진
(주)선도소프트
sjson@sundosoft.co.kr

최지우
(주)선도소프트
jwchoi1@sundosoft.co.kr
최인호
(주)선도소프트
ihchoi@sundosoft.co.kr

김인영
(주)선도소프트
iykim@sundosoft.co.kr

국문초록

전라북도의 지방도 포장보수 이력 관리 현황은 현장 건설사의 포장보수 후 성과품에만 의존하여 엑셀, 한글 문서로만 관리되고 있는 실정이며, 덧씌우기 예산 등은 매년 불규칙적인 투입으로 안정적인 도로 관리 불가능한 현황이다. 그에 따라 지방도의 체계적인 유지관리 방안 필요하다. 해당 논문에서는 도로 파손과 관련이 있는 데이터 및 도로 환경과 관련이 있는 데이터를 수집 및 가공하여, 도로 파손이 발생할 수 있는 위험지역을 도출하였다. 해당 예측 결과 지역을 현장검수하여 해당 방법론의 유효성을 파악하였다.

국토부에 따르면 일반국도의 도로 파임 발생 건수는 18년도에 약 4만7천건, 19년도에 약 3만8천건이며 도로 파임 피해 소송건수는 18년도에 93건, 19년도에 119건으로 증가했다. 일반국도의 경우 도로 파임 발생 건수가 18년도에 비해 줄었으나 이는 도로 포장 보수 등을 진행하면서 발생 건수가 줄어든 것이라고 한다. 전라북도의 지방도의 포장보수 우선순위를 분석하기 위해 연구를 진행하기 위해, 엑셀, 한글 문서로만 관리되는 지방도 포트홀 상습발생지, 덧씌우기 사업구간, 긴급 보수 구간위치와 같은 보수 이력데이터를 데이터화 하여, 분석하고, 보수 이력 데이터에서 벗어나 지방도의 체계적인 유지관리를 개선한다. 더 나아가, 도로와 관련된 다양한 현황데이터를 활용하여 공간 융합 데이터를 구축하고, 머신러닝 학습 데이터 및 예측에 필요한 데이터 형태로 가공하였다. 해당 공간 빅데이터를 사용하여 지방도 유지관리가 필요한 우선지역을 예측하고 도로포장 유지관리 우선순위 예측하였으며, 해당 결과를 활용하여 도로관리 예산 및 정책 수립에 활용하려 한다.

주제어

공간정보, 빅데이터, GIS, 머신러닝, 포트홀

C3.3 The Study on Determinants of User Satisfaction with Interoperable AI Voice Assistants

김엘레나
순천향대학교 경영학과
voogiejam22@sch.ac.kr

최재원
순천향대학교 경영학과
jaewonchoi@sch.ac.kr

Abstract –This study is built to identify the effect of System Quality and Service Convenience on Satisfaction in context of Interoperability of AI Voice Assistants. The proposed model was tested with Structural Equation Modelling (SEM). The results of SEM testing showed that System Quality has a positive effect on the Satisfaction. It has also proved that the System Quality has a positive effect on the Service Convenience as well. Service Convenience as well was proved to have a significant effect on the Satisfaction. Thus, all three of proposed hypotheses were supported in this study. Last, the analysis of Variance was applied to discover the differences in groups with different levels of perceived AI Voice Assistant interoperability.

Key Terms – AI Voice Assistant Interoperability, System Quality, Service Convenience

I. Introduction

Artificial Intelligence (AI) is one of technological innovations, which performs manual work, that requires human intelligence. The main feature of AI, which outstands hundreds of previous inventions and make it so outstanding is that AI uses big data to broaden the possibilities of its' task performance abilities and achieve best performance. Nowadays, AI is used in almost every field of human life: healthcare, law, finance, education, transport, and Virtual assistants. Virtual assistant or Voice assistant is a software that understands the user's language and performs the instructions that the user wants. Voice assistant service was created as a system, which could use AI to provide intelligent search techniques to simplify the search process, leading to a sufficient timesaving for multitasking (Rouso and Schwartz 2004). By applying its improved intelligent searching techniques, Voice assistant systems (VASs) are used as tools for online shopping, learning new languages, answering questions, controlling/using other applications and devices (Nasirian, Ahmadian & Lee, 2017). Apple made a huge breakthrough when the first ever digital virtual assistant Siri was introduced as a feature on company's iPhone 4s in 2011. Since then, similar attends of several companies brought many voice assistants to the

market. According to latest forecast from Gartner, worldwide artificial intelligence software revenue is forecast to total US \$62.5 billion in 2022, which compared to US \$51.5 billion In 2021, representing an increase of 21.3% in total (Gartner, 2021). Virtual Assistant software also taking a big part in of the revenue: the AI Voice Assistant software market revenue for 2022 is \$7.12 billion dollars, which indicates the growth compared to \$6.2 billion in 2021.

Though the AI Voice Assistants are constantly evolving, the adoption of such technologies remains a big issue. The adoption of AI technologies differs across the world (Mishra & Shukla, 2020). Voice-based virtual assistants are becoming more common on mobile devices. The technologies are now being integrated into other devices, such as laptops and desktop computers, and whole new market of stand-alone items that function as smart home assistants, like Amazon Echo, is emerging (Guzman, 2018). Given the exponential rise of voice-based technology, many tech-users now have a chance to communicate with voice assistants as part of everyday life, exactly as they would with other humans (Sundar et al., 2017). Equipped with the set of useful features. AI-based voice assistants could not only play digital music through Wi-Fi and Bluetooth, but also can perform various verbal commands, based on users' needs (Ling, et al., 2021). As for 2021 year, the active usage of AI voice assistants still differs depends on the region. For example, even though market researchers give the AI voice assistant technology a big growth in revenue, in case of South Korea, the country with the highest percent of households using the internet, only 33% of population in age of 20-50 are using AI Voice Assistant. In case of Taiwan, more than 80 percent of people have smartphones, but only less than 10 percent of the people adopted smart speakers, as well as India, where smart voice assistants remain as a relatively young product (TWNIC, 2018; IDC, 2019). Moreover, as market competition for AI Voice Assistants has intensified due to the indiscriminate launch of AI Voice Assistants, the areas that users can use through one AI voice Assistant are decreasing. To address current

issue, Microsoft Cortana and Amazon Alexa has launched an integrated service, where both features of each Voice Assistant can be used on one device. This integration of two Voice Assistants gives user the opportunity to get access to exclusive features of one or another voice assistant wherever they wanted. For example, a person with Cortana can order products off Amazon or manage existing orders with voice instructions. In case of manufacturers, the creation of interoperable Voice Assistant services brings companies greater powers to compete with other AI Voice Assistant service providers. In case of other ICT companies, the biggest manufacturer of smart voice speakers, Amazon could not skip the opportunity to expand its zone of interest and launched the Voice Interoperability Initiative in 2019. Currently, The Voice Interoperability Initiative has gained support from 80 companies, including brands like Baidu, BMW, Bose, Microsoft, Salesforce, Sony and more, including companies like Facebook, Qualcomm, and Intel as a part of the initiative. Prior studies on AI Voice assistants made a focus on factors, that influence the adoption of voice assistants and increase the purchase intention of smart voice speakers. Thus, the functionality and main attributes of AI Voice Assistant were tested by such models as Task-technology Fit Model and Diffusion of Innovations (Ling, et al., 2021). Technology Acceptance Model also is broadly used as a conceptual framework to test users' tendency to use Voice Assistant technology (Nasirian, Ahmadian & Lee, 2017). As the market of Voice Assistant related technologies is growing, there remains a big issue of lack of the research on voice assistants interoperability.

In this study, we aim to discover a method for increasing the usefulness of ai voice assistant to utilize the multi-area of AI voice assistant service. Through previous research on the interoperability of mobile services, we intended to conduct research on the compatibility of ai voice assistant and to find out the effect of interoperability on service convenience and system quality. The topic of Interoperable Voice Assistant systems remains unexplored in prior literature. To find out efficient implications on this topic, we conducted the research, consisting of two studies: First – How consumers perceive the AI Voice Assistant service, tested in UEQ+ model. The second study is conducted in aim to find answers to three main questions. First, Does Interoperability affect system quality and service convenience? Second, Does Service quality of AI Voice Assistants affect service convenience? And third, Does Service Quality and Service Convenience affect consumers' satisfaction and their intention to recommend the interoperable AI Voice Assistants?

II. Research Model



<Figure 1> Research Model

III. References

Gartner, "Gartner Forecasts Worldwide Artificial Intelligence Software Market to Reach \$62 Billion in 2022", (2021).

Guzman, A. L., "Voices in and of the machine: Source orientation toward mobile virtual assistants.", *Computers in Human Behavior*, (2019), 90, 343-350.

IDC, "India Smart Speakers Market Touches a New High in 2018", IDC India Reports, (2020). <https://www.idc.com/getdoc.jsp?containerId=prAP44965119>.

Ling, H. C., Chen, H. R., Ho, K. K., & Hsiao, K. L., "Exploring the factors affecting customers' intention to purchase a smart speaker", *Journal of Retailing and Consumer Services*, 59, (2021), 102331.

Mishra, A., A. Shukla, 2020. Psychological Determinants of Consumer's Usage, Satisfaction, and Word-of-Mouth Recommendations Toward Smart Voice Assistants. In book: *Re-imagining Diffusion and Adoption of Information Technology and Systems: A Continuing Conversation* (pp.274-283)

Nasirian, F., Ahmadian, M., & Lee, O. K. D., "AI-based voice assistant systems: evaluating from the interaction and trust perspectives", (2017).

Rouso, A., and Schwartz, S., "Apparatus, Method and System of Artificial Intelligence for Data Searching Applications.",(2004) Google Patents.

Sundar S., Eun HwaJung, T. Franklin Waddell, Ki Joon Kim, "Cheery companions or serious assistants? Role and demeanor congruity as predictors of robot attraction and use intentions among senior citizens", *International Journal of Human-Computer Studies*, (2017), 97, 88-97

TWNIC, "ANNUAL REPORT",(2019), <https://www.twnic.net.tw/doc/twrrp/201812b.pdf>

C3.4 The Developmental measures and implications of introducing voice-based public services for strengthening the accessibility of the social vulnerable and open public communication*.

송진순 (동아대)

Abstract

Public institutions and governments develop discussions on the premise that they can facilitate smooth public communication with the socially vulnerable by promoting citizens' welfare by providing voice-based service chatbots to citizens. The purpose of the study is to propose a plan for intelligent governments to provide quick and efficient administrative services by efficiently managing knowledge and information within and outside government organizations based on ICT and facilitating access and use of information for citizens, especially vulnerable groups. This paper confirms that citizens' attitudes, perceptions, and expectations for public institutions ahead of voice-based service provision are positive through small surveys and interviews with experts with knowledge of artificial intelligence, discuss the technical aspects of voice-based services, the significance and necessity of public institutions. In addition, the government and public institutions are considering the implications of using and providing voice-based services. As a result, chatbot's voice-based service is of great significance in providing an opportunity and platform for wider citizens to participate in intelligent government, to strengthen information accessibility, guarantee and strengthen human rights and basic rights of the

socially vulnerable.

Key Words: Voice-based services, public communication, Artificial Intelligence government, social-vulnerables, Digital Embrace, information accessibility.

C3.5 디지털 학습생태계 구축을 위한 기초 연구

오현숙
한양대학교 창의융합교육원
miimoh@hanyang.ac.kr

이종호
한양대학교 창의융합교육원
JI007c@hanyang.ac.kr

임규건
한양대학교 경영대학
gglim@hanyang.ac.kr

Abstract - 새로운 산업혁명 패러다임으로의 전환과 코로나19 팬데믹의 확산으로 사회 전반에서는 생존과 지속가능성 확보를 위한 디지털트랜스포메이션이 주요 이슈이다. 교육 영역에서도 사회 변화에 능동적으로 대처하고 학습자들의 학습권 보장, 높은 양질의 교육 서비스 제공을 위한 디지털트랜스포메이션에 대한 논의가 활발히 이루어지고 있다. 이에 총체적이고 통합적 관점에서의 체제 혁신을 통한 디지털트랜스포메이션 추진을 위한 디지털 학습생태계 구축을 위한 논의가 필요한 시점이다. 한양대학교는 2018년부터 실제 사회와의 연계성을 중심에 둔 IC-PBL(Industry Couple Problem/Project Based Learning)교수학습모델을 개발하여 대학에서 이루어지는 수업과 실제 사회 연계를 통해 관계성, 상호의존성, 공진화와 협력을 중점에 둔 학습생태계를 구축하였다. 그러나 온라인 기반 교육이 하나의 뉴노멀로 등장한 상황에서 학습생태계의 지속가능성 확보를 위하여 체제 혁신에 기반한 디지털트랜스포메이션 추진을 요구받고 있다.

본 연구에서는 기존에 구축되어진 학습생태계를 디지털트랜스포메이션을 통해 디지털 기반으로 전환하는데 필요한 요소와 전략을 도출하고자 한다. 테크놀로지의 도구적 활용을 넘어 테크놀로지 기반의 체제 혁신을 통한 디지털트랜스포메이션 핵심 요소를 추출하고 관계성, 상호의존성, 공진화와 협업가능성이라는 학습생태계 원리가 구현된 실제 사회 연계 중심의 Connect & Share 플랫폼 생태계 구축 전략을 제시하고자 한다. 이를 통해 테크놀로지 기반의 인프라 구축, 참여자들의 디지털 역량 강화 지원 체제, 이를 지지하는 포용적 거버넌스 구축을 포함하는 디지털 기반 교육 플랫폼 생태계의 청사진을 제시하고자 한다.

Key Terms - 교수학습, 교육플랫폼, 디지털트랜스포메이션, 학습생태계

C3.6 공공데이터를 활용한 공용 전기차 충전소 최적입지 선정 및 우선순위 도출 - 수원시를 중심으로 -

박경문
협성대학교 도시공학과
mpak09@empal.com

최인호
(주)선도소프트
지능정보사업부
ihchoi@sundosoft.co.kr

김연준
충북대학교
도시재생협동과정
kjguns@lh.or.kr

안태선
협성대학교 도시공학과
ats@uhs.ac.kr

국문초록

본 논문은 행정안전부의 공공데이터 개방표준에 기초한 수원시의 전기차 충전소 데이터를 구축하여 수원시 관내 공용 전기차 충전소의 최적입지의 선정과 우선순위를 제시한 연구이다. 수원시에는 2021년 현재, 496개소의 전기차 충전소가 있으나 향후 전기차의 수요 증가를 고려할 시 추가적인 전기차 충전소의 설치가 요구되는 실정이다. 이를 위해 본 연구에서는 전기차 충전소 관련법령의 검토, 전기차 충전가능 다중이용시설 검토, 근린주구 이론을 적용한 GIS 공간분석 등을 통해 최종적으로 168개소의 전기차 충전소 추가설치 대상 최적입지를 도출하였다. 도출된 168개소의 전기차 충전소 추가설치 대상지역은 최적입지 우선순위 기준적용을 통해 1순위 57개소, 2순위 90개소, 3순위 21개소 등으로 차등하여 제시함으로써 지자체에서 효율적인 정책집행이 될 수 있는 방안을 제시하고자 하였다.

구축·개방 및 데이터 기업 매칭 지원사업”의 “수원시 전기차 충전소 데이터 품질점검 및 신규 데이터 구축”의 연구내용을 수정, 보완한 논문임

주제어

전기차 충전소, 공공데이터, 근린주구, GIS 데이터, 최적입지 분석, 탄소저감

Acknowledgement (사사)

본 논문은 행정안전부의 “2021년 공공데이터

[DAY 2]

D3 [CEC-Paper Session] AI Applications

D3.1 User Experience with Chatbot: A Systematic Review

Sun, G.^a, Du, Z.^b, Wang, T.^c and Liu, J.^d

^a Business School of Sport, Beijing Sport University

E-mail: sgd23666@163.com

^b Business School of Sport, Beijing Sport University

E-mail: duzhao@bsu.edu.cn

^c Business School of Sport, Beijing Sport University

E-mail: wtj0817@163.com

^d Business School of Sport, Beijing Sport University

E-mail: 18701000308@163.com

Abstract

The emergence of novel digital technologies like artificial intelligence stimulates the application of chatbots to improve user experience in various fields such as medical, retail, and education. To comprehensively understand the impacts of chatbots on user experience, this research collates, analyzes, and summarizes extant literature on this topic. Specifically, we systematically reviewed the literature to identify the ways to improve user experience with chatbots. The results show that chatbots affect user experience through five primary aspects: satisfaction, engagement, empathy, trust, and humanness. Moreover, we put forward an agenda for future research. This research contributes to the development of human-computer interaction. Furthermore, this research also has important practical implications for improving user experience and increasing corporate profits.

Keywords: Chatbot, conversational agent, virtual assistant, user experience

D3.2 Toward the AI-enabled digital financial services innovation: The role of positive emotional interactions with users

Xi Chen

School of Business and Tourism Management
Management Science Department
Yunnan University
Kunming, 650091, China
Tel: + 8613808751231
E-mail: chenxi1231@ynu.edu.cn

Cheng Chen

School of Business and Tourism Management
Yunnan University
Kunming, 650091, China
Tel: + 8615911537845
E-mail: cc1369893260@163.com

Yi Cheng

School of Business and Tourism Management
Yunnan University
Pingan Bank of China, Chengdu Branch
Kunming, 650091, China
Tel: + 8615882245684
E-mail: 2313511321@qq.com

Acknowledgement

Financial support for this research project was provided by China National Social Science Fund Project (Grant number: 21BSH050, project leader: Xi Chen).

Toward the AI-enabled digital financial services innovation: The role of positive emotional interactions with users.

Purpose: Advancements in the AI-enabled technology have made the mobile and online the dominant place for launching financial services innovation. The existing literatures have revealed that online environment is easy to arouse users' emotions and promote emotional behavior, but still lack evidence how emotions affect the use of digital financial services. This study then develops a research model and two experiments to investigate whether and how the affordance of positive emotions through AI-enabled digital financial services innovation will enhance user's services adoption.

Design/methodology/approach: This paper used a mixed-methods approach to empirically study the role of emotions on users' adoption of digital financial services then providing the evidence to the value of positive emotions arousal through AI-enabled interaction. An convenience nonprobability sampling approach with total of 280 responses were collected to examine the model and two behavioral experiment with total of 121 and 140 participants respectively, as well as the partial least squares technique and paired sample mean t-test were utilized for data analysis.

Findings: Positive emotions promote users' intentions to continue to use digital financial services and also exert a significant positive role through the intermediary effect of trust and satisfaction(Study 1). The users' perception of the value rises in the state of positive emotional arousal and perception of the risk of financial loss decreases (Study 2). The anthropomorphic artificial intelligence service assistant can effectively evoke user's positive

emotions in service recommendations, improve their willingness of adoption and value perception and reduce perceived risk(Study 3).

Originality/value: Based on emotion theory and expectation confirmation theory (ECT), this study reveals that as features, positive emotions interaction help improve users' value perception and adoption intention, also help us further understand the role of user's emotions arousal in digital financial service. This research has practical importance in terms of understanding the affordance of positive emotional interaction through AI-enabled service is a valuable way to carry out service innovation in digital financial platform.

Key Words: AI-enabled digital financial service innovation, positive emotions, value perception, emotional interaction, expectation confirmation theory (ECT)

Introduction

AI enabled Digital Financial Services (DFS), provides forms for more tailored financial services (Pazarbasioglu, Mora, Uttamchandani, Natarajan, Feyen & Saal ,2020). Service quality research in the financial services has focused on user expectations and perceptions(Lewis, 1993).The AI-enabled online environment has become the main platform for digital financial services innovation, which is combined with the mobile and online financial service. Financial innovations offer promising opportunities for bridging the gap between research on product and service innovations (Nejad, 2022). Unlike traditional off-line financial services, interaction in the internet space is more likely to be affected by

emotion due to a lack of face-to-face real-time scenarios, with more evident and frequent emotional interactions in computer-mediated communication (CMC) (Derks, Fischer & Bos, 2008). However, as a service space, the internet also provides a technical platform for innovation in digital financial services, with AI-enabled technology contributing to more diversified human-machine interaction strategies in providing service. Therefore, research on the emotional factors in digital financial services and the impact mechanism of emotion on the adoption of digital financial services by user provides the basis of academic study and empirical exploration of the AI-enabled innovation of digital financial services.

Emotions play an important role in daily life, not only in human interactions but also in decision-making processes and the perception of the world around us (Alarcao & Fonseca, 2017). Recently the research community has shown an interest in identifying the emotional interactions between humans and computers (Picard & Klein, 2002; Brave & Nass, 2009; Nahin, Alam, Mahmud & Hasan, 2014; Lopatovska & Arapakis, 2011). Existing research findings show that, in services oriented toward enjoyment, user who feel pleased are more loyal than those who feel satisfied (Collier & Barnes, 2015). When people make decisions consciously or unconsciously, they tend to be impacted by emotions instead of evaluating the available information to make reasonable decisions (Finucane, Alhakami, Slovic & Johnson, 2000). Even in the face of risk-based decision-making, emotions still play an important role (Hönl Meissner & Wulf, 2017; O'Neill & Rothbard, 2017). Financial services are related to the motives for which people wish to earn profits, and people usually make rational decisions concerning the use of financial services.

Many research studies have explored the impact of emotions on financial services,

including the role of emotion in finance (Pixley, 2009), the segmentation of bank service users based on emotion (Calvo-Porral & Lévy-Mangin, 2020), emotion in making financial decisions (Nekrasova, 2011), and the impact of emotion regulation mechanisms on investment behavior (Im & Oh, 2016). At present, financial services have been transformed into fintech, a provider of digital service innovations and a highly relevant and novel channel through which people make creative use of digital technology in the financial domain (Lehner & Simlinger, 2019). There is a lack of literature on the role of emotions in using digital financial services. Therefore, the research evidence on service innovation through mobilizing users' positive emotions is still lacking.

The present research seeks to identify the innovations of digital financial services in users' positive emotion interactions by answering two questions on the role of emotions in the context of digital financial services.

RQ1: How emotions can be incorporated into users' continuous use of digital financial services?

Expectation confirmation theory (ECT) is widely used in consumer behavior literature to study service marketing, consumer satisfaction, and continuance using behavior (Oliver, 1980, 1993; Patterson, Johnson & Spreng, 1997; Dabholkar, Shepherd & Thorpe, 2000). The expectation confirmation model (ECM) describes using an information system. Users develop trust in the platform and the perceived usefulness of the service when the results meet expectations. Users' persistence decisions are closely linked to consumer satisfaction (Bhattacharjee, 2001a, 2001b). We built an ECM involving emotional factors to verify the expectation confirmation process of positive emotions and negative emotions, respectively, in

users' continued use of digital financial services. Data were collected through questionnaires to verify the model.

RQ2: How being in different states of emotional arousal affects users' perceptions of the value and risk of digital financial services?

The theoretical foundation rests on prospect theory, which focuses on rationality in decision-making but not on outcome irrationality, whereby the subject determines the reference point of gain and loss through subjective feelings (Kahneman & Tversky, 2013). Emotion and its respective effect on prospect theory's value function and probability weighting function (Prietzl, 2020) were also considered. We designed an experiment to check if the difference between a positive emotional state and a negative emotional state would change the perception of the risk and value of digital financial services by manipulating participants' emotions.

More and more companies serve their users through chatbots, on web or mobile APPS (Mygland, Schibbye, Pappas, & Vassilakopoulou, 2019). List of literatures has explored the meanings on implementing chatbots in online service encounters (Song, Xing, Duan, Cohen, & Mou, 2022). Although some studies have mentioned that emotional supply is a function of AI service agent (feine, morana, & gneuch, 2019), there is a lack of theoretical test and empirical evidence on the role of emotion, especially in the field of digital financial services, which emphasizes on wealth security. The two studies contribute to the literature by demonstrating that a positive emotional interaction can enhance users' value perception, decrease risk perception of loss, and effectively improve their willingness to continue to use. Therefore, positive emotional interaction becomes an important measure for digital financial

service innovation.

AI-enabled technology provides methods and technical foundations for mobilizing positive emotions, and the intelligent Customer Service Assistant is an important channel for conducting positive emotional interactions with users.

RQ3: With the introduction of positive emotional interactions, can the AI-enabled Customer Service Assistant effectively enhance users' willingness to use digital financial services?

Specific application scenarios were further designed to conduct an empirical study of whether the positive emotional interactions of the intelligent Customer Service Assistant with users can improve users' willingness to use and perceived value, which laid a foundation for the innovative practice of applying the theories on which the first two experiments were based to digital financial services. Figure 1 shows the research design and experimental process logic.

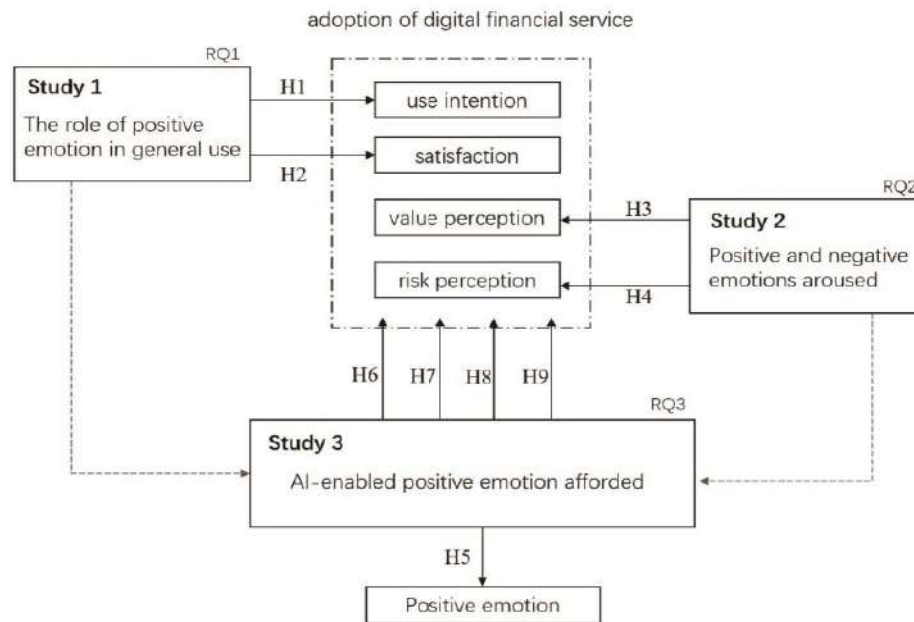


Figure 1. Research design and experimental process logic.

Theoretical foundations and literature review

Expectation confirmation theory

ECT is widely used in the consumer behavior literature to study service marketing, consumer satisfaction, and continuance usage behavior (Oliver, 1980, 1993; Patterson et al., 1997; Dabholkar et al., 2000). Based on ECT, the ECM has been proposed. It describes the use of an information system, how users develop trust in the platform, and the perceived usefulness of the service when the results meet expectations. Users' persistence decisions, similar to consumers' repurchase decisions, are closely linked to consumer satisfaction (Bhattacharjee, 2001b). ECT is widely applied for persistence decisions in internet information platforms, such as continuance intentions for mobile payment services (Park, Jun

& Park, 2017), persistent use of web-based knowledge learning platforms (Lee, 2010; Huang, 2019), persistent use of instant messaging software (Oghuma, Libaque-Saenz, Wong & Chang, 2016), and persistent use of cloud financial software (Li & Wang, 2021). These studies show that expectation confirmation promotes perceived usefulness and satisfaction, thereby enhancing users' continuance intentions.

Several studies have integrated the trust factor into ECT (Kim, Ferrin & Rao, 2009; Valvi & West, 2013; Lin, Wang, B., Wang, N. & Lu, 2014). Trust is considered a meta-emotion (Belli & Broncano, 2017). As trust reflects user belief in an internet product or service, gaining trust is the only way to generate consumer loyalty and persistent use of the service (Fang, Qureshi, Sun, McCole, Ramsey & Lim, 2014; Sullivan & Kim, 2018). Emotions significantly influence trust: positive emotions (e.g., gratitude and happiness) increase trust, whereas negative emotions (e.g., anger) decrease trust (Dunn & Schweitzer, 2005). Trust is an important consideration in internet finance (Lin, Whinston & Fan, 2015).

The existing literature provides a research basis for the persistent use of digital financial services. In the fields of internet banking (Vatanasombut, Igbaria, Stylianou & Rodgers, 2008; Foroughi, Iranmanesh & Hyun, 2019; Rahi & Abd. Ghani, 2019), electronic payment systems (Putri, 2018), digital financial services (Zhou, Tsiga, Li, Zheng & Jiang, 2018), and internet investment products (Liu, Zhang, Mao, Xue & Lin, 2018), users' continuance behavior has been explored using ECT. As a service application under online scenarios, behavioral decisions in internet finance are influenced by network effects (Shim & Shin, 2016; Au, 2021). Further research needs to be conducted on the influence of network effects and post-truth emotional factors on users' expectation confirmation and continuance

behavior. This study is also an attempt to integrate positive and negative emotions and trust into users' expectation confirmation under decision scenarios relating to the use of digital financial services.

Emotion theory and adoption of digital financial service

Emotion is a complex behavioral phenomenon involving many levels of neural and chemical integration (Lindsley, 1951). Emotional factors have become influential in various areas of online social life, with information interaction in cyberspace entering a post-truth era. In the post-truth cyberspace era, emotional behaviors prompted by misinformation result in the degradation of reason and facts (Lewandowsky, Ecker & Cook, 2017; Lewandowsky & Van Der Linden, 2021). Emotion management and sentiment interaction have attracted increasing attention in internet behavior studies (Kim, S. H., Kim, K., Park & Yang, 2011; Teixeira, Wedel & Pieters, 2012; Habib & Qayyum, 2018; Donald, Ciarrochi & Sahdra, 2020). Emotions influence decision-making from various perspectives, such as modulating the content and depth of thinking and changing implicit objective content (Lerner, Li, Valdesolo & Kassam, 2015).

Prospect theory focuses on rationality in decision-making but not on outcome irrationality. According to prospect theory, the subject determines the reference point of gain and loss through subjective feelings (Kahneman & Tversky, 2013).

Emotion and its respective effect are described by prospect theory's value function and probability weighting function (Prietzel, 2020). In academic research, dividing emotions into positive and negative emotions is commonly accepted (Denzin, 1994). However, emotions could be further divided into positive emotions, including happiness, self-confidence,

relaxation, and pride, and negative emotions, including rage, disappointment, anger, and shame (Denzin, 1994). Further investigations suggest that emotions can change decision-making preferences, that sadness can intensify risk resentment, and rage can significantly reduce loss avoidance.

Positive emotions can better predict consumer behaviors (Sanchez-Franco & Rondan-Cataluña, 2010), reduce risk perception (Jang & NamKung, 2009), enhance profit perception (Vazquez & Hervas, 2010), increase users' satisfaction with services (Kuo & Wu, 2012), and affect consumers' purchasing behaviors (Laros & Steenkamp, 2005). The influence of negative emotions is generally opposite to that of positive emotions (Laros & Steenkamp, 2005), and negative emotions enhance risk perception significantly (Vazquez & Hervas, 2010; Szymkowiak, Gaczek, Jeganathan & Kulawik, 2021).

Online platforms have become an important space for providing financial services. Do emotional factors play an important role in the use of digital financial services? Will emotions change users' risk and profit perception when using digital financial services? Corresponding research that fully explores such issues needs further exploration. Table 1 shows dimensions of adoption of digital financial service.

Table 1 here

Hypothesis development

Emotion

Emotions can influence the decision-making process, and they may also result in continuous

behavior, such as continuous shopping (Pansari & Kumar, 2017). Emotion affects human behavior in many ways. Research suggests that positive emotions can predict consumer behavior better in the service context than negative emotions (Jang & NamKung, 2009). Emotion plays a critical role in the use of IT. For example, positive emotions, such as excitement and happiness, are positively related to IT use, while negative emotions, such as anxiety, are negatively related to IT use (Beaudry & Pinsonneault, 2010). Emotion can also have an impact on online shopping. Positive emotions can influence online shopping behavior positively, while negative emotions can have passive effects (Pappas, Kourouthanassis, Giannakos & Chrissikopoulos, 2014). User's satisfaction can also be affected by emotions. Positive emotions can contribute to greater satisfaction, but negative emotions reduce satisfaction (Koenig-Lewis & Palmer, 2014; Kuo & Wu, 2012; Ali, Amin & Cobanoglu, 2016; Rychalski & Hudson, 2017). The impact of positive emotions on satisfaction is also deeper. Trust, as a fundamental aspect of online shopping, has great relevance with satisfaction (Pappas et al., 2014). However, trust can also be affected by emotion. Positive emotions, such as happiness and gratitude can increase trust. Negative emotions, such as anger and sadness, can decrease trust (Dunn & Schweitzer, 2005). In electronic situations, there is a positive correlation between positive emotions and satisfaction (Dai, Luo, Liao & Cao, 2015). Therefore, we hypothesize the following:

H1a. Users' positive emotions positively impact their trust in digital financial services.

H2a. Users' positive emotions positively impact their satisfaction with digital financial services.

Expectation confirmation

ECM assumes that users' confirmation will positively influence their perceived usefulness and satisfaction (Bhattacharjee, 2001a). ECT can be applied to explain consumers' satisfaction and repurchasing behavior; users' expectations can decide the degree of their satisfaction with products or services (Oghuma et al., 2016) and can influence their perceived usefulness (Venkatesh, Thong, Chan, Hu & Brown, 2011). On online payment platforms, users' satisfaction can be significantly influenced by their expectation confirmation (Susanto, Chang & Ha, 2016). When buying paid mobile applications, the consistency between experience and prior expectation can positively impact satisfaction (Hsu, Judy & Lin, 2015). Thus, we hypothesize the following:

H1b. Users' expectation confirmation of digital financial services positively impacts their perceived usefulness of digital financial services.

H2b. Users' expectation confirmation of digital financial services positively impacts their satisfaction with digital financial services.

Perceived usefulness

Perceived usefulness can positively influence users' satisfaction (Bhattacharjee, 2001b; Hsu, Judy & Lin, 2015). When using web-based learning applications, users' satisfaction is positively affected by their perceived usefulness (Lee, 2010). When taking part in online university tuition, learners' satisfaction can be predicted by their perception of usefulness (Joo, Lim & Kim, 2011). In the context of electronic learning services, satisfaction can be affected by perceived usefulness, information quality, and confirmation, the impact of

perceived usefulness on satisfaction being the most significant factor. When learning systems can provide users with useful information, learners' satisfaction will be increased (Chiu, Hsu, Sun, Lin & Sun, 2005; Roca, Chiu & Martinez, 2006). Thus, we hypothesize the following:

H2c. Users' perceived usefulness of digital financial services positively impacts their satisfaction with digital financial services.

Trust

When trading online, trust is a necessary precondition. Trust is a key success factor in social commerce, a subset of electronic commerce spawned by social network software (SNS). In an e-commerce environment, a user's intention to shop and word-of-mouth are significantly influenced by trust (Kim & Park, 2013). Research suggests that trust can strongly influence people's online shopping intention (Abu-Shamaa & Abu-Shanab, 2015), and it can significantly influence people's online shopping behavior (Hsieh & Liao, 2011). When using mobile banking, users' trust in technology can strongly predict their satisfaction levels (Masrek, Mohamed, Daud & Omar, 2014). Users prefer to trade with service providers who have gained their trust. The trust level before trading will directly impact users' satisfaction after buying. There are various paths for trust to affect satisfaction. Based on prospect theory, distrust has a greater impact on satisfaction than trust, and the effect is negative (Singh & Sirdeshmukh, 2000). In the mobile commerce context, users' satisfaction and loyalty can be positively influenced by trust. In other words, a user's trust can influence repurchasing willingness. Satisfaction plays a mediating role in the influence of trust on loyalty (Lin & Wang, 2006). Thus, we hypothesize the following:

H2d. Users' trust in digital financial services positively impacts their satisfaction with digital financial services.

Satisfaction

Satisfaction can positively influence users' repurchasing intention (Yang, Lu, Patrick & Gupta, 2017). When paying through an internet platform, users' satisfaction significantly influences their continuous use intention (Susanto et al., 2016; Alghamdi, Elbeltagi, Elsetouhi & Yacine Haddoud, 2018). In the catering industry, users' satisfaction is positively correlated with their behavioral intentions, such as repurchasing and recommendations (Ryu, Lee & Kim, 2012). When using a desktop service, learners' satisfaction will positively influence their continuous usage (Huang, 2019). When using electronic services, users' continuous use intention is mainly decided by their satisfaction (Liao, Chen & Yen, 2007). When using an electronic studying platform, learners' continuous intention is also determined by their satisfaction (Chiu et al., 2005).

The mediating role of satisfaction

Many previous studies have proved the mediating role of satisfaction in human behavior. For example, when using mobile social software, satisfaction has mediating effects on the impact of perceived usefulness on continuous use intention (Hsiao, Chang & Tang, 2016). When using fitness applications and wearable devices, positive and negative emotions can influence behavior intention through satisfaction. Specifically, positive emotions positively impact satisfaction, while negative emotions negatively impact satisfaction (Kim, 2021). The ECM has been used to explain users' behavior after accepting a technology innovation, namely

continuous usage. Expectation can influence a users' continuous use intention of IT by affecting satisfaction (Tam, Santos & Oliveira, 2020). Trust can impact the continuance intention of mobile payment via satisfaction (Cao, Yu, Liu, Gong & Adeel, 2018). Thus, we hypothesize the following:

H1c. Users' satisfaction with digital financial services positively impacts their continuous use intention of digital financial services.

H2e. Satisfaction has mediating effects on the impact of perceived usefulness on users' continuous use intention of digital financial services.

H2f. Satisfaction has mediating effects on the impact of trust on users' continuous use intention of digital financial services.

Continuance use intention

Perceived usefulness can significantly impact people's behavioral intention (Zhao & Zhou, 2018). When using the digital education platform, perceived usefulness can significantly influence users' continuous use intention (Wu & Chen, 2017). When using electronic services, perceived usefulness can influence a users' continuous use intention (Liao et al., 2007). We can also promote users' continuous usage through building trust (Zhou, 2013). Trusting intention, together with satisfaction, can predict continuance usage intention (Lankton, McKnight & Thatcher, 2014). When buying healthy products on WeChat, users' trust will be increased if their expectation confirmation toward the products occurs. Their buying willingness will also be enhanced, and their loyalty can also be improved. Thus, we

hypothesize the following:

H1d. Users' perceived usefulness of digital financial services positively impacts their continuous use intention of digital financial services.

H1e. Users' trust in digital financial services positively impacts their continuous use intention of digital financial services.

The role of aroused emotions

Compared to the utility function in the classical expected utility theory, the value functions displayed by psychological factor curves in prospect theory are somewhat subjective, whereby the influence of psychological factors on actual behavior selection can be better depicted (Zhao, Chen, Miao, Tan & Song, 2021). Generally, decision-makers prefer profits, avoid risks, and resent losses. Their risk attitude is shown to be risk-seeking for low-probability gain and high-probability loss and risk aversion for low-probability loss and high-probability gain (Glimcher & Fehr, 2014). Thus, we hypothesize the following:

H3. Users' perceived value of digital financial services will increase when positive emotion aroused.

H4. Users' perceived risk of wealth loss of digital financial services will increase when negative emotion aroused.

The role of AI-enabled positive emotion affordance

Long list of literatures has explored the meanings on implementing chatbots in online service encounters (Song, Xing, Duan, Cohen, & Mou, 2022). Studies have mentioned that emotional

supply is a function of AI service agent (Feine, Morana, & Gneuch, 2019). Positive emotions can better predict consumer behaviors (Sanchez-Franco & Rondan-Cataluña, 2010), reduce risk perception (Jang & Namkung, 2009), enhance profit perception (Vazquez & Hervas, 2010), increase users' satisfaction with services (Kuo & Wu, 2012), and affect consumers' purchasing behaviors (Laros & Steenkamp, 2005). The influence of negative emotions is generally opposite to that of positive emotions (Laros & Steenkamp, 2005), and negative emotions enhance risk perception significantly (Vazquez & Hervas, 2010; Szymkowiak, Gaczek, Jeganathan & Kulawik, 2021). Thus, we hypothesize the following:

H5. Users' positive emotion will increase significantly when AI service agent interacts with them positive emotionally.

H6. Users' use intention will increase significantly when AI service agent interacts with them positive emotionally.

H7. Users' satisfaction will increase significantly when AI service agent interacts with them positive emotionally.

H8. Users' value perception will increase significantly when AI service agent interacts with them positive emotionally.

H9. Users' risk perception will decrease significantly when AI service agent interacts with them positive emotionally.

Study 1: Emotions in continuous use of digital financial services

Study 1 explored the impact of emotional factors in the continuous use of digital financial services under a more general scenario. Based on the ECM, which describes the use of an

information system, users develop trust in the platform and the perceived usefulness of the service when the results meet expectations (Bhattacharjee, 2001b). This study introduced emotional factors into the ECM to test how positive emotions affect the expectation confirmation process and willingness to continue using digital financial services. Figure 2 shows the conceptual model of the study.

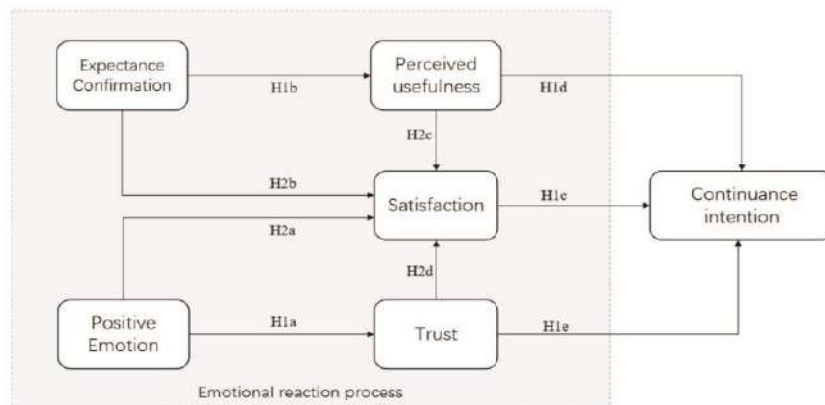


Figure 2. Research framework of Study 1.

Data collection

The respondents in the study are skilled at using digital financial services. A questionnaire was developed based on referencing past research literature. Data collected were used to verify the research models constructed in this study. Before the formal research, we adjusted scales selected from the relevant research literature to perform a pretest. We made further adjustments to the questionnaire by combining teachers' and professors' suggestions, before conducting formal research.

Data were collected from the questionnaires formed at Wen Juan Xing (<https://www.wjx.cn>), one of the largest survey platforms in China. Compared with traditional financial services, digital financial services have more advantages, such as lower trading

costs, no location limitations, and faster service speed. The number of Chinese netizens has increased significantly. Therefore, we chose people proficient in using digital financial services as our sample, indicating that these people have access to the internet and can complete the questionnaire. Based on proximity, we distributed questionnaires to family members, teachers, friends, and classmates. In snowball sampling, respondents were asked to distribute questionnaires to their friends, guaranteeing sample richness. The questionnaire consists of two parts. The first part is an informed consent statement, providing information on the use and scope of the questionnaire and privacy protection measures. Participants were asked to confirm this information. The second part is background information on the respondents and items related to their experiences and feelings about using digital financial services. After filling in the questionnaire, respondents received a random reward, such as discount coupons, from the Wen Juan Xing platform. We used SmartPLS 3.0 for the empirical analysis. SmartPLS can be used for structural equation model analysis. It is widely accepted among scholars as good data analysis software

Measurements

After reviewing some relevant past theories and research literature, we built a model and proposed some hypotheses. Variables were abstracted; specific items were formed on the basis of adjusting scales in existing research. The trust scale, positive emotion scale, expectation confirmation scale, satisfaction scale, perceived usefulness scale, and continuance intention scale were developed to measure their corresponding constructs. The factor loadings of all items were above 0.7. Item responses were averaged to create a single index of trust (Cronbach's $\alpha = 0.889$; CR = 0.918; AVE = 0.693), positive emotion

(Cronbach's α = 0.924; CR = 0.942; AVE = 0.766), expectation confirmation (Cronbach's α = 0.910; CR = 0.937; AVE = 0.788), satisfaction (Cronbach's α = 0.932; CR = 0.948; AVE = 0.785), perceived usefulness (Cronbach's α = 0.894; CR = 0.922; AVE = 0.705), and continuance intention (Cronbach's α = 0.909; CR = 0.933; AVE = 0.738).

We translated the scales into Chinese and then back to English to promote respondents' understanding of the scales and eliminate misunderstandings caused by cultural differences. A five-point Likert scale (1 = strongly disagree, 5 = strongly agree) was used. Table 2 shows the constructs and corresponding measurement items and their sources.

Table 2 here

In this study, we used Smart PLS 3.0 to carry out an empirical analysis of the research data collected. This technology provides a flexible method for scholars to conduct research on people's behavior and give coherent explanations about complex relationships. It is also suitable for predictive and exploratory factor analysis. The reliability and validity of data were tested using the two-step method to ensure that the data were available and the conclusions were valid. Subsequently, a structural model was evaluated. Table 4 shows the test results for reliability.

Table 4 here

Results

In this study, 362 questionnaires were returned, among which 280 were valid, an effective

recovery rate of 77.35%. Table 3 shows the demographic characteristics of the 280 respondents. As the fourth Statistical Report on the Development of Chinese Internet Network indicates, the population ratio of Chinese male and female netizens in June 2019 was 52.4:47.6, indicating a gender balance. Netizens aged 18–40 were in the majority, indicating that gender and age biases had been eliminated in this study. As the collected data shows, most respondents use digital financial services 2~5 times a day, 2~5 times a week, or 2~5 times a month. Most participants had also used digital financial services for 1~8 years, suggesting that the individuals had experience in using digital financial services proficiently. As discussed above, the selection of respondents is reasonable and representative.

Table 3 here

Reliability and validity

Cronbach's α values and CR of latent variables are often used to measure a research model's reliability. AVE was used to test convergence validity. Table 4 and Table A1 show Cronbach's α values, CR, and AVE of each latent variable under positive emotion, as well as factor loading, t-value, and standard deviation (SD) of the items measured. All latent variables' Cronbach's α values and CR under positive emotion are greater than 0.8, far greater than their respective thresholds 0.7, indicating that the model's reliability is good. Factor loadings of all items measured are also greater than 0.7, most of them greater than 0.8, suggesting that these items measure corresponding latent variables very well, thereby guaranteeing good convergence of the measurement models. In addition, all latent variables' AVEs are greater

than 0.6, most of them greater than 0.7, far greater than the AVEs' threshold of 0.6, suggesting the good convergence validity of the model.

Table A1 here

According to the Fornell-Larker Criterion matrix, when the square root of the variable's AVE is greater than the correlation coefficients between it and other variables, discrimination validity between variables is good. Table 4 shows the key constructs' correlation matrix and psychometric properties under positive emotion. The values on the diagonal in the table represent the square root of the AVE of latent variables. As, the square root of the AVE of variables is greater than 0.7 and greater than the correlation coefficients between a specific variable and other variables. Thus, the discrimination validity of the model is good.

Structural model

SmartPLS 3.0 was used to test the model constructed in this study. All hypotheses were tested based on analysis of path coefficient and significance of coefficient, the determination coefficient R^2 , total effect, and the specific indirect effect. Figure 3 shows the results of the data analysis, including the path between each construct, the path coefficient, the corresponding t-value of the coefficient and its significance to the structural equation model, and the corresponding R^2 values.

For the model, most of the hypotheses in this study were confirmed by the analysis results. Empirical evidence strongly supports these hypotheses, with two p-values < 0.01 , one

p-value < 0.05, and most hypotheses with a p-value < 0.001. This indicates strong support from the empirical evidence. We found that positive emotion strongly affects users' satisfaction with digital financial services ($\beta = 0.197$, $p < 0.001$), further confirming previous research. When consumers are in a good mood, their degree of satisfaction with products or services will be higher. Thus, H2a is supported.

In the model, as shown in Figure 3, trust was significantly positively influenced by positive emotion ($\beta = 0.649$, $p < 0.001$); H1a was supported. Expectation confirmation (EC) significantly positively influence users' perceived usefulness ($\beta = 0.675$, $p < 0.001$) and satisfaction ($\beta = 0.402$, $p < 0.001$); H1b and H2b were supported. Perceived usefulness significantly positively influences satisfaction ($\beta = 0.282$, $p < 0.001$); H2c was supported. Trust significantly positively influences satisfaction ($\beta = 0.148$, $p < 0.01$); H2d was supported. Users' continuance intention of using digital financial services was significantly positively influenced by satisfaction ($\beta = 0.249$, $p < 0.01$), perceived usefulness ($\beta = 0.536$, $p < 0.001$) and trust ($\beta = 0.127$, $p < 0.05$). The more satisfied users feel with digital financial services, the stronger their continuance intention. The more useful users think digital financial services are, the stronger their continuance intention. The more users trust digital financial services, the stronger their continuance intention. Therefore, H1c, H1d, and H1e were supported.

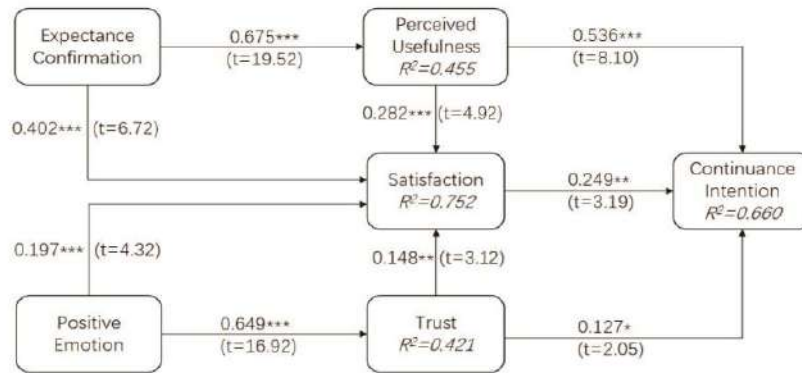


Figure 3. Results of model in study 1

Note: *p < 0.05, **p < 0.01, ***p < 0.001

The large part played by variance in the dependent variable can be explained by independent variables. In the model, EC explains the 45.5% variance of perceived usefulness. Positive emotion explains 42.1% variance of trust. The 75.2% satisfaction variance is explained by EC, perceived usefulness, positive emotion, and trust. The 66% variance of users' continuance intention of digital financial services is explained by perceived usefulness, satisfaction, and trust.

The fitness indicators of the model all proved good. In the model, the NFI value is 0.841, close to 1. The SRMR value is 0.064, lower than 0.08. The χ^2/df value is 4.34, lower than 5. All the indicators' values suggest that the model has good fitness.

Table 5 here

Based on the analysis of the direct effect (DE), specific indirect effect (SIE), and total

effect (TE) of the model constructs presented in Table 5, we summarized the mediating effects of satisfaction. The satisfaction scale was tested for reliability. The Cronbach's α value was greater than 0.8 in the model, indicating good reliability of the satisfaction measure.

Perceived usefulness and trust were considered independent variables, with satisfaction as the mediating variable and continuance intention as the dependent variable. After inserting the mediating variable satisfaction, the TE of perceived usefulness on continuance intention was significant (TE = 0.606, $P < 0.001$). Therefore, the following analysis can be carried out according to the mediating effect. The effect of perceived usefulness on satisfaction was significant ($t = 4.92$, $p < 0.001$). The effect of satisfaction on continuance intention was also significant ($t = 3.19$, $p < 0.01$). Satisfaction had a positive relationship with continuance intention. The more satisfied users feel with digital financial services, the stronger their continuance intention. In addition, the SIE of perceived usefulness on continuance intention was significant (SIE = 0.070, $P < 0.01$). The DE of perceived usefulness on continuance intention was also significant (DE = 0.536, $p < 0.001$). Thus, the mediated path of "perceived usefulness–satisfaction–continuance intention" was significant in the model, and satisfaction partially mediates the positive influence of perceived usefulness on continuance intention, supporting H2e.

After inserting the mediating variable trust, the TE of trust on continuance intention was significant (TE = 0.164, $P < 0.01$). Therefore, the following analysis can also be carried out according to the mediating effect. The effect of trust on satisfaction was significant ($t = 3.12$, $p < 0.01$). The effect of satisfaction on continuance intention was also significant ($t = 3.19$, $p < 0.01$). The SIE of trust on continuance intention was not significant in the model (SIE =

0.037). The DE of trust on continuance intention was also significant (DE = 0.127, $p < 0.05$). Thus, the mediated path of “trust–satisfaction–continuance intention” was not significant in the model. H2f was not confirmed.

Study 2: Risk and value perception of digital financial services in emotional reactions

Study 2 is a controlled laboratory experiment that aims to discover the impact of emotion on perceived risk and perceived value in the use of digital financial services. Improving users’ perceived risk and perceived value is of great significance for the innovation of digital financial services (Cunningham, Gerlach & Harper, 2005; Karjaluoto, Shaikh, Saarijärvi & Saraniemi, 2019). We conducted behavioral experiments to measure the changes in users’ perceived risk and perceived value of digital financial services under the situation of manipulating participants’ emotions.

Experimental design

Laboratory setup: This study was conducted on two occasions in a laboratory setting. According to Figure 4, to avoid interference between different emotional states, the two experiments were conducted on the same group of participants to manipulate their positive and negative emotions. There was a one-week interval between the tests. Participants’ feelings were mobilized to produce positive or negative emotions, and their perceptions of the benefit and risk of using digital financial services were then measured after the emotional manipulation.

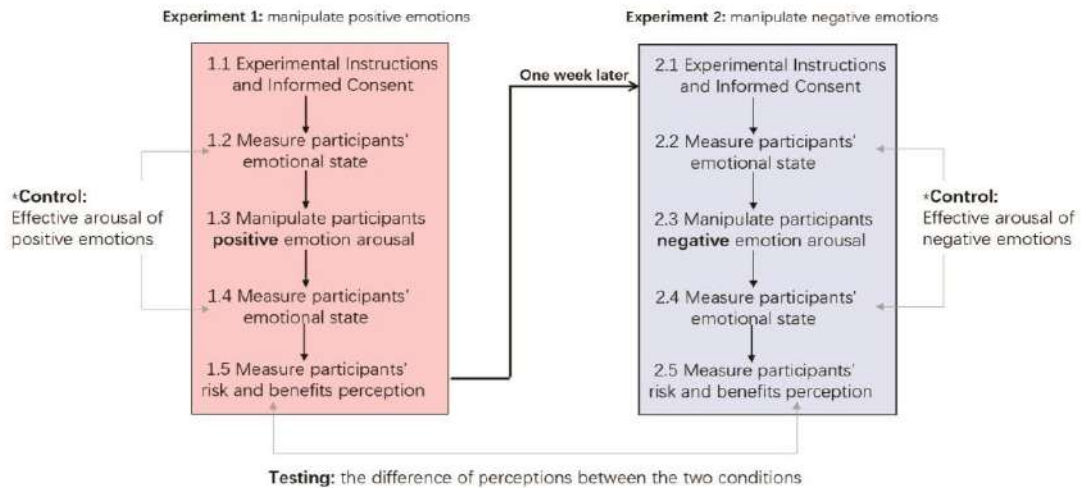


Figure 4: Experimental design on benefit and risk perception of digital financial services reflected by emotions

Emotional manipulation: At a very general level, both emotion and cognition are types of information processing, human emotions are influenced by the information that is input (Lemerise & Arsenio, 2000; Zadra & Clore, 2011), and humans are particularly susceptible to multimedia visual input information (Chen & Wang, 2011). Therefore, having participants watch videos that contain emotional cues is an effective method of evoking these emotions. In this study, participants were asked to watch videos with positive and negative emotional messages in two separate experiments to evoke either positive or negative emotions. To manipulate their positive emotions, the participants were asked to watch a funny video from a public video site on the internet, after which their arousal of positive emotions was measured. These emotions included a sense of happiness, surprise, and delight (Bastian, Kuppens, De Roover & Diener, 2014; Vanhamme, 2016). After a one-week interval, negative emotions

were manipulated. The participants were required to watch a video from a public video website that presented the leaving of a loved one. Their arousal of negative emotions was then measured. These emotions included sadness, anger, and fear. Participants were asked to rate their current state for these emotions on a 7-point scale (extremely weak, very weak, weak, moderate, strong, very strong, and extremely strong).

Decision-making scenarios: When their positive and negative emotions were aroused, the extent to which participants perceived the benefit and the risk was measured when they used digital financial services. Their perceived risk and perceived value were measured using measuring tools drawn from previous literature as shown in Table 6 and described using a 7-point Likert scale: extremely weak, very weak, weak, moderate, strong, very strong, and extremely strong.

Table 6 here

Participants: A total of 121 participants were recruited from a public university in China through two elective courses in internet business management. The average age of the participants was 21, and the participants comprised 42 males and 79 females. The demographic matches the primary cohort of internet consumers in China (CNNIC, 2015). The participants were given rewards distributed as WeChat red envelopes (a payment function of Chinese social apps; the average value is 1 USD).

Reliability and validity of the experiment

The measured data of the two experiments show acceptable Cronbach's α reliability and

composite reliability (CR). In the experiment manipulating positive emotions, the Cronbach's alpha values are greater than 0.8 (positive emotion is 0.886; perceived risk is 0.871; perceived value is 0.885), and CR is greater than 0.8 (positive emotion is 0.895; perceived risk is 0.876; perceived value is 0.891). In the experiment manipulating negative emotions, Cronbach's α values are greater than 0.7 (negative emotion is 0.714; perceived risk is 0.872; perceived value is 0.881), and CR is greater than 0.7 (negative emotion is 0.745; perceived risk is 0.878; perceived value is 0.885).

This study measured the experiment's effectiveness in emotional manipulation by testing the degree of participants' emotional arousal. The emotional status of the participants before and after manipulation was measured. In the positive emotion manipulation experiment, the change in pleasant surprise, joy, and happiness was measured. In the negative emotion manipulation experiment, the change in anger, sadness, and fear was measured. The paired sample t-test was adopted to test whether the participants' emotions were awakened effectively. Table 7 shows the experimental measurement results.

Table 7 here

We used MC to represent mean comparison. In the positive emotion manipulation experiment, positive emotion was successfully stimulated, surprise (MC = -0.603, $P < 0.001$) and pleasure (MC = -0.587, $P < 0.001$) were significantly increased. Happiness (MC = -0.050, $P = 0.569$) changed little and did not increase significantly. Funny short videos can arouse participants' surprise and pleasant emotions in a short time, and happiness is a

relatively stable emotional state. Therefore, the funny videos were not significantly associated with awakening happiness. In the negative emotion manipulation experiment, sadness was successfully stimulated ($MC = -1.736, P < 0.001$), and fear ($MC = -0.934, P < 0.001$) was significantly increased. Anger ($MC = 0.033, P = 0.800$) showed little change and was not significantly increased. In the experiment, participants were shown a video that induced negative emotions, a separation between loved ones in life or death scene in a disaster movie, successfully evoking feelings of sadness and fear. The video depicting family separation did not significantly arouse anger. Figure 5 shows the changing states of emotions.

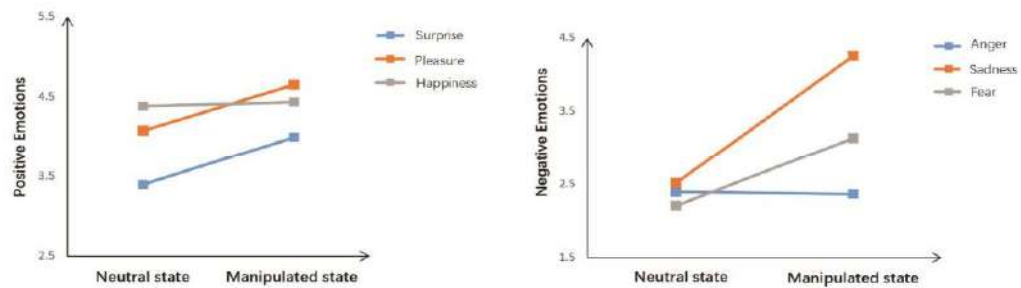


Figure 5. The changing states of different emotions in the experiment

Findings

We further measured the perceived risk (PR) and perceived value (PV) of participants using digital financial services in the wake of positive and negative emotions. In the two experiments, the paired sample t-test of participants' perception of risk and perceived value measurement items was analyzed under the arousal of positive and negative emotions to demonstrate empirically whether emotional arousal would affect participants' perception of risk and return when using digital financial services. Table 8 shows the results.

Table 8 here

We used MD to represent mean difference. PR1 (MD= 0.116, P = 0.389), the first item of perceived risk, reflects participants' concern regarding the credibility of digital financial services and has not been proved to cause significant changes under different emotional arousal states. The second item of perceived risk PR2 (MD= -0.025, P = 0.851) reflects participants' concern about the failure of digital financial services to bring expected benefits, and there is no significant change in the different emotional arousal states. The third item of perceived risk, PR3 (MD=0.116, P = 0.309), reflects participants' concern about the security risk of digital financial services, and no significant change was confirmed under different emotional arousal states. The fourth perceived risk item, PR4 (MD= 0.273, P = 0.026), reflects participants' concern about the risk of loss brought about by digital financial services. It is significantly affected by emotional changes. Participants with negative emotions are more likely to perceive the risk of loss, supporting H4.

The first item of perceived value, PV1 (MD= -0.174, P = 0.223), reflects participants' perception of the necessity for digital financial services. It has not been proved to cause significant changes under different emotional arousal states. The second perceived value item, PV2 (MD= -0.331, P = 0.004), reflects participants' perception of the expected benefits brought by digital financial services. It is significantly affected by emotional changes. The third perceived value item, PV3 (MD=-0.124, P = 0.334), reflects participants' perception of digital financial services meeting expectations. It did not show significant changes under

different emotional arousal states. The fourth item of perceived value, PV4 (MD=-0.248, P=0.045), reflects participants' perception of the benefits of using digital financial services. This item is significantly affected by emotional changes. Participants experiencing positive emotions are more likely to perceive the benefits of digital financial services, supporting H3.

Study 3: Adoption of digital financial services in AI-enabled positive emotion affordance.

Design of experiment

Study 3 used a single factor (advertisement type: static service introduction page vs. AI-based interactive service introduction page) within-subject group experimental design. The manipulated material for the advertisement type in this experiment consisted of two parts: The first part is picture material asking participants "At present, the recommendation pages of digital financial services are static advertisements. Take Yu 'ebao as an example, the recommendation pages of this service are only static pictures. The following picture is a 3-page recommendation page of Yu 'ebao business that we have captured from Alipay. Please answer the following questions truthfully according to the feelings brought to you by this recommended advertisement". The second part is the video material used to give the subject positive emotion stimulus by introducing a smart assistant who can interact with users on advertisement page. In the AI-based interactive advertisement's scenario, the video shows that when the user opens Yu Ebao service in Alipay, there will pop up a smart assistant named Xiao Yu who can interact with users intelligently, show specific operation procedure and introduce each service segment of Yu Ebao vividly. In order to enhance the emotional

stimulus effect after participants watching video, we inserted dynamic pictures between questions. In the static advertisement scenario, when the user opens Yu Ebao service in Alipay, they can only see some static pictures introducing Yu Ebao service with no intelligent voice introduction, and they can only explore the function of each service segment by themselves. Figure 6 shows common service and AI-enabled positive emotion affordance scenario.



Figure 6. common service and AI-enabled positive emotion affordance scenario

Procedure of experiment and variable measurement

Experiment 3 was conducted as a situational experiment with a questionnaire. Data were collected through an online questionnaire created on an online survey platform namely Wenjuanxing. 150 subjects were recruited. Participants were recruited by forwarding questionnaire link to participate in the study to groups on various social platforms. Our experiment conforms to the experimental requirements and the real advertisement page of Yu Ebao on Alipay. To ensure participants could relate to the overall experimental scenario, we

only recruited participants who had access to the internet and were able to answer the study questions. After reading the experimental design material, the success of the independent variable manipulation was examined by asking subjects about the degree to which they feel relaxed, joyful, happy and interesting after reading the advertisement, followed by questions on satisfaction measure, measure of intention to use, measure of perceived value and measure of perceived risk. Satisfaction measure is used to measure participants' satisfaction degree with digital financial services in the corresponding situation. One satisfaction measure asked: "I feel I am generally satisfied with digital financial services after reading the recommended advertisement above". Intention to use as the dependent variable was measured using one question "I feel that I would like to use digital financial services for a long time after reading the recommended advertisement above". A 5-point Likert scale was used for all measures, with "1" representing very low or strongly disagreement and "5" representing very high or strongly agreement. A total of 150 questionnaires were collected in study 3, of which 10 were deleted for inconsistent answers or refusing to answer, leaving 140 valid questionnaires. The demographic results showed that female subjects accounted for 64.3% of the total number of subjects with male subjects accounting for 35.7% of the total number. The average age of subjects was mainly under 25 (70.0%).

Results of study 3 and discussion

With reference to a manipulation test, the experiment was conducted by asking subjects "The degree to which you feel relaxed, joyful, happy and interesting after reading the recommended advertisement above" (1=very low, 5=very high) to test for manipulation of the

independent variable, a 5-point Likert scale was used for this measure. As shown in figure 7, for material 1 (static service introduction page), $M_{pre-emotion} = 2.40$ ($SD = 1.124$), indicating that subjects perceived a lower degree of emotion in material 1. For material 2, $M_{post-emotion} = 2.78$ ($SD = 1.004$), indicating that subjects perceived a higher degree of emotion in material 2. The paired sample T-test showed that $M_{post-emotion} = 2.78 > M_{pre-emotion} = 2.40$ ($MD = -0.379$, $t = -4.165$, $p < 0.001$), indicating the success manipulation of positive emotion. As the results show, AI-enabled positive emotion affordance can significantly increase users' positive emotion, supporting H5.

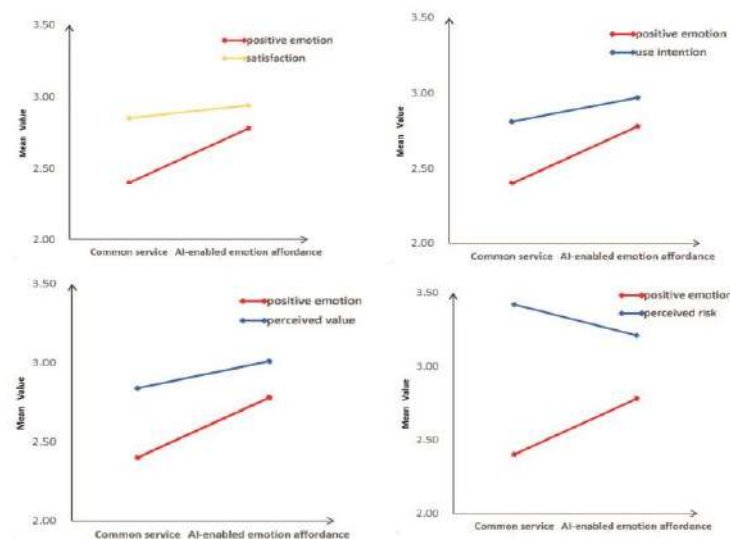


Figure 7. The effect of AI-enabled positive emotion affordance on digital financial service adoption

Satisfied with manipulation test, we could proceed to test hypothesis. The study used paired sample t-test to test hypothesis, and the result showed a significantly difference in the effect

of AI-enabled positive emotion affordance on intention to use ($M_{\text{post-intention to use}} = 2.97 > M_{\text{pre-intention to use}} = 2.81$, $MD = -0.157$, $t = -2.356$, $p < 0.05$), supporting H6, on satisfaction ($M_{\text{post-satisfaction}} = 2.94 > M_{\text{pre-satisfaction}} = 2.85$, $MD = -0.093$, $t = -1.338$, $p > 0.05$), not supporting H7, on value perception ($M_{\text{post-value perception}} = 3.01 > M_{\text{pre-value perception}} = 2.84$, $MD = -0.179$, $t = -2.776$, $p < 0.01$), supporting H8, on risk perception ($M_{\text{post-risk perception}} = 3.21 > M_{\text{pre-risk perception}} = 3.42$, $MD = 0.207$, $t = 2.820$, $p < 0.01$), supporting H9. The reason why H7 was not verified may be that our satisfaction can only develop after we use a product for a long time.

Study 3 demonstrated a significant difference in the effect of AI-enabled positive emotion affordance on consumer's positive emotion, use intention, value perception and risk perception of digital financial services. Consumers' positive emotion will be aroused when they can interact with anthropomorphic artificial intelligence service assistant. They are more willing to use digital financial services with AI-based interactive service introduction page than those with static service introduction page. And in AI-enabled positive emotion affordance scenario, users' value perception will increase, while their risk perception will decrease. In study 1, we found that positive emotions can promote users' intentions to continue to use digital financial services and also exert a significant positive role through the intermediary effect of trust and satisfaction. In study 2, we confirmed that positive emotion arousal can increase consumers' perceived value and reduce their perceived risk. Here, we confirmed AI-enabled positive emotion affordance can stimulate one's positive emotion and value perception, reduce risk perception, which is consistent with findings in study 1 and study 2. From the three studies, we found that AI-based interactive advertisement can

effectively arouse one's positive emotion compared with advertisement based on static pictures, and it will enhance user's services adoption.

Discussion and implications

This paper explores the role of emotion in digital financial services, laying an empirical foundation for digital finance innovation while serving users. Digital technology provides a platform and support for financial service innovation, which has significant social and commercial value (Ye, Chen & Li, 2022). The platform could interact with users better and provide more effective service innovation based on digital technology. This study used mixed methods research to carry out a two-stage behavioral experiment with a time interval of one week, manipulating the emotions of 121 subjects. Users' perception of the value of digital financial services rose significantly in the state of positive emotional arousal. In contrast, users' perception of the risk of capital loss decreased. Emotional factors were included in the expectation confirmation model (Bhattacharjee, 2001b) in the more general usage scenarios to verify the function of positive emotions in facilitating digital financial services. Having an active emotional interaction with users is an innovative measure that would enhance users' perception of value and encourage them to continue using the service.

Theoretical significance

This research has theoretical significance. First, it verifies and explores the function of emotion in digital financial services, demonstrating that the arousal of positive emotions reduces the perception of the risk of asset loss significantly and improves the perception of the value of service. In addition, positive emotions raise users' satisfaction significantly and encourage them to use digital financial services continuously. As digitization becomes a

trend, this paper expands the interpretation of ECT (Bhattacharjee, 2001b; Kahneman & Tversky, 2013). Second, it provides a basis for further research exploring digital financial services under positive emotional interaction. This study confirms that emotion promotes users' willingness to continue to use digital financial services through trust and satisfaction. It also lays a theoretical foundation for expanding and exploring the emotional factors in the digital technology innovation service experience.

Although our research is limited to a Chinese sample, this empirical study of emotional factors in digital financial services provides new insights for researchers and practitioners.

Practical implications

This research lays the empirical foundation for using positive emotional interactions to innovate digital financial services. The emotions of users can be directed in a digital context. Positive emotional interactions will significantly improve user perceptions of services. Improved user satisfaction and trust will trigger a willingness to use digital financial services constantly. The post-truth effect of the internet means that digital technology can easily arouse users' emotions. Sometimes emotions will have greater effects on people's behaviors than truth (Laybats & Tredinnick, 2016). Therefore, it is necessary to see emotional management as an important component of innovative digital financial services. During digital financial service innovation, it is essential to arouse users' positive emotions. For example, a friendly human-computer interaction interface can be designed, and interesting videos and animations can be used to please users. In addition, intelligent systems can be used for business recommendations while users are emotionally positive, especially for business recommendations of wealth management products. In short, it is vital to arouse

positive emotions in users.

Directions for future research

We should acknowledge some limitations of this study. First, users' positive and negative emotions can be further divided into different categories. This study only divided emotions into positive and negative and did not pay attention to the impact of specific emotions in these two categories. Future research could subdivide emotions to explore the impact of a specific emotion on the use of digital financial services. Second, future research could analyze the decision-making behaviors when using digital financial services, especially the impact on the decision-making function of financial services under the context of emotional arousal. According to the research by Lian, Ma & Wang (2019), individuals "reach for yield," that is, have a greater appetite for risk-taking when interest rates are low. This research indicated the positive influence from negative emotions on risk of loss perception. Does the low interest rates have any connections with negative emotions becomes an interesting future research topic. Third, this study provides an empirical basis for conducting positive emotional interactions in digital financial services innovation. Future research could refine the specific measures to mobilize participants' positive emotions in digital financial services innovation and compare the effectiveness of different measures. Fourth, this study expanded the interpretation scope of the user information system sustainable utilization model and brought the factors of emotion and trust into the ECM, resulting in more comprehensive and effective business models. Future research could also explore modeling to show the proposed service innovation model based on emotional factors under different use scenarios and verify its

effectiveness.

Reference:

- Abu-Shamaa, R., Abu-Shanab, E. (2015). Factors influencing the intention to buy from online stores: an empirical study in Jordan. In: Proceedings of the 2015 IEEE 8th GCC Conference and Exhibition (GCCCE), pp. 1–6.
- Alarcao, S. M., & Fonseca, M. J. (2017). Emotions recognition using EEG signals: A survey. *IEEE Transactions on Affective Computing*, 10(3), 374-393.
- Alghamdi, A., Elbeltagi, I., Elsetouhi, A., & Yacine Haddoud, M. (2018). Antecedents of continuance intention of using Internet banking in Saudi Arabia: A new integrated model. *Strategic Change*, 27(3), 231-243.
- Ali, F., Amin, M. & Cobanoglu, C.(2016). An Integrated Model of Service Experience, Emotions, Satisfaction, and Price Acceptance: An Empirical Analysis in the Chinese Hospitality Industry. *Journal of hospitality marketing & management*, 25(4): 449-475.
- Au, A. (2021). FinTech innovation and knowledge flows in Hong Kong's financial sector: a social network analysis approach. *Journal of Asia Business Studies*.
- Bastian, B., Kuppens, P., De Roover, K., & Diener, E. (2014). Is valuing positive emotion associated with life satisfaction?. *Emotion*, 14(4), 639.
- Beaudry, A., & Pinsonneault, A. (2010). The other side of acceptance: studying the direct and indirect effects of emotions on IT use. *MIS Quarterly*, 34(4), 689–710.
- Belanger, F. & Carter, L. (2008). Trust and risk in e-government adoption. *Journal of Strategic Information Systems*, 17(2): 165-176.
- Belli, S., & Broncano, F. (2017). Trust as a meta-emotion. *Metaphilosophy*, 48(4), 430-448.
- Bhattacharjee, A. (2001a). An empirical analysis of the antecedents of electronic commerce service continuance. *Decision support systems*, 32(2), 201-214.

- Bhattacharjee, A. (2001b). Understanding information systems continuance: an expectation-confirmation model. *MIS quarterly*, 351-370.
- Biswas, A., Jaiswal, D. & Kant, R. (2021). Augmenting bank service quality dimensions: moderation of perceived trust and perceived risk. *International Journal of Productivity and Performance Management*.
- Brave, S., & Nass, C. (2009). Emotion in human-computer interaction. *Human-computer interaction fundamentals*, 20094635(53-68), 4.
- Calvo-Porrá, C., & Lévy-Mangin, J. P. (2020). An emotion-based segmentation of bank service customers. *International Journal of Bank Marketing*.
- Cao, X., Yu, L., Liu, Z., Gong, M., & Adeel, L. (2018). Understanding mobile payment users' continuance intention: a trust transfer perspective. *Internet Research*.
- Chen, Y. S. & Chang, C. H. (2012). Enhance green purchase intentions The roles of green perceived value, green perceived risk, and green trust. *Management Decision*, 50(3-4): 502-520.
- Chen, C. M., & Wang, H. P. (2011). Using emotion recognition technology to assess the effects of different multimedia materials on learning emotion and performance. *Library & Information Science Research*, 33(3), 244-255.
- Chiu, C. M., Hsu, M. H., Sun, S. Y., Lin, T. C. & Sun, P. C. (2005). Usability, quality, value and e-learning continuance decisions. *Computers & Education*, 45(4):399-416.
- Collier, J. E., & Barnes, D. C. (2015). Self-service delight: Exploring the hedonic aspects of self-service. *Journal of Business Research*, 68(5), 986-993.
- Cunningham, L. F., Gerlach, J., & Harper, M. D. (2005). Perceived risk and e-banking services: An analysis from the perspective of the consumer. *Journal of Financial services marketing*, 10(2), 165-178.

- Cyr, D., Head, M., & Ivanov, A. (2006). Design aesthetics leading to m-loyalty in mobile commerce. *Information & management*, 43(8), 950-963.
- Dabholkar, P. A., Shepherd, C. D., & Thorpe, D. I. (2000). A comprehensive framework for service quality: an investigation of critical conceptual and measurement issues through a longitudinal study. *Journal of retailing*, 76(2), 139-173.
- Dai, H., Luo, X., Liao, Q. Y. & Cao, M. K. (2015). Explaining consumer satisfaction of services: The role of innovativeness and emotion in an electronic mediated environment. *Decision Support Systems*, 70: 97-106.
- Denzin, N. K. (1994). *On understanding emotion*. Transaction Publishers.
- Derks, D., Fischer, A. H., & Bos, A. E. (2008). The role of emotion in computer-mediated communication: A review. *Computers in human behavior*, 24(3), 766-785.
- Ding, Y. & Chai, K. H. (2015). Emotions and continued usage of mobile applications. *Industrial Management & Data Systems*, 115(5) : 833-852.
- Donald, J. N., Ciarrochi, J., & Sahdra, B. K. (2020). The consequences of compulsion: A 4-year longitudinal study of compulsive internet use and emotion regulation difficulties. *Emotion*.
- Dunn, J. R., & Schweitzer, M. E. (2005). Feeling and believing: the influence of emotion on trust. *Journal of personality and social psychology*, 88(5), 736.
- Eriksson, K., & Nilsson, D. (2007). Determinants of the continued use of self-service technology: The case of Internet banking. *Technovation*, 27(4), 159-167.
- Fang, Y., Qureshi, I., Sun, H., McCole, P., Ramsey, E., & Lim, K. H. (2014). Trust, Satisfaction and Online Repurchase Intention: The Moderating Role of Perceived Effectiveness of E-commerce Institutional Mechanisms. *MISQuarterly*, 38(2), 407-427.
- Feine, J., Morana, S., & Gnewuch, U. (2019). Measuring service encounter satisfaction with customer service chatbots using sentiment analysis.

- Finucane, M. L., Alhakami, A., Slovic, P., & Johnson, S. M. (2000). The affect heuristic in judgments of risks and benefits. *Journal of behavioral decision making*, 13(1), 1-17.
- Foroughi, B., Iranmanesh, M. & Hyun, S. S. (2019). Understanding the determinants of mobile banking continuance usage intention. *Journal of Enterprise Information Management*, 32(6): 1015-1033.
- Glimcher, P. W., & Fehr, E. (2014). Introduction: A brief history of neuroeconomics. *Handbook of Neuroeconomics* (2nd ed.), Elsevier: New York.
- Habib, M. D., & Qayyum, A. (2018). Cognitive emotion theory and emotion-action tendency in online impulsive buying behavior. *Journal of Management Sciences*, 5(1), 86-99.
- Hönl, A., Meissner, P. & Wulf, T. (2017). Risk attribution theory: an exploratory conceptualization of individual choice under uncertainty. *Journal of Behavioral & Experimental Economics*, 67(Complete), 20-27.
- Hsiao, C. H., Chang, J. J. & Tang, K. Y. (2016). Exploring the influential factors in continuance usage of mobile social Apps: Satisfaction, habit, and customer value perspectives. *Telematics and Informatics*, 33(2):342-355.
- Hsieh, J. Y., & Liao, P. W. (2011). Antecedents and moderators of online shopping behavior in undergraduate students. *Social Behavior and Personality: an international journal*, 39(9), 1271-1280.
- Hsu, C. L., Judy & Lin, C. C. (2015). What drives purchase intention for paid mobile apps?—An expectation confirmation model with perceived value. *Electronic Commerce Research and Applications*, 14(1), 46-57.
- Huang, Y. M. (2019). Examining students' continued use of desktop services: Perspectives from expectation-confirmation and social influence. *Computers in Human Behavior*, 96, 23-31.

- Im, M., & Oh, J. (2016). Effect of emotion regulation as a de-biasing mechanism on overconfidence in investment behavior. *Journal of Financial Services Marketing*, 21(3), 209-225.
- Jang, S. C. & Namkung, Y. (2009). Perceived quality, emotions, and behavioral intentions: Application of an extended Mehrabian–Russell model to restaurants. *Journal of Business Research*, 62(4): 451-460.
- Joo, Y. J., Lim, K. Y. & Kim, E. K. (2011). Online university students' satisfaction and persistence: Examining perceived level of presence, usefulness and ease of use as predictors in a structural model. *Computers & Education*, 57(2):1654-1664.
- Kahneman, D., & Tversky, A. (2013). Prospect theory: An analysis of decision under risk. In *Handbook of the fundamentals of financial decision making*.
- Karjaluoto, H., Shaikh, A. A., Saarijärvi, H., & Saraniemi, S. (2019). How perceived value drives the use of mobile financial services apps. *International Journal of Information Management*, 47, 252-261.
- Kim, D. J., Ferrin, D. L., & Rao, H. R. (2009). Trust and satisfaction, two stepping stones for successful e-commerce relationships: A longitudinal exploration. *Information systems research*, 20(2), 237-257.
- Kim, M. (2021). Conceptualization of e-services capes in the fitness applications and wearable devices context: Multi-dimensions, consumer satisfaction, and behavioral intention. *Journal of Retailing and Consumer services*, 61.
- Kim, S. & Park, H. (2013). Effects of various characteristics of social commerce (s-commerce) on consumers' trust and trust performance. *International Journal of Information Management*, 33(2):318-332.

- Kim, S. H., Kim, K., Park, M. S., & Yang, J. H. (2011). Effect of Customer's Emotion Experienced during Internet Shopping On Shopping Behavior According to Internet Shopping Motivation. *Management & Information Systems Review*, 30(1), 1-37.
- Koenig-Lewis, N., & Palmer, A. (2014). The effects of anticipatory emotions on service satisfaction and behavioral intention. *Journal of Services Marketing*, 28(6), 437-451.
- Kuo, Y. F. & Wu, C. M. (2012). Satisfaction and post-purchase intentions with service recovery of online shopping websites: Perspectives on perceived justice and emotions. *International Journal of Information Management*, 32(2): 127-138.
- Lankton, N., McKnight, D. H., & Thatcher, J. B. (2014). Incorporating trust-in-technology into Expectation Disconfirmation Theory. *The Journal of Strategic Information Systems*, 23(2), 128-145.
- Laros, F. J., & Steenkamp, J. B. E. (2005). Emotions in consumer behavior: a hierarchical approach. *Journal of business Research*, 58(10), 1437-1445.
- Laybats, C., & Tredinnick, L. (2016). Post truth, information, and emotion. *Business Information Review*, 33(4), 204-206.
- Lee, M. C. (2009). Factors influencing the adoption of internet banking: An integration of TAM and TPB with perceived risk and perceived benefit. *Electronic Commerce Research and Applications*, 8, 130-141.
- Lee, M. C. (2010). Explaining and predicting users' continuance intention toward e-learning: An extension of the expectation–confirmation model. *Computers & Education*, 54(2), 506-516.
- Lehner, O. M. & Simlinger, R. (2019). When function meets emotion, change can happen: societal value propositions and disruptive potential in fintechs. *The International Journal of Entrepreneurship and Innovation*, 20(4), 277-288.

- Lemerise, E. A., & Arsenio, W. F. (2000). An integrated model of emotion processes and cognition in social information processing. *Child development*, 71(1), 107-118.
- Lerner, J. S., Li, Y., Valdesolo, P., & Kassam, K. S. (2015). Emotion and decision making. *Annual review of psychology*, 66, 799-823.
- Lewandowsky, S., & Van Der Linden, S. (2021). Countering misinformation and fake news through inoculation and prebunking. *European Review of Social Psychology*, 1-38.
- Lewandowsky, S., Ecker, U. K., & Cook, J. (2017). Beyond misinformation: Understanding and coping with the “post-truth” era. *Journal of applied research in memory and cognition*, 6(4), 353-369.
- Lewis, B. R. (1993). Service quality: recent developments in financial services. *International Journal of Bank Marketing*, 11(4), 4-12.
- Li, Y. & J. Wang. (2021). Evaluating the Impact of Information System Quality on Continuance Intention Toward Cloud Financial Information System. *Frontiers in Psychology*, 12.
- Lian, C., Ma, Y., & Wang, C. (2019). Low interest rates and risk-taking: Evidence from individual investment decisions. *The Review of Financial Studies*, 32(6), 2107-2148.
- Liao, C. C., Chen, J. L. & Yen, D. C. (2007). Theory of planning behavior (TPB) and customer satisfaction in the continued use of e-service: An integrated model. *Computers in Human Behavior*, 23(6):2804-2822.
- Lin, H. H. & Wang, Y. S. (2006). An examination of the determinants of customer loyalty in mobile commerce contexts. *Information & Management*, 43(3):271-282.
- Lin, J., Wang, B., Wang, N., & Lu, Y. (2014). Understanding the evolution of consumer trust in mobile commerce: a longitudinal study. *Information Technology and Management*, 15(1), 37-49.

- Lin, Z., Whinston, A. B., & Fan, S. (2015). Harnessing Internet finance with innovative cyber credit management. *Financial Innovation*, 1(1), 1-24.
- Lindsley, D. B. (1951). Emotion. In S. S. Stevens (Ed.), *Handbook of experimental psychology* (pp. 473–516). Wiley.
- Liu, Q., Zhang, F., Mao, M., Xue, B., & Lin, Z. (2018). An empirical study on factors affecting continuance intention of using Yu'e Bao. *Tehnički vjesnik*, 25(5), 1414-1420.
- Lopatovska, I., & Arapakis, I. (2011). Theories, methods and current research on emotions in library and information science, information retrieval and human–computer interaction. *Information Processing & Management*, 47(4), 575-592.
- Makanyeza, C.(2017). Determinants of consumers' intention to adopt mobile banking services in Zimbabwe. *International Journal of Bank Marketing*, 35(6): 997-1017.
- Martins, C., Oliveira, T., & Popovič, A. (2014). Understanding the Internet banking adoption: A unified theory of acceptance and use of technology and perceived risk application. *International journal of information management*, 34(1), 1-13.
- Masrek, M. N., Mohamed, I. S., Daud, N. M., & Omar, N. (2014). Technology trust and mobile banking satisfaction: a case of Malaysian consumers. *Procedia-Social and behavioral sciences*, 129, 53-58.
- Mbama, C. I. & Ezepeue, P. O.(2018). Digital banking, customer experience and bank financial performance : UK customers' perceptions. *International Journal of Bank Marketing*, 36(2): 230-255.
- Musa, D., Schulz, R. Harris, R., Silverman, M. & Thomas, S. B. (2009). Trust in the Health Care System and the Use of Preventive Health Services by Older Black and White Adults. *American Journal of Public Health*, 99(7), 1293-1299.

- Mygland, M. J., Schibbye, M., Pappas, I. O., & Vassilakopoulou, P. (2021, September).
Affordances in human-chatbot interaction: a review of the literature. In Conference on e-Business, e-Services and e-Society (pp. 3-17). Springer, Cham.
- Nahin, A. N. H., Alam, J. M., Mahmud, H., & Hasan, K. (2014). Identifying emotion by
keystroke dynamics and text pattern analysis. *Behaviour & Information Technology*,
33(9), 987-996.
- Nejad, M. G. (2022). Research on financial innovations: an interdisciplinary
review. *International Journal of Bank Marketing*, 40(3), 78-612.
- Nekrasova, D. (2011). Emotion and Reason in Making Financial Decisions. *International
Journal of Interdisciplinary Social Sciences*, 5(10).
- O'Neill, O. A., & Rothbard, N. P. (2017). Is love all you need? The effects of emotional
culture, suppression, and work-family conflict on firefighter risk-taking and health.
Academy of Management Journal, 60(1), 78-108.
- Oghuma, A. P., Libaque-Saenz, C. F., Wong, S. F. & Chang, Y. (2016). An expectation-
confirmation model of continuance intention to use mobile instant messaging. *Telematics
and Informatics*, 33(1), 34-47.
- Oliver, R. L. (1980). A cognitive model of the antecedents and consequences of satisfaction
decisions. *Journal of marketing research*, 17(4), 460-469.
- Oliver, R. L. (1993). Cognitive, affective, and attribute bases of the satisfaction response.
Journal of consumer research, 20(3), 418-430.
- Pansari, A., & Kumar, V. (2017). Customer engagement: the construct, antecedents, and
consequences. *Journal of the Academy of Marketing Science*, 45(3), 294-311.
- Pappas, I. O., Kourouthanassis, P. E., Giannakos, M. N., & Chrissikopoulos, V. (2014).
Shiny happy people buying: the role of emotions on personalized e-shopping. *Electronic
Markets*, 24(3), 193-206.

- Pappas, I. O., Papavlasopoulou, S., Mikalef, P. & Giannakos, M. N. (2020). Identifying the combinations of motivations and emotions for creating satisfied users in SNSs: An fsQCA approach. *International Journal of Information Management*, 53.
- Park, M., Jun, J., & Park, H. (2017). Understanding mobile payment service continuous use intention: an expectation-confirmation model and inertia. *Quality Innovation Prosperity*, 21(3), 78-94.
- Patterson, P. G., Johnson, L. W., & Spreng, R. A. (1997). Modeling the determinants of customer satisfaction for business-to-business professional services. *Journal of the academy of marketing science*, 25(1), 4-17.
- Pazarbasioglu, C., Mora, A. G., Uttamchandani, M., Natarajan, H., Feyen, E., & Saal, M. (2020). Digital financial services. World Bank Group, 54.
- Picard, R. W., & Klein, J. (2002). Computers that recognise and respond to user emotion: theoretical and practical implications. *Interacting with computers*, 14(2), 141-169.
- Pixley, J. (2009). Time orientations and emotion-rules in finance. *Theory and Society*, 38(4), 383-400.
- Prietzl, T. T. (2020). The effect of emotion on risky decision making in the context of prospect theory: a comprehensive literature review. *Management Review Quarterly*, 70(3), 313-353.
- Putri, D. A. (2018). Analyzing factors influencing continuance intention of e-payment adoption using modified UTAUT 2 model. In 2018 6th International Conference on Information and Communication Technology (ICoICT) (pp. 167-173). IEEE.
- Rahi, S. & Abd. Ghani, M. (2019). Integration of expectation confirmation theory and self-determination theory in internet banking continuance intention. *Journal of Science and Technology Policy Management*, 10(3): 533-550.

- Roca, J. C., Chiu, C. M. & Martinez, F. J. (2006). Understanding e-learning continuance intention: An extension of the Technology Acceptance Model. *International Journal of Human-Computer Studies*, 64(8):683-696.
- Roig, J. C. F., Garcia, J. S., Tena, M. A. M., & Monzonis, J. L. (2006). Customer perceived value in banking services. *Marketing*, 24(5), 266-283.
- Rychalski, A., & Hudson, S. (2017). Asymmetric effects of customer emotions on satisfaction and loyalty in a utilitarian service context. *Journal of Business Research*, 71, 84-91.
- Ryu, K., Lee, H. R. & Kim, W. G. (2012). The influence of the quality of the physical environment, food, and service on restaurant image, customer perceived value, customer satisfaction, and behavioral intentions. *International Journal of Contemporary Hospitality Management*, 24(2-3), 200-223.
- Sanchez-Franco, M. J., & Rondan-Cataluña, F. J. (2010). Virtual travel communities and customer loyalty: Customer purchase involvement and web site design. *Electronic commerce research and applications*, 9(2), 171-182.
- Shim, Y., & Shin, D. H. (2016). Analyzing China's fintech industry from the perspective of actor-network theory. *Telecommunications Policy*, 40(2-3), 168-181.
- Singh, J. & Sirdeshmukh, D. (2000). Agency and Trust Mechanisms in Consumer Satisfaction and Loyalty Judgments. *Journal of the Academy of Marketing Science*, 28(1):150-167.
- Song, M., Xing, X., Duan, Y., Cohen, J., & Mou, J. (2022). Will artificial intelligence replace human customer service? The impact of communication quality and privacy risks on adoption intention. *Journal of Retailing and Consumer Services*, 66, 102900.

- Sullivan, Y. W. & Kim, D. J. (2018). Assessing the effects of consumers' product evaluations and trust on repurchase intention in e-commerce environments. *International Journal of Information Management*, 39, 199-219.
- Susanto, A., Chang, Y., & Ha, Y. (2016). Determinants of continuance intention to use the smartphone banking services: An extension to the expectation-confirmation model. *Industrial Management & Data Systems*.
- Sweeneya, J. C., & Soutarb, G. N. (2001). Consumer perceived value: The development of a multiple item scale. *Journal of Retailing*, 77, 203-220.
- Szymkowiak, A., Gaczek, P., Jeganathan, K., & Kulawik, P. (2021). The impact of emotions on shopping behavior during epidemic. What a business can do to protect customers. *Journal of Consumer Behaviour*, 20(1), 48-60.
- Tam, C., Santos, D. & Oliveira, T. (2020). Exploring the influential factors of continuance intention to use mobile Apps: Extending the expectation confirmation model. *Information Systems Frontiers*, 22(1), 243-257.
- Teixeira, T., Wedel, M., & Pieters, R. (2012). Emotion-induced engagement in internet video advertisements. *Journal of marketing research*, 49(2), 144-159.
- Valvi, A. C., & West, D. C. (2013). E-loyalty is not all about trust, price also matters: extending expectation-confirmation theory in bookselling websites. *Journal of Electronic Commerce Research*, 14(1), 99.
- Vanhamme, J. (2016). The Surprise–Delight Relationship Revisited in the Management of Experience. In *Memorable Customer Experiences* (pp. 251-270). Routledge.
- Vatanasombut, B., Igarria, M., Stylianou, A. C. & Rodgers, W. (2008). Information systems continuance intention of web-based applications customers: The case of online banking. *Information & Management*, 45(7): 419-428.

- Vazquez, C., & Hervás, G. (2010). Perceived benefits after terrorist attacks: The role of positive and negative emotions. *The Journal of Positive Psychology*, 5(2), 154-163.
- Venkatesh, V., Thong, J. Y., Chan, F. K., Hu, P. J. H., & Brown, S. A. (2011). Extending the two-stage information systems continuance model: Incorporating UTAUT predictors and the role of context. *Information systems journal*, 21(6), 527-555.
- Wu, B. & Chen, X. H. (2017). Continuance intention to use MOOCs: Integrating the technology acceptance model (TAM) and task technologyfit (TTF) model. *Computers in Human Behavior*, 67, 221-232.
- Yang, S. Q., Lu, Y. B., Patrick, Y. K. & Gupta, S. (2017). Role of channel integration on the service quality, satisfaction, and repurchase intention in a multi-channel (online-cum-mobile) retail environment. *International Journal of Mobile Communications*, 15(1), 1-25.
- Ye, Y., Chen, S., & Li, C. (2022). Financial technology as a driver of poverty alleviation in China: Evidence from an innovative regression approach. *Journal of Innovation & Knowledge*, 7(1), 100164.
- Yousafzai, S., Pollister, J. & Foxall, G. (2009). Multi-dimensional role of trust in Internet banking adoption. *Service Industries Journal*, 29(5): 591-605.
- Zadra, J. R., & Clore, G. L. (2011). Emotion and perception: The role of affective information. *Wiley interdisciplinary reviews: cognitive science*, 2(6), 676-685.
- Zhao, Y. P., Chen, X., Miao, X. H., Tan, Y. R., & Song, X. Y. (2021). Never forget where you started: to prevent pre-retirement corruption at China's state-owned enterprises. *Emerging Markets Finance and Trade*, 57(5), 1380-1398.
- Zhao, Y., Ni, Q. & Zhou, R. X. (2018). What factors influence the mobile health service adoption? A meta-analysis and the moderating role of age. *International Journal of Information Management*, 43, 342-350.

Zhou, T. (2013). An empirical examination of user adoption of location-based services.

Electronic Commerce Research, 13(1):25-39.

Zhou, W., Tsiga, Z., Li, B., Zheng, S. & Jiang, S. (2018). "What influence users' e-finance continuance intention? The moderating role of trust". Industrial Management & Data Systems.

Table 1 Dimensions of adoption of digital financial service

Dimensions	Descriptions	Sources
Satisfaction	Satisfied perceptions with digital financial services.	Bhattacharjee, 2001a, 2001b; Roca et al., 2006; Pappas, Papavlasopoulou, Mikalef & Giannakos, 2020
Use intention	Willingness to use digital financial services.	Lee, 2009; Cheng, Lam & Yeung, 2006
Value perception	Benefits achieved by digital financial services using.	Chen & Chang, 2012; Mbama & Ezepeue, 2018
Risk perception	Risk feeling of wealth loss when using digital financial services.	Chen & Chang, 2012; Makanyeza, 2017; Biswas, Jaiswal & Kant, 2021

Table 2 Constructs and measurement items

Constructs	Measurement Items	Sources
Trust (TS)	TS1: I believe my transaction on digital financial services is safe.	Belanger and Carter, 2008; Zhou, 2013; Yousafzai, Pollister & Foxall, 2009; Musa, Schulz, Harris, , Silverman & Thomas, 2009
	TS2: I believe my personal information on digital financial services is safe.	
	TS3: I believe managers of digital financial services won't abuse my personal information.	
	TS4: I trust the information provided by digital financial services.	
	TS5: Based on experience, I know that digital financial services care about consumers.	
Positive Emotion	PE1: When using digital financial services, I feel very happy.	Cyr, Head & Ivanov, 2006;

(PE)	PE2: When using digital financial services, I have a warm feeling.	Pappas et al., 2014; Pappas, Papavlasopoulou, Mikalef & Giannakos, 2020
	PE3: When using digital financial services, I am being valued.	
	PE4: When using digital financial services, I feel excited.	
	PE5: When using digital financial services, I feel very cool.	
Expectation Confirmation (EC)	EC1: I think digital financial services are more useful than what I expected.	Bhattacharjee, 2001a; Bhattacharjee, 2001b; Oghuma et al., 2016; Ding and Chai, 2015
	EC2: My experience with using digital financial services is better than what I expected.	
	EC3: The service level provided by digital financial services is better than what I expected.	
	EC4: In short, the functions of digital financial services met my expectations.	
Satisfaction (ST)	ST1: I am very satisfied with using digital financial services.	Bhattacharjee, 2001a; Bhattacharjee, 2001b; Roca et al., 2006
	ST2: I am very pleased with my use of digital financial services.	
	ST3: My decision to use digital financial services was a wise one.	
	ST4: I feel very contented when using digital financial services.	
	ST5: I feel very happy when using digital financial services.	
Perceived Usefulness (PU)	PU1: I think interest rates for digital financial services are more reasonable than for actual banks.	Bhattacharjee, 2001a; Bhattacharjee, 2001b; Eriksson and Nilsson2007; Oghuma et al., 2016
	PU2: I think it's more convenient to use digital financial services than other methods.	
	PU3: I find it's useful for me to use digital financial services.	
	PU4: Using digital financial services increases my effectiveness.	
	PU5: I think using digital financial services helps me accomplish things more quickly.	
Continuance Intention (CON)	CON1: I intend to continue using digital financial services in the future.	Bhattacharjee, 2001a; Bhattacharjee, 2001b; Eriksson and Nilsson, 2007; Ding and Chai, 2015
	CON2: I strongly recommend other people to use digital financial services.	
	CON3: I want to continue using digital financial services rather than using other platforms.	
	CON4: I want to continue using digital financial services instead of stopping.	

	CON5: I will keep using digital financial services as regularly as I do now.	
--	--	--

Table 3. Descriptive statistics of participants' characteristics

Topic	Choice	Frequency	Percentage
Gender	Male	114	40.7%
	Female	166	59.3%
Age	Under 18	1	0.4%
	18~25	171	61.1%
	26~30	84	30.0%
	31~40	21	7.5%
	41~50	2	0.7%
	51~60	1	0.4%
	Above 60	0	0.0%
Education level	High school and below	7	2.5%
	Junior college	41	14.6%
	Undergraduate	148	52.9%
	Postgraduate	84	27.9%
Frequency of use	2~5 times a day	61	21.8%
	2~5 times a week	99	35.4%
	2~5 times a month	60	21.4%
	2~5 times a quarter	18	6.4%
	2~5 times every half a year	12	4.3%
	2~5 times a year	30	10.7%

Table 4. Indicators for testing reliability and validity

	CON	EC	PE	PU	ST	TS
Continuance Intention (CON)	0.859					
Expectation Confirmation (EC)	0.641	0.888				
Positive Emotion (PE)	0.440	0.628	0.875			
Perceived Usefulness (PU)	0.774	0.675	0.500	0.840		
Satisfaction	0.714	0.798	0.687	0.720	0.886	

(ST)						
Trust (TS)	0.529	0.550	0.649	0.459	0.627	0.832
Cronbach's α	0.909	0.910	0.924	0.894	0.932	0.889
CR	0.933	0.937	0.942	0.922	0.948	0.918
AVE	0.738	0.788	0.766	0.705	0.785	0.693

Note: For the first seven rows, diagonal cells represent the square root of AVE, off-diagonal cells show the correlations coefficients between constructs.

Table 5 Multiple mediation analysis (Bootstrap = 2000)

Type	Paths	Total effect	Direct effect	Specific indirect effect	Types of mediation
Positive Emotion	PU—ST—CON	0.606***	0.536***	0.070**	Complementary mediation
	TS—ST—CON	0.164**	0.127*	0.037	No mediation

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 6 The measurements of benefit and risk perceptions of digital financial services

Constructs	Items	Source
Perceived Value	PV1. I think it is necessary to use digital financial services. PV2. I think digital financial services will bring the expected benefits. PV3. I think digital financial services have achieved my goal of financial management. PV4. I think the benefits of digital financial services are realistic.	Sweeney & Soutarb, 2001; Roig, Garcia, Tena & Monzonis, 2006
Perceived Risk	PR1. I am worried about the reliability of digital financial services. PR2. I am worried that digital financial services will not bring the benefits I expect.	Lee, 2009; Martins, Oliveira &

	PR3. I am worried about the security risks of digital financial services. PR4. I am worried that digital financial services will cause me to make losses.	Popovič, 2014
--	--	---------------

Table 7. Significance test of emotional manipulation effect in the two experiments

Experiment	Mood		Mean	Mean difference test					
				Mean Comparison	Standard Deviation	95% confidence interval		T	Sig.
Manipulating positive emotions	Surprise	N	3.39	-.603	1.261	-.830	-.376	-5.261	.000
		M	3.99						
	Pleasure	N	4.07	-.587	1.108	-.786	-.387	-5.825	.000
		M	4.65						
	Happiness	N	4.38	-.050	.956	-.222	.123	-.570	.569
		M	4.43						
Manipulating negative emotions	Anger	N	2.39	.033	1.431	-.225	.291	.254	.800
		M	2.36						
	Sadness	N	2.51	-1.736	1.883	-2.074	-1.397	-10.138	.000
		M	4.25						
	Fear	N	2.20	-.934	1.721	-1.244	-.624	-5.969	.000
		M	3.13						

Note: N means a neutral state, M means a manipulated state.

Table 8. Test of the difference between participants' perceived risk and perceived value under positive and negative emotional arousal

Variable	Manipulated item		Mean	Mean difference test					
				Mean difference	Standard deviation	95% confidence interval		T	Sig.
Perceived risk	PR1	P	4.00	.116	1.473	-.149	.381	.864	.389
		N	3.88						
	PR2	P	4.11	-.025	1.446	-.285	.235	-.189	.851
		N	4.13						
	PR3	P	3.99	.116	1.246	-.109	.340	1.021	.309
		N	3.88						

	PR4	P	3.96	.273	1.329	.033	.512	2.257	.026
		N	3.69						
Perceived value	PV1	P	3.00	-.174	1.558	-.454	.107	-1.225	.223
		N	3.17						
	PV2	P	3.17	-.331	1.234	-.553	-.108	-2.946	.004
		N	3.50						
	PV3	P	3.02	-.124	1.406	-.377	.129	-.970	.334
		N	3.15						
	PV4	P	3.37	-.248	1.343	-.490	-.006	-2.030	.045
		N	3.62						

Note: P means in a positive emotional state. N means in a negative emotional state. MD is mean difference

Appendix:

Table A.1 Indicators for testing reliability and validity in positive emotion model

Constructs and items	Loading	T-value	Mean	SD
TS1	0.747	15.419	0.746	0.048
TS2	0.846	38.076	0.846	0.022
TS3	0.877	45.451	0.877	0.019
TS4	0.867	52.392	0.867	0.017
TS5	0.818	38.049	0.819	0.021
PE1	0.853	42.379	0.853	0.020
PE2	0.877	49.491	0.877	0.018
PE3	0.887	49.187	0.887	0.018
PE4	0.900	61.373	0.900	0.015
PE5	0.858	46.436	0.858	0.018
EC1	0.895	60.084	0.895	0.015
EC2	0.902	54.569	0.902	0.017
EC3	0.890	53.601	0.890	0.017
EC4	0.863	40.946	0.863	0.021
ST1	0.894	65.967	0.895	0.014
ST2	0.885	56.203	0.885	0.016
ST3	0.879	53.846	0.880	0.016
ST4	0.906	65.071	0.907	0.014
ST5	0.866	47.318	0.866	0.018
PU1	0.743	22.954	0.743	0.032
PU2	0.832	40.974	0.833	0.020

PU3	0.890	55.917	0.890	0.016
PU4	0.864	37.751	0.863	0.023
PU5	0.861	47.950	0.861	0.018
CON1	0.891	56.908	0.891	0.016
CON2	0.835	29.679	0.835	0.028
CON3	0.915	72.541	0.915	0.013
CON4	0.913	79.854	0.914	0.011
CON5	0.727	17.837	0.727	0.041

D3.3 MV-GNN: Multi-View Graph Neural Networks for CTR Prediction

Zhai, P. Y.^a, Yang, Y. W.^a and Zhang, C. J.^b

^a Department of Management, Huazhong University of Science and Technology
E-mail: {zhaipanyu.isec, yangyanwu.isec}@gmail.com

^b Department of Computer and Information Technology, Beijing Jiaotong University
E-mail: cjzhang@bjtu.edu.cn

Abstract

As a prevalent problem in online advertising, CTR prediction has attracted plentiful attention from both academia and industry. The GNN framework enables high-order feature representations in non-Euclidean spaces. Recent studies have emerged to establish CTR prediction models using GNN to enhance feature interactions. This paper proposes a GNN-based model (MV-GNN) for CTR prediction, which is capable of integrating representations of users, ads, features and users' behavior sequences in the context of online advertising. In our model, a feature interaction approach (GraphFwFM) is designed to capture feature representations in the feature graph, and GraphSAGE is employed to obtain representations of users and ads in user graph and ad graph. Experiments conducted on three public datasets show that MV-GNN outperforms several state-of-the-art baselines in AUC and Logloss, and GraphFwFM is useful in capturing high-order interactions in the feature graph.

Keywords: CTR prediction, graph neural networks, feature interactions, deep learning, online advertising

D3.4 Classification of Restricted and Unrestricted Content based on Convolutional Neural Network and Long Short-Term Memory (CNN-LSTM) Method

Zhang, X. P.^a and Choi, J. W.^b

^a Department of Business Administration, Soonchunhyang University

E-mail: zhangxiuping@sch.ac.kr

^b Department of Business Administration, Soonchunhyang University

E-mail: jaewonchoi@sch.ac.kr

Abstract

The development of social media is beneficial for users to quickly access various types of information online. However, this can be a risky for teenagers under the age of 18 years because they may become exposed to information that is unsuitable for them. It is important to classify restricted and unrestricted content to protect teenagers' online safety because teenagers are more likely to be negatively affected by biased and harmful content than adults are. We suggest a strategy for classifying restricted and unrestricted content in this study by examining content comments. We collected and cleaned comments obtained from YouTube. Word2vec was used to display comments as vectors, and the classifier was established using convolutional neural network and long short-term memory. Through our findings, we hope make the social media environment more secure to protect the physical and mental health of teenagers.

Keywords: Content classification, convolutional neural network, long short-term memory

Introduction

The practice of sharing and watching online videos via social media has exploded in popularity in recent years (Rubenking, 2019). Video watching is becoming an important part of daily life for social media users (Ferchaud et al., 2018). YouTube is one of the largest video-sharing platforms, allowing users to upload, view, rate, and share videos (Khan, 2017). According to the report from statista, the global YouTube user base is expected to reach 2,854.14 million people by 2025. Furthermore, it was shown that the majority of YouTube users in the United States are between the ages of 15 and 25 (Statista, 2021; Statista, 2022). It follows from the above that teenagers under the age of 18 years occupy an important position among YouTube users (Livingstone et al., 2014).

While teenagers under the age of 18 years benefit from social media by interacting with and learning from others, they are also at risk of exposure to large amounts of objectionable online content (O'Keeffe and Clarke-Pearson, 2011). Social media violence and cyberbullying are on the rise. Video-sharing sites are generally regarded as sites that bring online risks to teenagers under the age of 18 years (Livingstone et al., 2014).

YouTube is the most used free video-sharing platform globally and the most utilized social media platform. Therefore, we selected YouTube as the object of this study. On YouTube, restricted content refers to content or videos that contain vulgar language, sexual content, gore/violence, or dangerous activity (YouTube). In order to prevent teenagers under the age of 18 years from accessing restricted video on the YouTube platform, the platform provides regulations to control restricted content as well

as employees who are responsible for evaluating content based on user requests, among other measures. However, a sizable proportion of videos that can be categorized as restricted content are still accessible on the website, and many of them are not labeled, making them accessible to teenagers. This is related to the reasons that the quantity of videos uploaded to the platform is expanding on a regular basis (Southerton et al., 2021). Meanwhile, it has been discovered that restricted videos are incredibly popular, garnering a large number of views and likes. Teenagers are classed as vulnerable groups owing to their lack of life experience, which makes it difficult for them to distinguish right from wrong. They may be particularly vulnerable to the effects of a video and may imitate the inappropriate behavior displayed in it (Narayanan, 2018; Janssen et al., 2018). Video categorization can assist video-sharing platforms in distinguishing unacceptable videos from acceptable videos, as well as in implementing autonomous video management (Huang et al., 2010).

Comments reflect the feelings, perceptions, and opinions of viewers about the content they watch (Yu et al., 2019). Over than 100 million people interact with videos on YouTube every week, according to the survey of YouTube. They do so by rating, sharing, and commenting on videos. The comments of users can be used to explain the content of a video, and can be valid evidence to declare the video quality, perfection, relevance, and popularity (Huang et al., 2010; Kavitha et al., 2020) Therefore, users' comments on a video can be highly beneficial for video classification. In this study, we classify restricted content based on YouTube video comments using deep learning methods. The following two questions will be the primary focus of our discussion: (1) How effective is deep learning in classifying restricted content? (2) Is hybrid model building using a convolutional neural network (CNN) and long short-term memory (LSTM) effective for restricted content classification?

The following is the structure of the remainder of this study: Section 2 summarizes related work and discusses how this study differs from previous work. Detailed explanations of the methodology and experimental results are provided in Sections 3 and 4. The suggested model and its findings are described and discussed in Section 5. Section 6 offers the final conclusion.

Literature review

Previous studies on video classification have found that machine learning can be used to classify videos by constructing classifiers on the metadata and comments on videos (Huang et al., 2010). However, the simplicity of ML functions may reduce their generalization ability. This, combined with limited samples and computational units, makes them unable to handle complex classification problems and express complex functions, and restricts the extent of possible classification (Jang et al., 2020). Some studies used metadata for videos to develop naïve Bayes and support vector machine (SVM) classifiers for detecting videos that contain racism, racist slurs, and feminism (Isa et al., 2008). Neural network technology is widely used for image processing. Detecting pornographic content using motion information and deep learning architectures; using an architecture based on a CNN to detect inappropriate video scenes in video files by analyzing audio and video features; and a fine-grained approach called KidsGUARD1 were proposed to detect videos that contain violent and pornographic scenes (Perez et al., 2017; Mallmann et al., 2020; Cifuentes et al., 2022). Pornographic content detection was hindered by the poor resolution, tiny patch support, and variety in appearance (Gai and Bao, 2019). The analysis of video reviews utilizing long short-term memory (LSTM) methods to identify video content that is detrimental to teenagers has not been addressed before, and this is the focus of our work.

With the help of the CNN and the LSTM, we have developed a text classification system that is hybrid model-building-based. The LSTM model was used to preserve historical information and identify contextual dependencies of text after we employed CNN to extract local characteristics of the text.

Background of the deep learning model

Deep learning replicates how the human brain works in order to create machine learning models with multiple hidden layers, transforms low-level features into higher-level features to represent attribute categories, and reveals scattered features in data. It creates deep network architectures for extracting features efficiently and has good generalization ability (Chen et al., 2014). Many models of deep learning, like as deep neural networks (DNN), LSTM, autoencoder (AE), and CNN have been used in different tasks. Furthermore, the deep learning model has shown remarkable success in the processing

of natural language for a number of situations because the feature definition work can be decreased and higher performance in terms of accuracy can be achieved (Yilmaz and Toklu, 2020; Otter et al., 2020).

Word2vec

As a deep learning model, Word2vec is one of many approaches to word embedding that have been proposed, it is capable of converting text to vector format and relocating words into a new space (Zhang et al., 2015). In other words, the natural language problem is translated into a form that can be understood and processed by machines. Word2vec is able to regulate the dimensions of feature vectors and handle the situation of multiple dimensions. In addition, as compared to other methods of text representation, the word vector created by the word2vec model contains more contextual semantic information, which is beneficial in the training of neural networks, as previously stated (Kim et al., 2021). Each word in word2vec is represented as a vector that is concatenated or averaged with the vectors of the other words in the context. The generated vector is utilized to make context-dependent predictions about further words. Word2vec learns vector representations of words using continuous bag-of-words (CBOW) model and continuous skip-gram model. Figure 1 shows the CBOW and skip-gram models. As seen in the Figure 1, the CBOW model predicts the present word based on context, while the skip-gram model predicts the surrounding words based on the present word (Mikolov et al., 2013).

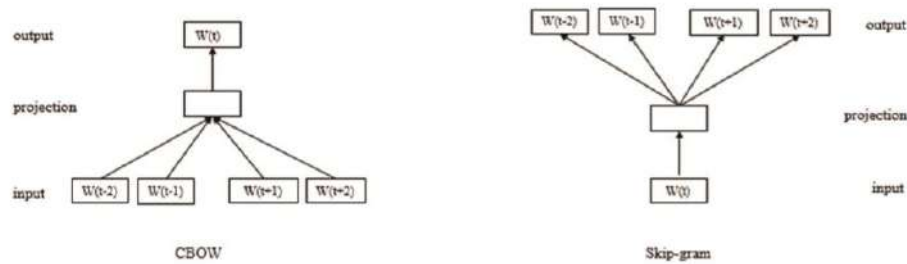


Figure 1. The Method of CBOW and Skip-gram

In previous studies, word2vec was applied to sentiment classification because it can identify the semantic relationship between words in a document. Zhang et al., (2015) utilized word2vec clustering synonyms referencing the same product attributes to verify their ability to extract semantic features, and then SVMperf was used to classify review text. The experimental findings suggest that combining word2vec with SVMperf can achieve satisfactory classification performance. Sun and Chen (2018) devised a method for categorizing short texts using word2vec and the Latent Dirichlet Allocation (LDA) topic model in their study. Gibbs sampling was used in their study to train the LDA topic model based on speech weight. The results were vectorized with topic high-frequency words and trained using word2vec, which lengthened the test text. The extended short phrases were categorized using the SVM approach after the features were increased. In accordance with the experimental findings, the proposed strategy in their research has the potential to greatly improve classification performance. According to Xue et al. (2014), a novel model based on the semantic orientation pointwise similarity distance (SO-SD) model may be used to assess the emotional inclinations of Weibo posts and other social media communications. They began by segmenting Weibo information into discrete Chinese terms with the use of a word segmentation tool. The word2vec program was trained using a subset of the processed Weibo words, resulting in the production of an extended Weibo emotion lexicon. The distance between words was measured in order to establish which group each word belonged to. The researcher pointed out that word2vec has the potential to capture sentiment information in citations. Jang et al. (2019) created a convolutional neural network (CNN) employing two word2vec embedding algorithms, the CBOW model and the skip-gram model, to explore the effect of word2vec on the CNN classification model's outcomes. On real news and tweets, they tested CNN's categorization accuracy using CBOW, skip-gram, and word2vec models. The experimental findings indicated that word2vec considerably enhanced the classification model's accuracy.

Convolutional neural network model (CNN)

The CNN is a multi-stage trainable neural network architecture developed for classification tasks. Its design was inspired by the human eye system (Aydoğan and Karci, 2020). The CNN was initially used for image processing research and achieved excellent results in this field (Gai and Bao, 2019). Recently, the CNN model was effectively used in text classification (Rehman et al., 2019). As part of the investigation into the classification of social media communications, Yu et al. (2019) used a CNN model on three manually labeled Twitter datasets to examine its effectiveness on the categorization of social media messages. Using the findings, it was discovered that the accuracy of the CNN model was superior to that of SVMs and logistic regression models (LR). Georgakopoulos et al. (2018) also proved that CNN was better than traditional text mining algorithms, such as SVMs, naive Bayes, and K-nearest neighbor (KNN), in terms of classification of toxic comments. Wei et al. (2018) evaluated the performance of CNN in categorization using real-world data from a variety of legal projects. They compared the effectiveness with an SVM. The findings indicated that the performance of the CNN model was still superior to that of the SVM model, despite the fact that the CNN model was utilized in the experiment without additional optimization. Pei et al. (2018) suggested a model named TW-CNN which obtains the semantic characteristics of the short text using LDA and word2vec and then extracts the text features using a CNN for classification. The trials demonstrated that the TW-CNN model has a greater classification accuracy than standard machine learning approaches for text categorization. Furthermore, it has been shown that deep CNN is capable of classifying words without any prior knowledge of the words or the syntactic or semantic structure of a language (Zhang and Wang, 2015). This is because the CNN has strong adaptability and can make full use of the convolution filter, which can automatically learn the characteristics suitable for the given task, and no professional knowledge about the structure of the target language is required (LeCun et al., 1998; Otter et al., 2020).

The CNN is built primarily of three layers: the input layer, the hidden layer, and the output layer. In the CNN model, the embedding layer is used to address the sparse matrix problem in recommendation systems. The trained vector values from the embedding layer were sent into the convolutional layer, which extracted the relevant features of the text from the input text. The matrix obtained by the convolution layer was utilized as the input to the polling layer in the next step. The main purpose of the polling layer is to reduce computational complexity. Max-polling is the most used polling technique, which makes use of as much information about the immediate vicinity as possible. The pooling layer outputs the two-dimensional vector, which is flattened and sent to the next layer. Typically, the fully connected layer is the last layer of the CNN. In this study, the CNN model had one embedding layer, three convolutional layers, three max-polling layer, and one max-polling layer. Figure 2 shows the architecture of the CNN used in this study.

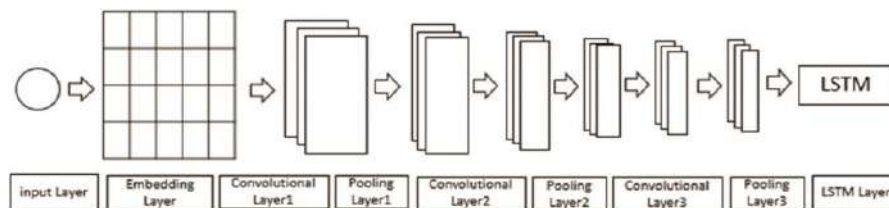


Figure 2. The Architecture of Convolutional Neural Network

Long Short-Term Memory (LSTM)

The Recurrent Neural Network (RNN) is a kind of neural network that was developed from feed forward neural networks, which are capable of processing variable-length sequences of inputs by using their internal state (memory). Hochreiter (1998) proposed the Long Short-Term Memory (LSTM) as a specific sort of RNN. The LSTM seeks to improve the expression of long- and short-time dependency relations, as well as the handling of gradient diffusion and gradient explosion difficulties that are generated by a normal RNN algorithm. The LSTM model has also been shown to be quite powerful in capturing long-distance correlations in sequences of variable lengths, which is another advantage

(Hochreiter, 1998). The LSTM architecture is made up of a cell and three gates: an input gate, an output gate, and a forget gate. Figure 3 depicts the LSTM architecture.

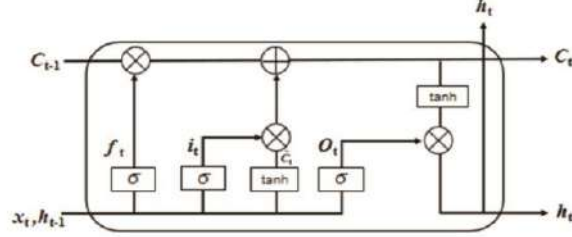


Figure 3. The Architecture of Long Short-Term Memory

The LSTM uses its gates to add, delete, and reset information in each block, which is stored as a cell state. The importance of new information exceeds the importance of current information (Hochreiter and Schmidhuber, 1997). The calculation formula is as follows:

$$i_t = \sigma(W_i h_{t-1} + U_i \alpha_t + b_i) \quad (1)$$

$$f_t = \sigma(W_f h_{t-1} + U_f \alpha_t + b_f) \quad (2)$$

$$\tilde{c}_t = \tanh(W_c h_{t-1} + U_c \alpha_t + b_c) \quad (3)$$

$$c_t = f_t * c_{t-1} + i_t * \tilde{c}_t \quad (4)$$

$$o_t = \sigma(W_o h_{t-1} + U_o \alpha_t + b_o) \quad (5)$$

$$h_t = o_t * \tanh(c_t) \quad (6)$$

σ is the logistic sigmoid function, and $*$ denotes the two vectors' element-wise product. The activation function is denoted by \tanh . The parameters are represented by the letters W , U , and b . W and U denote the weight matrices between two consecutive layers, while b is the bias between the two successive levels. Furthermore, the input gate, forget gate, cell memory, and output gate are represented by the symbols i_t , f_t , c_t , and o_t , respectively. The input vector at time t is denoted by the symbol α_t . As seen in equation (6), the variable h_t not only includes the information represented by α_t but it also contains the past output state h_{t-1} , which may be used to capture dependencies in a phrase based on previous contextual knowledge.

The LSTM is suitable for processing sequence data because of its unique design structure. Numerous research use it in conjunction with other network architectures to address complicated issues. For the classification challenge of large-scale news texts, Li et al. (2018) employed Bi-LSTM-CNN as the learning model. They did not employ a unidirectional LSTM layer to gather context information, but rather a bidirectional LSTM layer. Following that, CNN was utilized to create the contexts for each individual word. The findings revealed that this strategy performs an excellent work to maintain context information while also allowing for a greater variety of word orders. A classification model based on word2vec and LSTM was used to classify patent texts in a study by Xiao et al. (2018). The findings from their analysis show it was discovered that this method outperformed the classification accuracy rates of classification models based on LSTM, KNN, CNN as well as the accuracy rates of models based on CNN and word2Vec. Zhou et al. (2016) suggested a cross-language sentiment categorization model based on an attention-based LSTM. This model employs multilingual bidirectional LSTM to represent the source and destination languages' word sequences. Validation was carried out using a benchmark dataset in which Chinese was used as the source language and English was used as the target language, with exceptional results. Liang and Zhang (2016) introduced a framework for modeling phrases and documents named AC-BLSTM, which combines an asymmetric convolutional neural network (ACNN) with a bidirectional long short-term memory network (BLSTM) for modeling. When training the model, it is applied to phrases and sentences from the Stanford Sentiment Treebank (SST), although only the sentences are examined during the validation phase. The results demonstrate that the AC-BLSTM

model outperforms all other models in the commonly used sentiment classification, question classification, and document classification tasks used by academics.

Astonishing improvements in the area of natural language processing have been made possible by deep learning. Nevertheless, due to CNN's shortcomings in capturing long-term relationships of words in text, some semantic information may be lost, which may result in a reduction in its modeling performance (Zhang and Wang, 2015). Furthermore, LSTM may capture long- or short-term relationships, as well as model text sequences of varying lengths. We propose a hybrid model in this study, which incorporates CNN and LSTM to distinguish between restricted and unrestricted content classification.

Research methodology

This study used unstructured data from YouTube as input. After removing stop words and symbols, word2vec converted words into vectors to identify inference between words conveniently. These vector values became the input for the proposed model, which processed the vector values. Finally, accuracy, precision, recall, and F-score were used to verify the classification results. Figure 4 shows the study process.

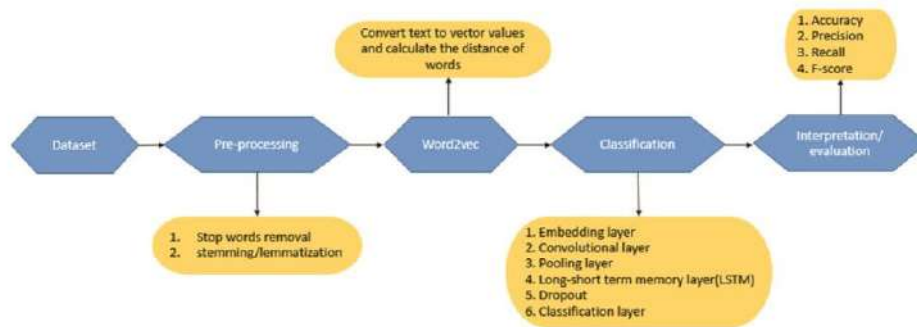


Figure 4. Research Process

The Proposed Hybrid CNN-LSTM model

A schematic diagram of our hybrid CNN-LSTM model is shown in Figure 5. CNN and LSTM were utilized in this model to get the desired results. We started by converting words into vectors using word2vec, since deep learning is unable to interpret human-written text directly. These vector values were sent into the CNN model as its input data. We used convolutional layers to extract local characteristics from the CNN model's input vector values. Next, the feature vector generated by CNN was used as input for the LSTM model, which was used to extract context-dependent features, and a classifier layer was applied at the end of this process.

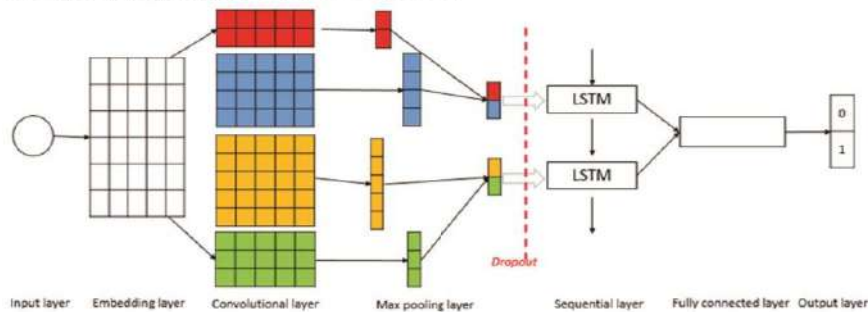


Figure 5. The Architecture of the Proposed Hybrid CNN-LSTM Model

Embedding Layer

The proposed model's first layer is the embedding layer, which is capable of extracting semantic characteristics from the input and initializing vocabulary word vectors through a pre-trained word vector matrix (Rao and Spasojevic, 2016). The embedding layer is initialized using the embedding extracted from word2vec. We froze the embedding layer to maintain the general meaning of the words. This layer's output is used as the input for the convolutional layers of model.

CNN Layer

The embedding layer's data is supplied to the CNN module, which extracts local characteristics from it. v_i is considered as the d -dimensional word vectors for the i^{th} location of a given word in a headline. Assuming the phrase comprises L words and the CNN's sliding window has a size of k , the word vector in the j^{th} ($j \leq L-1$) sliding window may be represented as $v_j, v_{j+1}, \dots, v_{j+k-1}$. They can be represented as window vectors, as follows:

$$X_j = [v_j, v_{j+1}, \dots, v_{j+k-1}] \quad (7)$$

Where the window vector associated with the current word v_j is denoted by the following: $X_{j-k+1}, X_{j-k+2}, \dots, X_j$. Then, for each element Y_j of the feature map for window vector X_j , the following expression may be used:

$$Y_j = f(X_j \odot W + b) \quad (8)$$

Where b is the bias, W denotes the convolution kernel, \odot is the convolution multiplication, f denotes the activation function, and *relu* function may enhance the network's learning dynamics and minimize the number of iterations necessary for convergence in deep networks. The *relu* function is represented by:

$$g(x) = \max(0, x) \quad (9)$$

After the convolution layer, max-pooling is used to dramatically reduce the number of features and parameters, as well as the complexity of the computations involved. It is possible to describe the window vector feature matrix as $Y_{j-k+1}, Y_{j-k+2}, \dots, Y_j$, determining the maximum eigenvalue by performing a maximum operation on each row of the matrix. The maximal produced word feature is represented by the following formula:

$$\alpha_j = \text{Max}(Y_{j-k+1}, Y_{j-k+2}, \dots, Y_j) \quad (10)$$

LSTM Layer

However, although CNN can extract local characteristics from text and increase the accuracy of classification, it has limitations when it comes to identifying context dependencies from the text (Kim and Jeong, 2019). An exceptionally successful method for collecting long-distance correlations in sequences of variable length has been shown using the LSTM algorithm (Hochreiter, 1998). The text feature vector produced by the CNN is passed on to the LSTM as input (Fan et al., 2016). The following is the formula for calculating the result:

$$i_t = \sigma(W_i h_{t-1} + U_i \alpha_t + b_i) \quad (11)$$

$$f_t = \sigma(W_f h_{t-1} + U_f \alpha_t + b_f) \quad (12)$$

$$\tilde{c}_t = \tanh(W_c h_{t-1} + U_c \alpha_t + b_c) \quad (13)$$

$$c_t = f_t * c_{t-1} + i_t * \tilde{c}_t \quad (14)$$

$$o_t = \sigma(W_o h_{t-1} + U_o \alpha_t + b_o) \quad (15)$$

$$h_t = o_t * \tanh(c_t) \quad (16)$$

Each of the CNN layer's α_j output corresponds to an LSTM input at time t . The output of the LSTM layer is sent into the *softmax* classifier, which then performs classification on the information. The *softmax* function converts the average of random outcomes into a 0, 1 form, and its formula is as follows:

$$P(y = i|x, \theta) = \frac{e^{\theta_i}}{\sum_{k=1}^N e^{\theta_k}} \quad (17)$$

Experiments

It is in this part that the suggested CNN-LSTM model's classification performance is evaluated and the results are analyzed using the training dataset. We will first describe the training and testing datasets, and then we will assess the metrics and outcomes that were obtained.

Datasets

This study used two datasets from YouTube as corpus. There are 15 categories divided into YouTube channels, and the people and blogs category has been the most deleted and taken down according to ID Africa's survey (Idafrica, 2016). We collected comments on videos that were and were not labeled age-restricted in the category of people and blogs. The videos deemed unsuitable for teenagers are tagged with "Age-restricted video (based on Community Guidelines)" on YouTube. First, we manually confirmed the videos that fit our purpose, and then crawled comments. Finally, 81,986 comments were taken from videos labeled as age-restricted, and 77,622 comments were obtained from videos not labeled as age-restricted. The corpus was separated into three portions in this study using a 7:1:2 ratio for the training, verification, and testing sets.

Experimental Setting

Keras, a prominent Python package, was used to implement the suggested model. In this study, the CNN model consisted of six layers: one embedding layer, three convolutional layers, and three polling layers. Because DNN consists of a large number of parameters, they are prone to overfitting. With the use of dropout, it is possible to randomly remove the feature detector from the network during training and produce less interdependent network elements, resulting in improved performance (Zhang et al., 2018). Therefore, the dropout technique was used in each convolutional layer to prevent the overfitting of the model. The suggested Hybrid CNN-LSTM model's parameters are listed in Table 1 below, along with their associated values.

Table 1. CNN-LSTM Model Parameter Settings

Parameters	Value
Convolutional function	ReLU
Filter windows size	3,5,7
Learning rate	self-adaptive
Dropout	0.2
Embed size	300
Step size	earlystopping
Batch size	50
LSTM hidden vector size	200

Results and discussion

On the same corpus, two popular deep learning models (CNN and LSTM) as well as the hybrid model suggested in this work were tested for performance. According to the results, the proposed hybrid model outperforms the other LSTM and CNN models in terms of performance. Model performance was evaluated using conventional evaluation measures such as accuracy, precision, recall, and the F-measure. Figure 6 depicts the outcomes of the study.

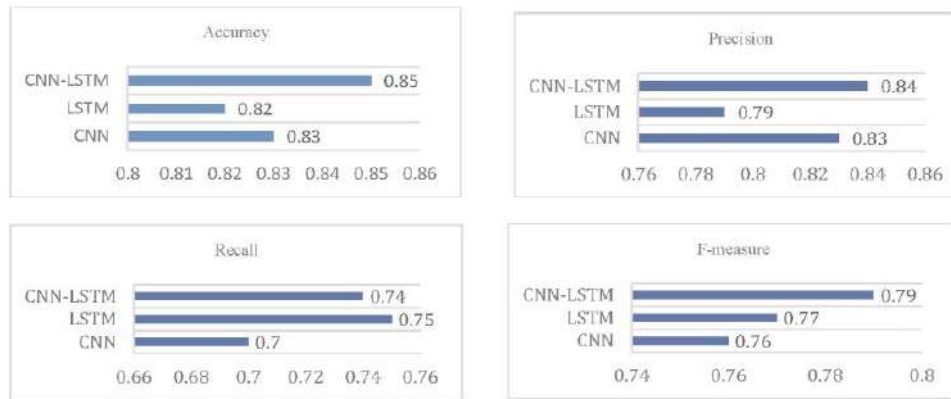


Figure 6. Comparison Results in Accuracy, Precision, Recall and F-measure

The classification system's accuracy is defined as the proportion of correctly classified samples to the total number of samples in each dataset. The accuracy equation can be expressed as $Accuracy = \frac{TP+TN}{(TP+TN+FP+FN)}$. As seen in Figure 6, the hybrid model has an accuracy of 85%, which is greater than the accuracy of LSTM and CNN models of 82% and 83%, respectively. Precision means that the positive examples that are judged to be true account for the proportion of all examples that are judged to be true. The equation can be expressed as $Precision = \frac{TP}{(TP+FP)}$. Additionally, the hybrid model's precision was 84%. This is greater than LSTM and CNN models, which have 79% and 83%, respectively. The recall rate was utilized to account for the relationship between the number of positive examples in the classifier and the total number of positive examples. The equation can be expressed as $Recall = \frac{TP}{(TP+FN)}$. Further, the result of the hybrid model reached 74%, that of the typical LSTM model reached 75%, and that of the CNN model reached 70%. The F-measure tries to achieve a better balance between the influence of the accuracy rate and the recall rate, as well as to assess a classifier more comprehensively. Its equation can be expressed as $F - measure = \frac{(2 * Precision * Recall)}{(Precision + Recall)}$. The result of the hybrid model reached 79%, which is higher than the 77% and 76% of typical LSTM and CNN models, respectively. According to the results, the hybrid CNN-LSTM model was proposed to achieve ideal classification performance for classifying restricted and unrestricted content. The hybrid model not only efficiently exploits the sliding window properties of CNN to extract local features, but it also incorporates LSTM to maintain historical information and extract contextual dependencies from text.

Conclusion

Technology companies should concentrate on creating a secure online environment for teenagers, who account for the preponderance of social media users, as network technology continues to evolve and social media platforms continue to grow in popularity and growth. We suggested a framework for distinguishing restricted and unrestricted videos in this study using online user comments. The study's findings indicate that the suggested framework may successfully assist social media platforms in identifying content that is inappropriate for teens. This study has the potential to make three contributions. First, this study proposed a framework built using deep learning methods by analyzing and summarizing the theoretical and practical experiences of earlier studies, and the examination of user comments demonstrates the suggested framework's superior performance. This enriches the literature in the field of video classification. Second, in contrast to the practice of using machine learning techniques to analyze comments in earlier studies, this study used a combination of CNN and LSTM to build the framework and compared the classification performance of the framework using a single deep learning technique. The results proved that the framework established by hybrid technology showed

excellent classification performance. Third, the results of this study demonstrate that user-generated content can be analyzed to effectively distinguish between restricted and unrestricted videos. Social media platforms must create a safe online environment and improve service quality by analyzing user comments to identify inappropriate content for teenagers in a timely manner.

There are several limitations to this study. First, we only used data from user comments for our study, and future research could consider exploring additional available data types, such as video titles or information about video authors. Second, we only collected data from one category on the YouTube channel. Future research could collect data from other categories to make the dataset more comprehensive. Third, this work focused only on text-based classification algorithms; future research could examine both textual and non-textual aspects for online video categorization.

References

- Aydođan, M., and Karci, A. 2020. "Improving the Accuracy Using Pre-trained Word Embeddings on Deep Neural Networks for Turkish Text Classification," *Physica A: Statistical Mechanics and its Applications*, 541, 123288.
- Chen, Y., Lin, Z., Zhao, X., Wang, G., and Gu, Y. 2014. "Deep Learning-based Classification of Hyperspectral Data," *IEEE Journal of Selected topics in applied earth observations and remote sensing* (7:6), pp. 2094-2107.
- Cifuentes, J., Sandoval Orozco, A. L., and Garcia Villalba, L. J. 2022. A Survey of Artificial Intelligence Strategies for Automatic Detection of Sexually Explicit Videos," *Multimedia Tools and Applications* (81:3), pp. 3205-3222.
- Fan, Y., Lu, X., Li, D., and Liu, Y. 2016. "Video-based Emotion Recognition using CNN-RNN and C3D Hybrid Networks," *In Proceedings of the 18th ACM international conference on multimodal interaction*, pp. 445-450.
- Ferchaud, A., Grzeslo, J., Orme, S., and LaGroue, J. 2018. "Parasocial Attributes and YouTube Personalities: Exploring Content Trends across the Most Subscribed YouTube Channels." *Computers in Human Behavior* (80), pp. 88-96.
- Gai, S., and Bao, Z. 2019. "New Image Denoising Algorithm via Improved Deep Convolutional Neural Network with Perceptive Loss," *Expert Systems with Applications* (138), 112815.
- Georgakopoulos, S. V., Tasoulis, S. K., Vrahatis, A. G., and Plagianakos, V. P. 2018. "Convolutional Neural Networks for Toxic Comment Classification," *In Proceedings of the 10th hellenic conference on artificial intelligence*, pp. 1-6.
- Hochreiter, S. 1998. "The Vanishing Gradient Problem during Learning Recurrent Neural Nets and Problem Solutions," *International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems* (6:02), pp. 107-116.
- Hochreiter, S., and Schmidhuber, J. 1997. "Long Short-term Memory," *Neural computation* (9:8), pp. 1735-1780.
- Huang, C., Fu, T., and Chen, H. 2010. "Text-based Video Content Classification for Online Video-sharing Sites," *Journal of the American Society for Information Science and Technology* (61:5), pp. 891-906.
- Idafrica, 2016. <https://idafrica.ng/13-youtube-facts-the-most-interesting-infographic-youll-see-today/>
- Isa, D., Lee, L. H., Kallimani, V. P., and Rajkumar, R. 2008. "Text Document Preprocessing with the Bayes Formula for Classification Using the Support Vector Machine," *IEEE Transactions on Knowledge and Data engineering* (20:9), pp. 1264-1272.
- Jang, B., Kim, I., and Kim, J. W. 2019. "Word2vec Convolutional Neural Networks for Classification of News Articles and Tweets." *PloS one* (14:8), e0220976.

- Jang, B., Kim, M., Harerimana, G., Kang, S. U., and Kim, J. W. 2020. Bi-LSTM Model to Increase Accuracy in Text Classification: Combining Word2vec CNN and attention mechanism," *Applied Sciences* (10:17), 5841.
- Janssen, T., Cox, M. J., Stoolmiller, M., Barnett, N. P., and Jackson, K. M. 2018. "The Role of Sensation Seeking and R-rated Movie Watching in Early Substance use Initiation," *Journal of youth and adolescence* (47:5), pp. 991-1006.
- Kavitha, K. M., Shetty, A., Abreo, B., D'Souza, A., and Kondana, A. 2020. "Analysis and Classification of User Comments on YouTube Videos," *Procedia Computer Science* (177), pp. 593-598.
- Khan, M. L. 2017. "Social Media Engagement: What Motivates User Participation and Consumption on YouTube?" *Computers in human behavior* (66), pp. 236-247.
- Kim, H., and Jeong, Y. S. 2019. "Sentiment Classification using Convolutional Neural Networks," *Applied Sciences* (9:11), 2347.
- Kim, J., Aum, J., Lee, S., Jang, Y., Park, E., and Choi, D. 2021. "FibVID: Comprehensive Fake News Diffusion Dataset during the COVID-19 Period," *Telematics and Informatics* (64), 101688.
- LeCun, Y., Bottou, L., Bengio, Y., and Haffner, P. 1998. "Gradient-based Learning Applied to Document Recognition," *Proceedings of the IEEE* (86:11), pp. 2278-2324.
- Li, C., Zhan, G., and Li, Z. 2018. "News Text Classification based on Improved Bi-LSTM-CNN," In *2018 9th International conference on information technology in medicine and education (ITME)*, pp. 890-893. IEEE.
- Liang, D., and Zhang, Y. 2016. "AC-BLSTM: Asymmetric Convolutional Bidirectional LSTM Networks for Text Classification," *arXiv preprint arXiv:1611.01884*.
- Livingstone, S., Kirwil, L., Ponte, C., and Staksrud, E. 2014. "In their Own Words: What Bothers Children Online?" *European Journal of Communication* (29:3), pp. 271-288.
- Mallmann, J., Santin, A. O., Viegas, E. K., dos Santos, R. R., and Geremias, J. 2020. "PPCensor: Architecture for Real-time Pornography Detection in Video Streaming," *Future Generation Computer Systems* (112), pp. 945-955.
- Mikolov, T., Chen, K., Corrado, G., and Dean, J. 2013. "Efficient Estimation of Word Representations in Vector Space," *arXiv preprint arXiv:1301.3781*.
- Narayanan, B. K. 2018. "Adult Content Filtering: Restricting Minor Audience from Accessing Inappropriate Internet Content," *Education and Information Technologies* (23:6), pp. 2719-2735.
- O'Keeffe, G. S., and Clarke-Pearson, K. 2011. "The Impact of Social Media on Children, Adolescents, and Families," *Pediatrics* (127:4), pp. 800-804.
- Otter, D. W., Medina, J. R., and Kalita, J. K. 2020. "A Survey of the Usages of Deep Learning for Natural Language Processing," *IEEE transactions on neural networks and learning systems* (32:2), pp. 604-624.
- Pei, K., Chen, Y., Ma, J., and Nie, W. 2018. "Short text classification research based on TW-CNN".
- Perez, M., Avila, S., Moreira, D., Moraes, D., Testoni, V., Valle, E., Goldenstein, S., and Rocha, A. 2017. "Video Pornography Detection through Deep Learning Techniques and Motion Information," *Neurocomputing* (230), pp. 279-293.
- Rao, A., and Spasojevic, N. 2016. "Actionable and Political Text Classification using Word Embeddings and LSTM," *arXiv preprint arXiv:1607.02501*.
- Rehman, A. U., Malik, A. K., Raza, B., and Ali, W. 2019. "A Hybrid CNN-LSTM Model for Improving Accuracy of Movie Reviews Sentiment Analysis," *Multimedia Tools and Applications* (78:18), pp. 26597-26613.
- Rubenking, B. 2019. "Emotion, Attitudes, Norms and Sources: Exploring Sharing Intent of Disgusting Online Videos," *Computers in Human Behavior* (96), pp. 63-71.
- Southerton, C., Marshall, D., Aggleton, P., Rasmussen, M. L., and Cover, R. 2021. "Restricted Modes: Social Media, Content Classification and LGBTQ Sexual Citizenship," *New Media & Society* (23:5), pp. 920-938.
- Statista, 2021. <https://www.statista.com/forecasts/1144088/youtube-users-in-the-world>
- Statista, 2022. <https://www.statista.com/statistics/296227/us-youtube-reach-age-gender/>
- Sun, F., and Chen, H. 2018. "Feature Extension for Chinese Short Text Classification based on LDA and Word2vec," In *2018 13th IEEE Conference on Industrial Electronics and Applications (ICIEA)*, pp. 1189-1194. IEEE.

- Wei, F., Qin, H., Ye, S., and Zhao, H. 2018. "Empirical Study of Deep Learning for Text Classification in Legal Document Review," In *2018 IEEE International Conference on Big Data (Big Data)*, pp. 3317-3320. IEEE.
- Xiao, L., Wang, G., and Zuo, Y. 2018. "Research on Patent Text Classification based on Word2Vec and LSTM," In *2018 11th International Symposium on Computational Intelligence and Design (ISCID) (1)*, pp. 71-74. IEEE.
- Xue, B., Fu, C., and Shaobin, Z. 2014. "A Study on Sentiment Computing and Classification of Sina Weibo with Word2vec," In *2014 IEEE International Congress on Big Data*, pp. 358-363. IEEE.
- Yilmaz, S., and Toklu, S. 2020. "A Deep Learning Analysis on Question Classification Task using Word2vec Representations," *Neural Computing and Applications (32:7)*, pp. 2909-2928.
- YouTube. <https://support.google.com/youtube/answer/2802167?hl=en>.
- Yu, M., Huang, Q., Qin, H., Scheele, C., and Yang, C. 2019. "Deep Learning for Real-time Social Media Text Classification for Situation Awareness—using Hurricanes Sandy, Harvey, and Irma as Case Studies," *International Journal of Digital Earth (12:11)*, pp. 1230-1247.
- Zhang, D., and Wang, D. 2015. "Relation Classification via Recurrent Neural Network," *arXiv preprint arXiv:1508.01006*.
- Zhang, D., Xu, H., Su, Z., and Xu, Y. 2015. "Chinese Comments Sentiment Classification based on Word2vec and SVMperf," *Expert Systems with Applications (42:4)*, pp. 1857-1863.
- Zhang, X., Chen, F., and Huang, R. 2018. "A Combination of RNN and CNN for Attention-based Relation Classification," *Procedia computer science (131)*, pp. 911-917.
- Zhou, X., Wan, X., and Xiao, J. 2016. "Attention-based LSTM Network for Cross-lingual Sentiment Classification," In *Proceedings of the 2016 conference on empirical methods in natural language processing*, pp. 247-256.

D3.5 A Study on Vacant House Estimation using Artificial Intelligence : In the case of Gunsan

Gyoo Gun Lim, Jong Hua Noh, Hyun Tae Lee, Jae Ik Ahn

Hanyang University, Hanyang University, Hanyang University, Hanyang University

Abstract

According to the 2015-2019 Population and Housing Census of the National Statistical Office, the number of vacant houses in South Korea was 1.07 million in 2015, and the national vacancy rate was 6.5%. However, as of 2019, the number of vacant houses in South Korea increased to 1.52 million, and the national vacancy rate increased to 8.4%, and the problem of vacant houses is getting worse. The cause of the increase in vacant houses is a low birth rate and an increase in the elderly population. In areas with many vacant houses, the living environment deteriorates, safety and fire risk occur, so vacant houses are a serious social problem. Therefore, this study aims to respond to the spread of vacant houses through efficient management of vacant houses by developing an artificial intelligence vacant house estimation model using data such as electricity/water consumption, social/economic variables, and building information in Gunsan, Jeollabuk-do.

In this study, the status of vacant houses in Gunsan, electricity consumption, water consumption, building information (area, structure, use, date of approval of use, etc.), individual official land price, individual housing price, basic livelihood recipient status, Gunsan city population status (total population, population over 65 years old, etc.) and spatial information (point of interest information (POI)) were used.

The first model(Model 1) is learned based on electricity consumption, water supply usage, building ledger, individual official land price, individual housing price, the status of recipients of basic living in Gunsan, and the population of Gunsan. The second model(Model 2) is learned by adding the POI information near each address 500 meters to the data of the first model, reduced to three dimensions using principal component analysis (PCA). The third model(Model 3) is trained based on the data used in the second model, without electricity and water supply. The difference in performance of AI models such as Logistic Regression, Ridge Regression, Lasso Regression, Decision Tree, Random Forest, SVM, Gradient Boosting, XGBoost and DNN used in Models 1, 2 and 3 with different data structures and the importance of characteristics for each variable were compared and analyzed.

As a result of the analysis, it was confirmed that Random Forest, Gradient Boosting and XGBoost performed equally well in Models 1, 2, and 3. However, in the case of the Gradient boosting model, hyperparameter tuning and learning take a long time, which is a big disadvantage. To solve this problem, we improved the model by tuning hyperparameters using Optuna and trying the fast boosting algorithm LightGBM. In addition, the model was made lighter through the backward elimination method that removes variables with low importance, and the correlation between variables was lowered and independence was strengthened, thereby advantageously guiding the analysis of feature importance.

The result of this study was to derive a system for preventing the spread of vacant houses and slumping through accurate extraction of vacant house estimation based on artificial intelligence. This is meaningful in that it is possible to effectively manage vacant houses, improve the living environment, and suggest directions for improvement of old houses.

Keywords: Vacant house, Estimation, Artificial intelligence

[DAY 2]

E3 [ICEC-Paper Session]
Service Design & Business Model

E3.1 ¹Value Co-creation of Online Service : A model proposed based on Activity System model

Meng, Y. H.^a; Li, Y.^b; Mou, J.^c and Raheela, B.^d

*^a Department of Business, Pusan National University
E-mail: sarahmengyuhui@163.com*

*^b Department of Business, Liaoning University
E-mail: liying@lnu.edu.cn*

*^c Department of Business, Pusan National University
E-mail: jian.mou@pusan.ac.kr*

*^d Department of Business, Pusan National University
E-mail: batoolrahee@gmail.com*

Abstract

We proposed a conceptual model of value cocreation in online service based on Activity System model, then described the elements and co-creating process in the model so as to provide a theoretical basis for the research in this field.

Keywords: Value co-creation, online service, value co-creating process

Introduction

In the recent years, Value Co-creation is a hot topic which appeared in various industry and enterprise including the real economy, e-commerce and also in the academic research. Norman and Ramirez (1994) defined consumers/providers, and even governments, participating together in an activity to create value (such as service exchange and resource integration) as actors. Early in 2008, consumers were linked as co-creators of value (Xie, Bagozzi & Troye, 2008). Hoyer WD, Chandy R, Dorotic M, Krafft M and Singh SS (2010) defines the degree of co-creation as a function of the scope of consumer co-creation in new product design activities and the intensity of those activities; the scope of co-creation refers to the collaborate tendency of firms and consumers at all stages of product design activities; co-creation intensity refers to the degree to which enterprises depend on co-creation in product development. So we can think of co-creation as "a cooperative activity in the provision of services such as developing a new products. The basic premise of the co-creation approach is that each group of participants brings a unique set of skills and resources that can be utilized by other participants to further the realization of common goals (Brugmann & Prahalad, 2007).

At present, the specific information system could be designed based on the demand of company and different related service systems could be combined with business-related applications. It is noteworthy that with the development of e-commerce, a large quantity number of the e-commerce enterprises and organizations gradually pay attention to the online service which includes the whole follow-up procedure of it. However it should be noted that online value co-creation activities are not only limited to economic transactions, but also include any online co-creation activities that can promote social development and enhance social benefits, ecological and environmental benefits and cultural benefits to improve the construction level of public service facilities and create well-being for

¹ Research on "value Co-creation mechanism of Forest Health Industry in Key State-owned Forest Regions: Based on Policy Incentive Perspective", project number (No.71973057).

residents (Sander Munster, Christopher Georgia, Katrina Heijneb, Kevin Klamerta, Jorg Rainer Noenniga, Matthias Pumpa, & Han van der Meer, 2017; Laakkonen, Anu, 2019).

Online service based on value co-creation belongs to an activity. Activity theory can describe human activity in technological and social contexts (Kaptelinin et al., 1999; Kaptelinin, 2013) and emphasizes the interrelationships between people, artifacts and subjects (Duignan et al., 2006; Kaptelinin et al., 1999). People in activities could exchange ideas and spread culture through interaction with others (Kaptelinin, 2013). So VCC of online service can be regarded as a kind of system in which different activities elements (VCC for the participants, such as providers and consumers, etc) participate in VCC activities and output VCC outcome such as product innovation (Rita Kuvykaitea & Zaneta Piligrimicneb, 2014) or resource integration (Ainhize Eletzigerrea, Jose M. Barrutia, & Carmen Echebarria, 2018) through activities fixator (the form or the carrier of co-creation activities), such as service intermediary platform (Tindara Abbate et al., 2015). So we define the scope of our study on online services based on VCC from the perspective of Activity Theory.

In order to clarify the trends and focus of online service based on VCC research, we proposed a model of VCC in online service based on Activity system model, then explain the co-creating process of it. At last, we find the deficiencies of the current research and make a summary in order to find the direction of online service based on VCC in the future.

Value co-creation

It has been mentioned in introduction section that the concept of value co-creation refers to the participation of the community of interests in the same task for the common goal. Ainhize Eletzigerrea, Jose M. Barrutia and Carmen Echebarria (2018) pointed that value co-creation can be as service exchange and resources integration, companies are willing to let customers participate in the design and creation of products and then co-produce products and create value, and resources can be as antecedents of value co-creation. And the outcome of value co-creation is related to enhance customers' wellbeing or making the customer better off in some respect (Stephen L. Vargo, Paul P. Maglio, & Melissa Archpru Akaka, 2008). The focus of 'co-creation' activities refers to the interaction, engagement, personalization, experience sharing, and knowledge sharing (Kumar Rakesh Ranjan & Stuart Read, 2021). And value co-creation is a mutually complementary relationship in which stakeholders cooperate to achieve mutual benefit and win-win situation. Stakeholders can be users/merchants. Besides, the construction and service of digital resources based on technology support completes knowledge transfer and knowledge sharing without space limitation, which also belongs to the research category of electronic service value co-creation, and it creates the open-ended value (Henfridsson, O., Nandhakumar, J., Scarbrough, H., & Panourgias, N., 2018).

VCC Online Service Model Proposed

Christina Lundstrom and Jessica Lindblom (2021) studied care in dairy farming with automatic milking systems from the activity theory lens. Activity theory was first proposed by Vygotsky (1978), known as cultural-historical activity or (CHAT), provides a comprehensive conceptual framework for describing the structure and development of human activity in technological and social contexts (Kaptelinin et al., 1999; Kaptelinin, 2013), focusing on the interrelationships between people, artifacts and subjects (Duignan et al., 2006; Kaptelinin et al., 1999). Activities are the process in which human beings exchange ideas and spread culture through social interaction with the outside world (Kaptelinin, 2013). Activities are regarded as a whole system in which members interact with each other over time. One way to describe this AT system is called Activity System Model (Engeström, 2001, 2015) (Fig.1). This model can clearly describe how different members of an activity interact and produce results. It can therefore be used to explain the interaction of systems in activities and the interrelationships of related entities.

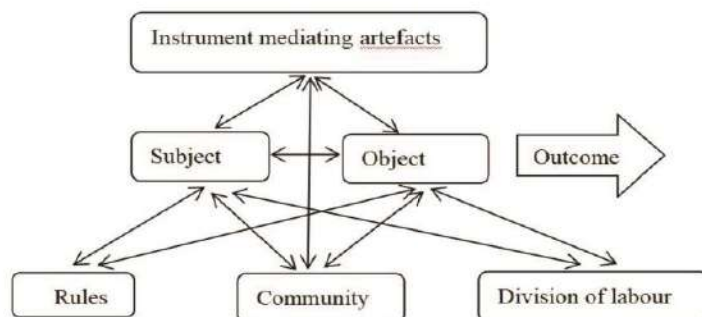


Figure 1. The Activity System model includes the interactions between the elements of the overall activity and its outcome(modified from Engestrom,2015,p.63).

Cocreation subject

It points out that instead of assigning one participant as an innovator or producer and the other as an adopter or consumer, all participants are brought together as resource integrators as a key part of the innovation process(Stephen L. Vargo, Melissa Archpru Akakab, &Heiko Wielandc.2020),so subject and object are not distinguished.We could use cocreation subject A and cocreation subject B insstead of subject and object.

Mediating desmone(environment)

Traditional enterprise services rely on the material bearing of physical stores, while online services rely on various kind of cyberspace based on Internet technology, which is a non-regional medium for communication between value co-creators and integrators. So instrument mediating artifacts item in Activity system model could be replaced by Mediating desmone(environment).“community”item in the active system model can be understood as online community (usually directly called community)in online value co-creation research field , which is included in Mediating desmone.

Cocreation content carrier

In entity service, server and server can be directly communicate throughing the transmission of movement and expression, while both sides need a carrier which can transmit language,expression and opinions in the online services desmone(environment), users and their online communities communicate and convey information through a type of text called memes (Kietzmann, Hermkens, McCarthy, & Silvestre, 2011). Using communication strategies such as humor to demonstrate their dissatisfaction/satisfaction and loyalty to the organization(Pamela Jo Brubaker,Scott Haden Church, Jared Hansen, Steven Pelham,&Alison Ostler, 2018).

Rules

While Christina Lundstrom and Jessica Lindblom talking about the care in dairy farming with automatic milking systems,they pointed out that interactions between subjects (farmers), objects (cows), primary intermediary artifacts (milking robots, etc.), and communities (consultants, etc.) are conducted through intermediary artifacts and tools, rules of agent-community interaction (e.g., norms, work practices, and legislation) and the division of labor in the activity system model(Engestrom,2015;Kaptelinin, 2013;Christina Lundstrom, Jessica Lindblom,2021). The rules in mediating desmone(online environment such as community) involved is very wide, such as the contract payment in the transaction process, development and service standards and industry legal norms; in addition, online communication spaces (such as communities) also cover certain entry standards and operating regulations such as technical guidelines and standards concerning data encryption, firewalls and security(Georgios Vardaxogloua, Evangelia Baralou,2012).Therefore, rules

are formulated according to different online service value co-creation fields, and are a general name for value co-creation rules of all research categories of co-creation subjects. Furthermore, it can be clarified for subsequent scholars to study the value of online services in a specific field.

Co-creating process

In the study of crowdfunding, Damien Chaney(2019) pointed it out a specific case where enterprises encourage online consumers to fund new projects in the community and participate in co-production in which process it includes Pre-design,production ,price,commnication and After-sales service .Thus, "Division of Labour" in Activity System model should refer to co-creating process which includes the consumer/user co-creating process and the provider co-creating process .So "Co-creating process" is instead of "Division of Labour" in our research content.

It was mentioned in the service marketing review that resources are the antecedents of value co-creation activities in the service ecosystem included provider network and consumer network, and value co-creation results are output in the form of service (exchange) or resource integration (Ainhize Eletxigerra, Jose M. Barrutia, & Carmen Echebarria;2018).Based on research content of VCC in online service in the perpective of Activity theory,the VCC of online service model was proposed as below(Fig.2)

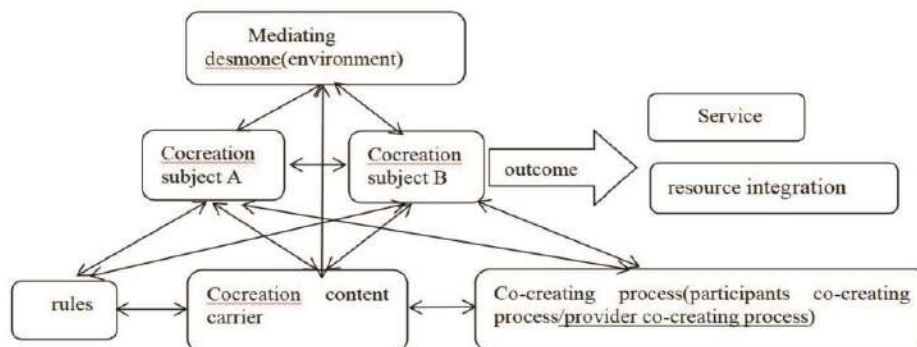


Figure 2. VCC of online service model based on Activity System mode

So we can give the explanation of this online service model to answer Q2: what is the co-creating process in online service from activity theory perspectives? Cocreation subject A and Cocreation subject B interact to achieve common value co-creation outcome(service Exchange and resource synthesis) in online value co-creation activities,and use Cocreation content carrier (such as text which is the embodiment of Digital media) through Mediating desmone(online communicating environment)to communicate and coordinate, exchange cultural concepts or ideas,then participate in the value co-creating process (consumer/user co-creating process and provider co-creating process).And the cocreating process (SA and SB) are proceeding at the same time and play the same important role in creating value.Value co-creation subject and Mediating desmone(environment), as the main elements of co-creation activities, have mutual influence to each other. Meanwhile, the interaction process of Cocreation subject and Mediating desmone is restricted by some certain conditions: These conditions include rules, Cocreation Content Carrier and Co-creating Process.In addition, the online service value co-creation activity system model includes the results of the activity system as a whole, that is, the objects generated by related online value co-creation activities are converted to the form of results (include service exchange and resource integration).This creative activity continues to change and evolve over time.Then come to Question 1:what is the main body of value co-creation in online service from activity theory perspectives? In activity system theory, the subject/object and instrument mediating artefacts constitute the main part of system activity , this point of view was mentioned in Christina Lundstrom and Jessica Lindblom's paper published in 2021.So Cocreation subject A,Cocreation subject B and Mediating desmone(environment) which

instead of three main elements in Activity System Model main body of value co-creation are the main body in VCC of online service.

Conclusion

Regulation provided in the level of law is lacked. It is suggested that e-commerce supervision platforms improve the clear relationship between power and obligation, and improve the differences existing in transactions.

Social value appeal is lacking. Call for the establishment of social value creation oriented enterprise culture to promote the social welfare of value co-creation instead of only the pursuit of corporate interests based business model.

From the perspective of the company, there is no concern about the value co-creation research between the company and employees, so the future research can be carried out in this field.

References

- Ainhize, E., Jose, M. B., and Carmen E. 2018. "Place marketing examined through a service-dominant logic lens: A review," *Journal of Destination Marketing & Management*(9), pp. 72-84.
- Ainhize E., Jose M. B., and Carmen E. 2018. "Place marketing examined through a service-dominant logic lens: A review," *Journal of Destination Marketing & Management*(9), pp. 72-84.
- Brugmann, J., and Prahalad, C. K. 2007. "Cocreating business's new social compact," *Harvard Business Review*, February.
- Christina L. , and Jessica L.,2021. "Care in dairy farming with automatic milking systems, identified using an Activity Theory lens," *Journal of Rural Studies*(87), pp. 386-403.
- Duignan, M., Noble, T., and Biddle, R. 2006. In: Clemmensen, T., Campos, P., Omgreen, R., Petjersen, Al, Wong, W. (Eds.), *IFIP International Federation for Information Processing*(221), *Human Work Interaction Design: Designing for Human Work*. Springer, Boston, pp. 1-25.
- Damien C. 2019. "A principal-agent perspective on consumer co-production: Crowdfunding and the redefinition of consumer power," *Technological Forecasting & Social Change*(141), pp. 74-84.
- Engestrom, Y., 2001. "Expansive Learning at Work: toward an activity theoretical reconceptualization," *J. Educ. Work*(141), pp.133-156. <https://doi.org/10.1080/13639080020028747>.
- Engestrom, Y., 2015. *Learning by Expanding: an Activity-Theoretical Approach to Developmental Research*, second ed. Cambridge University Press, New York.
- Georgios V., and Evangelia B. 2012. "Developing a platform for serious gaming: open innovation through closed innovation," *Procedia Computer Science*, pp.111 - 121.
- Hoyer WD, Chandy R, Dorotic M, Krafft M, and Singh SS. 2010. "Consumer cocreation in new product development," *Journal of Service Research*(13:3), pp. 283-296.
- Henfridsson, O., Nandhakumar, J., Scarbrough, H., and Panourgias, N. 2018. "Recombination in the Open-Ended Value Landscape of Digital Innovation," *Information & Organization*(28:2), pp. 89-100.
- Kaptelinin, V., Nardi, B., and Macaulay, C., 1999. "The activity checklist: a tool for representing the "space" of context," *Interactions* (6 :4), pp. 27-39.
- Kaptelinin, 2013. Activity theory. In: the encyclopedia of human-computer interaction. In: Soegaard, M., Dam, R.F. (Eds.), *The Interaction Design Foundation: Aarhus, Denmark, second ed*. <https://www.interactiondesign.org/literature/book/theencyclopedia-of-human-computer-interaction-2nded/activity-theory>.
- Kietzmann, J. H., Hermkens, K., McCarthy, I. P., and Silvestre, B. S. 2011. "Social media? Get serious! Understanding the functional building blocks of social media," *Business Horizons*54(3), pp. 241-251.
- Kumar R., Ranjan, and Stuart R. 2021. "An ecosystem perspective synthesis of co-creation research," *Industrial Marketing Management*(99), pp.79-96.

- Laakkonen, and Anu. 2019. Integrating intangible resources enables creating new types of forest services - developing forest leasing value network in Finland In: © Elsevier B.V. CC BY-NC-ND. <https://creativecommons.org/licenses/by-nc-nd/4.0/>. <http://dx.doi.org/10.1016/j.forpol.2018.07.003>
- Norman, R., & Ramirez, R. (1994). *Designing interactive strategy: From value chain to value constellation*. Chichester: John Wiley & Sons.
- Pamela J. B., Scott H. C., Jared H., Steven P., and Alison O. 2018. "One does not simply meme about organizations: Exploring the content creation strategies of user-generated memes on Imgur." *Public Relations Review*(44), pp.741-751.
- Rita K., and Zaneta P.2014. "Consumer engagement into brand equity creation," *Procedia - Social and Behavioral Sciences* (156), pp. 479 – 483.
- Sander M., Christopher G., Katrina H., Kevin K., Jörg R. N., Matthias P...., and Han v. d. M. 2017."How to involve inhabitants in urban design planning by using digital tools? An overview on a state of the art, key challenges and promising approaches," *Procedia Computer Science* (112),pp. 2391–2405.
- Stephen L. V.,Paul P. M., and Melissa A. A. 2008. "On value and value co-creation: A service systems and service logic perspective," *European Management Journal*(26),pp. 145-152.
- Stephen L. V., Melissa A. A., and Heiko W.2020. "Rethinking the process of diffusion in innovation: A service-ecosystems and institutional perspective," *Journal of Business Research*(116), pp. 526-534.
- Tindara A. et al..2015. "Analysis of open innovation intermediaries platforms by considering the smart service system perspective," *Procedia Manufacturing*(3), pp. 3575 – 3582.
- Vygotsky, L.S., 1978. *Mind in Society: the Development of Higher Psychological Processes*. Harvard University Press, Cambridge, MA, USA [Original work published in 1934].
- Xie, C., Bagozzi, R. P., and Troye, S. V. 2008. "Trying to presume: Toward a theory of consumers as co-creators of value," *Journal of the Academy of Marketing Science*(36:1), pp. 109–122.

E3.2 Physicians' language and patient behavior in online health platforms

Jiang, W. Y.^a Liu, S.^b Si, G. S.^c Gao, B. J.^d and Kou, B.^e

^a School of Management, Xi'an Jiaotong University
E-mail: jwy724965147@163.com

^b School of Management, Xi'an Jiaotong University
E-mail: shan.l.china@gmail.com

^c School of Management, Xi'an Jiaotong University
E-mail: guangsensi@163.com

^d Economics and Management School, Wuhan University
E-mail: gaobj@whu.edu.cn

^e Department of Otorhinolaryngology-Head & Neck Surgery, The First Affiliated Hospital of Xi'an Jiaotong University
E-mail: bobiekou@163.com

Abstract

This study explores the persuasive mechanism of two directive acts regarding the language style — giving a command and giving a suggestion. We collect physician-patient interaction data and physician personal information from an online health platform to test our hypotheses. We expect that both language styles have differential persuasion effects on patients' compliance and their further gifting behavior. Furthermore, we explore the boundary conditions of focal two styles. Our research conclusions can optimize the interaction strategies of physicians and platforms, and promote the stable development of the platform ecosystems.

Keywords: Platform, online health, machine learning

E3.3 A Study on Data-Driven Service Design for the Improvement of Media Literacy

Park, S. W.^a, Lee, I. S.^a, and Sul, S. H.^b

^a Department of Service Design Convergence, Sungkyunkwan University
E-mail: psw1108@g.skku.edu, lizzm@naver.com

^b Department of Global Convergence, Sungkyunkwan University
E-mail: sanghunsul@skku.edu

Abstract

The media become an integral part of the younger generation. This study discusses media literacy education methods conducted for MZ generation. It also discusses media literacy education methods for them and their media literacy improvement process. Research is needed to directly participate and understand social issues that can be freely accessed through various media using the language of the MZ generation. Therefore, this study intends to present educational services applying Data-driven service design process. As the educational content for the experiment, it was designed based on a data-driven service design model that improved the efficiency of service design double-diamond model, and media platform was used as a media learning tool. In order to confirm the effectiveness of media literacy education, media platform contents were derived as results, and social network analysis evaluation of the results was conducted. Through this, it can be seen that learners of the MZ generation not only improved their media utilization ability, but also participated creatively and actively in the process of directly producing media.

Keywords: Education, Media Literacy, Service Design, Data Visualization, SNA

Introduction

With the rapid development and spread of information and communication technology (ICT) in the 21st century, the acquisition and use of necessary information has become an essential part of the digital era. Therefore, the influence of digital media has become absolute, and most common discussions about digital media focus on the characteristics of media as new technologies and tools. However, it is always in the specific socio-cultural and institutional context in which the media is used that determines why and how the media is used (Jenkins, 2008). Since media technology is generally used in all environments such as social activities, schools, and homes, people need to understand not only ICT technology but also the context in which it is used (Hague et al., 2009). Media is positioned as an important tool to express, participate, observe and understand society anytime, anywhere. Literacy education is very important to improve young people's ability to participate in the culture and choose exactly what they need in this digital age.

Erdem and researchers (2018) predicted that the results of these studies would help develop curriculum development research on media literacy instruction in preparatory teacher education by mixing multi-stage clusters mapping and interviewing. Tully and researchers (2018) investigated the relationship between news media literacy (NML) and political effects through a combined approach combining experiments and interviews. It was evaluated to provide insight into NML developed from the results tested in theory and experiment. Research is being carried out to improve media literacy in this way, and various approaches provide a positive outlook.

However, the study by Roh Deul and Ok Hyounjin (2020) identified significant similarities between media literacy and digital literacy concepts through text mining of newspaper articles, pointing out that such results may act as communication difficulties within society. At the same time, it was emphasized that the contents of the core attribute changes constituting the concept of literacy should be actively reflected in the contents of education as time changes. Research trends in domestic media literacy show that research efforts are needed because there are very few studies on participation capabilities compared to access understanding and production capabilities in the competence part of media literacy (Ahn et al., 2017). After all, the concept of media literacy changes rapidly, so smooth communication is important and research is needed to improve participation capabilities.

Media literacy is not a form of service that can be provided to users immediately, but a context itself. Therefore, it is judged that service design is useful as an analysis tool that people can access. Ofcom defined media literacy as 'approach', 'understanding', and 'creation' to the media in a variety of contexts, which can provide the direction of education that media education should aim for (Ofcom, 2003). In the methodology of service design, it is considered as worth fully utilizing in media education because it has processes and methods that match the direction of media literacy education.

This study proposes an educational process that applies data-based service design methodology to improve media literacy for MZ generation and examines whether it is effective in improving media literacy through such educational process-based experiments.

First, it is important to communicate in the language of the MZ generation (Won, 2021). We would like to promote media platform-based literacy education for students.

Second, we introduce card-sorting techniques that are effective in finding optimal information structures, taking into account the restrictive parts of the educational environment (Wood & wood, 2008), and encourage understanding of policy context using social network analysis.

Third, in order to verify the effectiveness of media education, we would like to use media platform (TikTok) content as the result of education and proceed with the evaluation of the results.

The purpose of this experiment is to contribute to the consolidation and activation of the basis for the introduction and application of the data driven service design process in the future media literacy education area.

Related Works

Media Literacy Education

Media literacy is the ability to decipher social language, a tool of media communication, and the basic ability necessary to live in the media age (Silverstone, 1999). According to a study by Bawden (2001), everything is defined as having literacy skills related to core information, and in addition to this information literacy, terms such as computer literacy, live literacy, media literacy, network literacy, and digital literacy. Digital literacy can be broadly divided into 'technology literacy,' 'information literacy,' and 'community literacy'. Similarly, it can be divided into operational technology (computer literacy), information generation, processing, analysis, retrieval, utilization (information literacy), and information production capacity (knowledge literacy) for generating and communicating new knowledge with secured information.

Media literacy education is an education that enables people to understand and evaluate the cultural, social, political, and economic environment of their society through a part of education that reads and writes media, including teaching them to understand the language, grammar, nature and technology (Aufderheide, 1992). In addition, the structure and function of the media organization and the institution are well known and understood, and the contents of the media can be evaluated, and the education of the media itself is not through the media (Kwon, 1997).

Service Design

Service design is the reorganization of the service provider's actions as the act of planning and organizing stakeholders, infrastructure, communication, and physical elements to improve service quality, customer experience, and service interaction (Lee & Cho, 2011).

For existing service designs, the Double-Diamond Model, which consists of four stages: 'Discover', 'Develop', and 'Deliver' presented by Design Council (Council, 2005). At first, 'Discover' is the stage of understanding customers through social, cultural, industrial, market, and trend research. 'Discover' is basically a data survey, a market survey, and a user survey, which can be divided into two categories: quantitative and qualitative surveys. Qualitative surveys collect data through interviews and field surveys, quantitative surveys focus on data and represent user behavior and thoughts in numerical form through measurable data. Second, 'Define' is the stage where extended information is filtered through research to understand problems and to present directions and strategies. Third, 'Develop' is the stage where ideas are spread, tested, and progressively developed through brainstorming, scenarios, and prototyping. Finally, 'Deliver' is the stage where final results are derived through Discover-Define-Develop (Kwon et al., 2021).

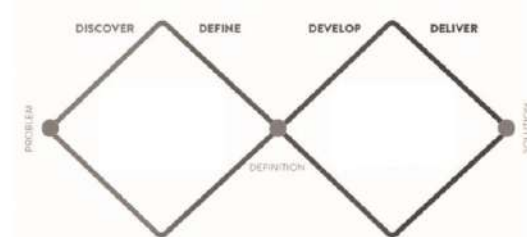


Figure 1. Service design double-diamond model

Data-driven Study in various field

The amount of data is gradually increasing due to the development of Internet and smart devices, and the rapid spread of social networks. As a result, data has many strengths, such as accuracy of decision-making, prediction of the near future, and possibility of creating new businesses. In particular, these strengths are being used in various research fields (Oh & Lee, 2013). In the manufacturing field, there is a research case that improves product quality and service by applying collectable customer experience data including manufacturing data, product use information and usage reviews to product design and process (Jang, 2012). In addition, in the design field, one research was conducted on ZARA's service design case, which created a system that enables sales prediction based on sales and inventory data, and immediate product supply by analyzing real-time sales status (Oh & Lee, 2013). From these research cases, it can be confirmed that data can be used in various fields and possess a high value. In particular, the Discover phase of service design involves user interviews, but as COVID-19 restricts face-to-face activities, in-depth interviews have become difficult to proceed. Therefore, quantitative research is considered important at the Discover stage and data utilization is emphasized (Kwon et al., 2021). Data has several advantages in service design. First, the hidden needs of the user can be grasped. Second, effective visualization can be achieved through data and insight can be derived. Third, a collaborative system with various fields can be established on a data visualization basis (Kang, 2013). Therefore, service design techniques utilizing data can be useful in terms of efficiency and practicality.

Method

Data-driven Service Design Model

Data-Driven Service Design model applies double diamond model, which is used by existing service design. Although the existing double diamond model consists of Discover–Define–Develop–Deliver, this model consists of Exploration–Interpretation–Design–Share.

In the double diamond, the vertical axis represents the amount of ideas, and the area of the picture represents time, cost, and effort. The Data-Driven Service Design Model proposes an efficient problem-solving methodology by reducing time, cost, and effort for problem-solving by using data in the process of spreading and converging ideas. Following Figure 2, we present the Data-Driven Service Design model as an efficient methodology for media literacy education to directly create media content. The theme of media content is based on the keyword ‘Carbon Neutrality’, which has become a policy issue around the world.

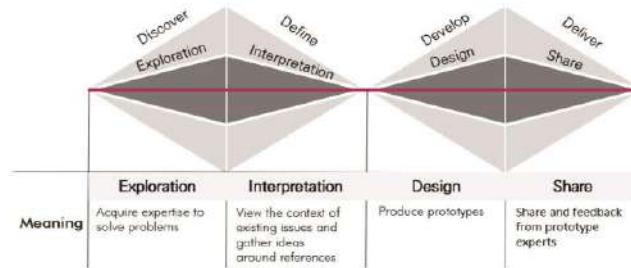


Figure 2. Data-Driven Service Design Model

In this study, students create public communication content based on data evidence in ‘Social Media Utilization Education for Carbon Neutrality’, and look at how the content of students changes in data and what kind of crowds they create. Education is conducted five times in total. Prior to media training,

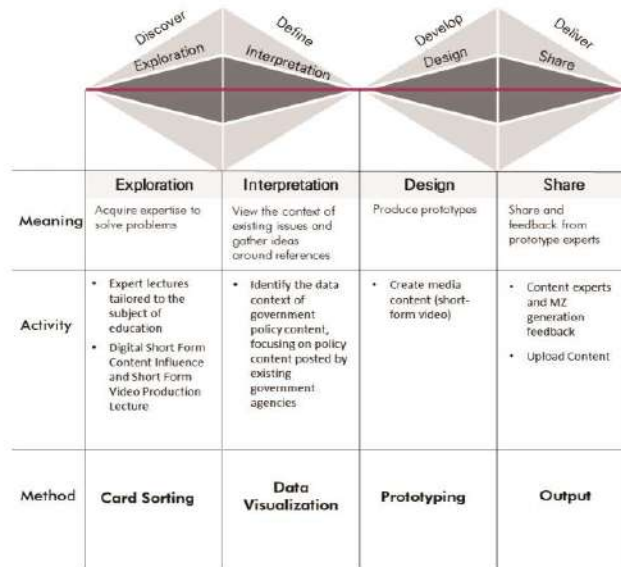


Figure 3. Media Education Activities based on Data-Driven Service Design Model

Figure 3 shows an educational process designed based on the Data-Driven Service Design model for the experiment. It indicates that activities tailored to the topic of media literacy were planned according to the meaning of each step in the model.

Experimental Verification

Figure 4 is Media Education Experimental Process applying Data-driven Service Design Model

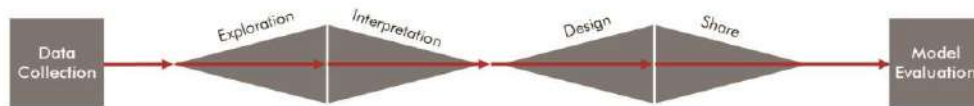


Figure 4. Media Education Experimental Process

Data collection and Making Cards

In this study, content data is collected from five instagram accounts: 'Gov_Korea', 'statisticsKorea', 'motie.go.kr', and 'smgstory', which is run by government agencies. Table 3 shows the number of posts of contents ordered from each SNS, and the collected data are images and hashtags. Posting in a similar format and overlapping posting are eliminated, and a choroid domain is set based on a hashtag for each image. For example, if it consists of hashtags such as 'resource_circulation', 'zerowaste', 'environmental_protection', the context domain of this posting is defined as 'zerowaste'. As a result of performing data preprocessing and context domain definition tasks, 554 data were constructed, and 100 contents related to 'Carbon Neutrality' were extracted. Based on the collected content images, 100 cards are created for the experiment.

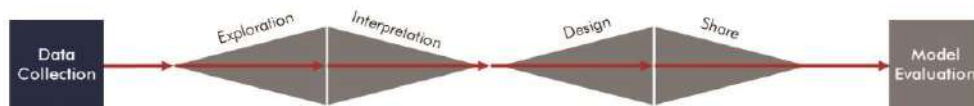


Figure 5. Data collection before media education

Exploration stage

In the Exploration stage, they are trained on specialized knowledge of media content themes, influence of digital platforms, and video content production techniques. First, since the educational topic is a concept that requires professional knowledge even though it is an issue worldwide, content topic education is conducted to help understand in terms of theory. Second, media platform education is

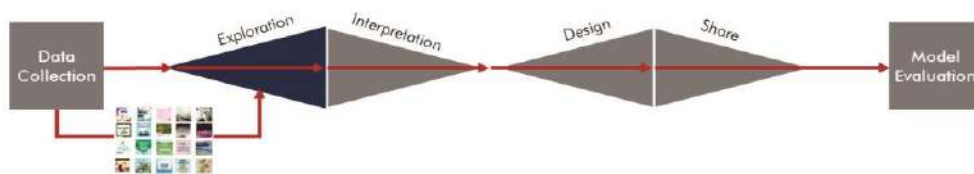


Figure 6. Context domain network visualization example in Exploration stage

promoted because it has a large influence on social network platforms in the media and is considered a fast-spreading type. Third, we will promote content production education for direct use of media.

Interpretation stage

Interpretation stage is an educational stage in which content produced by existing government agencies is reviewed and content ideas are collected by checking the contextual data of current government media content. The trainees are composed of 3 or 4 MZ generations per team, and 30 out of 100 content cards are sorted for each team to perform data context design. Also, the network is visualized and confirmed based on the context data of the card image. In such a way, it is useful for understanding the contents.

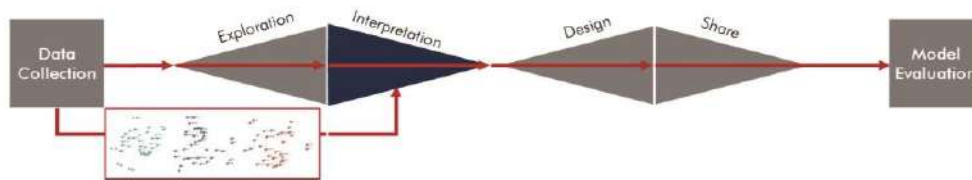


Figure 7. Data visualization in Interpretation stage

Design stage

Exploration stage provided expertise, media platforms, and video content production training. Interpretation stage provided data context and understood content flow. Based on this process, Design stage will conduct team-specific media content production practice to directly use the media. Content production time is given for three hours, and at least one or more contents are created per team. The created content must be uploaded to the media platform account and must include three hashtags: educational theme, student affiliation, and platform slogan. For example, the educational theme should be "#CarbonNeutrality" and the platform slogan should be "#Tiktokforgood".

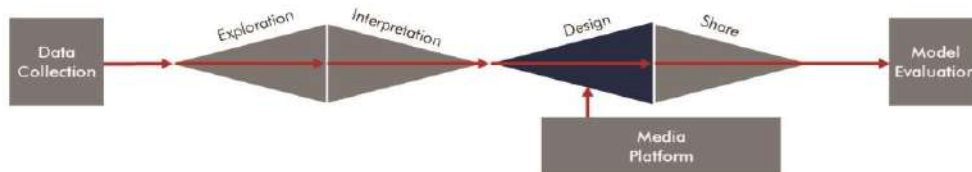


Figure 8. Prototyping contents in Design stage

Share stage

Share stage is the stage of sharing and spreading prototypes created by Design. Students share and present content created by teams. Take time to share feedback and opinions from experts and other students, and proceed with content modification based on this content. Finally, the revised content is uploaded and the content is spread to end the education.

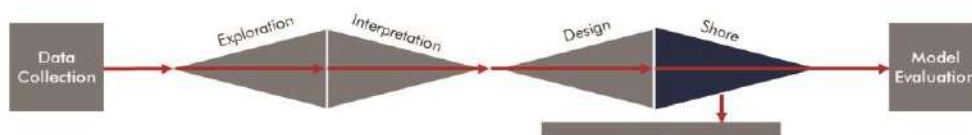


Figure 9. Upload contents in Share stage

Social Network Analysis Evaluation

Figure 11 is the result of hashtag context networks from contents with the hashtag '#CarbonNetrality' through Social Network Analysis. It can be seen that the network before the training has one cluster in the middle based on 'Carbon Netrality' and most of the data contexts are out of the cluster. It consists of hashtag keywords of results derived from intra-colonial education and has become an important context. This means that the ability to produce media content showed a significant effect through education. As a result, it shows that the media literacy education of this study is effective in understanding the new media culture.

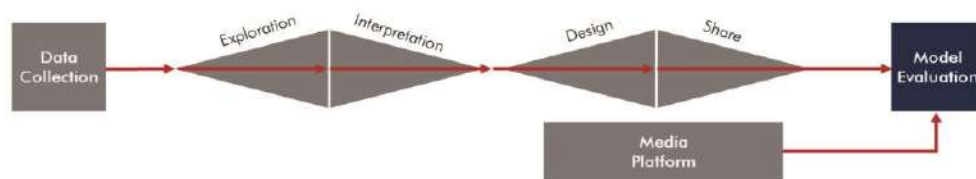


Figure 10. Content evaluation for experiment verification

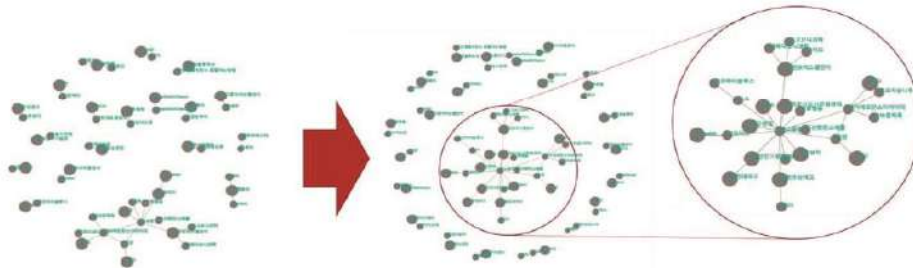


Figure 11. Content keyword network visualization for evaluation

Conclusion

Data-driven service design process is introduced as a tool for improving media literacy, and media education experiments are conducted according to this process. After the experiment, media platform contents produced by trainees were derived as experimental results, and these were verified to be effective in spreading media usage capabilities through keyword network evaluation of content.

In this study, it was conducted with 'Tiktok', a short form content platform, as a media platform. However, SNS has different user personas, characteristics, and behaviors depending on platform characteristics such as shape, image, video, text, and voice. Therefore, in future studies, it is necessary to check whether meaningful results can be derived even on other types of SNS platforms other than shortform-based platforms.

References

- H. Jenkins. 2006. *Confronting the challenges of participatory culture: Media education for the 21st century*. MacArthur Education. https://www.macfound.org/media/article_pdfs/JENKINS_WHITE_PAPER.PDF.
- Hague, Cassie, and Ben Williamson. 2009. "Digital participation, digital literacy, and school subjects: A review of the policies, literature and evidence," *Futurelab*.
- Erdem, Cahit, and Bahadır Eristi. 2018. "Paving the Way for Media Literacy Instruction in Preservice Teacher Education: Prospective Teachers' Levels of Media Literacy Skills." *International Journal of Instruction* (11:4), pp. 795-810.
- Tully, Melissa, and Emily K. Vraga. 2018. "A mixed methods approach to examining the relationship between news media literacy and political efficacy." *International Journal of Communication* (12: 22)
- Roh Deul, Ok Hyounjin. 2020. "A Comparative Analysis of Media Literacy and Digital Literacy Through Text Mining of News Articles" *The Korean Journal of Literacy Research* (11:5), pp. 103-129.
- Ahn, Jung-Im, Seo, Youn-Kyung, Kim, Sung-Mi. 2017. "Research Trends on Media Literacy in Korea: Focusing on Research Characteristics, the Role of Media and Media Literacy Competences." *Korean Journal of Broadcasting and Telecommunication Studies* (31:5), pp. 5-49.
- Ofcom [Office of Communications] 2003. *About media literacy*. Available: <https://www.ofcom.org.uk/research-and-data/media-literacy-research/media-literacy>
- Won, Kyung-rim. 2021. "A Study on the Characteristics of 'Actively Listening' Competencies: Focusing on Core Competencies in ICF Coaching." *Journal of Korean Coaching Research* (14:5), pp. 105-125.
- Wood, J. R., and L. E. Wood. 2008. "Card Sorting: Current Practices and Beyond." *Journal of Usability Studies* (4:1), pp. 1-6.
- Silverstone, R. 1999. *Why Study the Media?*
- Bawden, D. (2001). *Information and digital literacies: A review of concepts*. *Journal of Documentation* (57:2), 218-259.
- P. Aufderheide, *Aspen Media Literacy Conference Report - Part II: Proceedings and Next Steps*, 1992. <http://www.medialit.org/reading-room/aspen-media-literacy-conference-report-part-ii>
- Kwon, Sungho. 1997. "A Study for the Development of Media Literacy Curriculum and Learning Resources." *Korean Society for Engineering Education* (13) pp. 1-26.
- Lyoungh Lee, Mi Kyung Cho, 2011. "A Study of Double Diamond Design Process Stylized in Korean Form", *JOURNAL OF THE KOREAN SOCIETY DESIGN CULTURE* (17:2), pp.411-423.
- Soonyoung Kwon, Kyungho Lee, Gwanseob Shin, 2021. "Ergonomic Intervention for Double Diamond Design Process and its Application", *KSDS Conference Proceeding* (17), pp.120-125.
- I. K. Oh and D. B. Lee, 2013. "A Study on the Application Methods of Big Data in the Design Field" *Journal of Digital Design* (13:4), pp. 665-674.
- Y. J. Jang, 2012. "Utilization of big data technology in manufacturing field," *The Journal of the Korean Institute of Communication Sciences* (29:11), pp. 30-35.
- Kang, Sungjoong, 2013. "A Study on Direction for Application of Big Data in Design," *JOURNAL OF THE KOREAN SOCIETY DESIGN CULTURE* (19:3) pp.1-12.

E3.4 Research on the evolution path of start-up platform structure and user scale

Hu, H. Q.^a, Chen, Y. R.^b and Li, Y.^c

^a Business School, Shandong Normal University
E-mail: huhqkelly@163.com

^b Business School, Shandong Normal University
E-mail: 675554791@qq.com

^c Business School, Shandong Normal University
E-mail: cnjnly@163.com

Abstract

Based on the perspective of supply structure, this study investigates the evolution path of start-up platform structure and user scale. The results show that the competitive relationship model is stricter than the reciprocal relationship model in selecting suppliers. In the competitive relationship model, the competitive intensity will bring more threats to the relatively weak side of the platform, while the cross-network externality will bring more large-scale changes to the relatively superior side of the platform. In the reciprocal relationship model, the enhancement of complementarity intensity and the externality of the crossover network are conducive to the expansion of the platform scale. The evolution path of user scale is related to the intensity of externality of cross-network. In the competitive relationship model, low competitive strength is conducive to the expansion of platform synergy scale, and both the scale and growth rate of platform synergy increase with the increase of externality.

Keywords: Platform structure, user scale, evolution path, competitive relationship, reciprocal relationship

Introduction

Pulled by the achievement of platform business model innovation and the COVID-19 epidemic, the transformation to the platform has become the first choice of business model innovation for many enterprises, with bilateral platforms being the most common. Haier's COSMO platform, which gathers more than 300 million users and more than 3.8 million global ecological resources, has a platform scale of more than 200 billion, realizing cross-industry and cross-domain expansion and services (Li et al., 2020). Bilateral platform refers to platform enterprises providing different products or services to bilateral users at different prices so that bilateral users can reach a deal on the platform (Greiner et al. 2018). Platform users form a platform ecosystem based on their interactions with each other (Ramaswamy and Ozcan, 2018). User scale is regarded as an important indicator of growth performance platform (Tiwana, 2015), in the theory of ecological system, it is considered that the initial structure and the interaction mechanism of the ecosystem is one of the important factors affecting system evolution. Therefore, how start-up platform companies reasonably select suppliers and set up the competitive and complementary structures of the platform has an important impact on the growth rate and growth path of the platform.

Literature Review

Based on the structure-behavior-performance theoretical framework, the structure is considered to be one of the fundamental reasons affecting performance. The study of supply chain structure is closely related to that of platform supply structure. Existing studies on supply chain structure mostly focus on the relationship between the complexity of supply chain structure and performance. It has been

demonstrated that a supply chain that is excessively complicated would raise production costs (Butzer et al., 2016), hinder decision-making (Manuj and Sahin, 2011), and aggravate interruption (Chopra and Sodhi, 2014). In addition, it is also found that supply chain complexity can negatively affect operational efficiency (Bozarth et al., 2009) and enterprise performance (Kim, 2014). Lu et al. (2017) constructed three visible (horizontal, vertical and spatial) and two less visible (independent and cooperative) structural complexity measures by mapping the basic supply chain structure of 867 listed companies, and empirically proved the complexity of supply chain structure has both positive and negative effects on performance. Bimpikis et al. (2019) focused on the issue of a multi-level supply chain network and explored how the company quantity, production cost, and interrupt risk of each layer of the network structure affect the company's profits. They found that for companies operating at different stages of the production process, especially the upstream suppliers and downstream retailers, their profit maximization of the network is different in structure. The above research proves that supply chain structure has an impact on performance and the complexity of supply chain structure has a dual impact on performance. However, existing studies focus on the length of the chain and the number of nodes in the interpretation of the complexity of the supply chain structure, it still lacks dynamic analysis on the evolution of supply chain structure and the cooperation relationships between different nodes are not clear.

With the introduction of the concept of ecosystem into business research, many scholars have studied the growth mechanism of platforms based on the theoretical system of platform ecosystem, taking the scale of platform users as the main indicator of platform growth. For example, Basole and Karla (2011) classified platform ecosystem into Keystone, Dominators and Niche Players, and studied the evolution mechanism and path of the platform ecosystem; Tiwana (2015) gave the growth trajectory of platform enterprises under risk shocks in terms of the impact of their risk coping capacity. The above studies adopt a dynamic perspective to explore the growth trajectories of platforms in different contexts, however, they do not provide a clear answer to the setting of the supply structure of start-up platform enterprises, nor do they provide an in-depth analysis of the connotation of the supply structure and the impact of changes in the supply structure on the evolution of platform user scale.

This study focuses on the optimal supply structure of two types of suppliers with competitive or reciprocal relationships in the platform ecosystem. Focusing on start-up platform enterprises, this innovative study develops an evolutionary game model of two types of competitive and reciprocal relationships in the supply chain platform ecosystem and draws on the idea of interspecific relationships in biological systems to analyze what kind of supply structure a platform should have under the influence of factors such as resource heterogeneity (Agrawal et al., 2016) and network externalities (Wright, 2004), to ensure the sustainable development of the platform in the long-term market evolution.

Model Construction and Model Analysis

Whether it is a competitive relationship model or a reciprocal relationship model, the behavior of each enterprise in the platform will have an impact on other enterprises, and resource heterogeneity is an important influencing factor (Agrawal et al., 2016). Resource heterogeneity is related to the number of suppliers in the platform. The greater the number of suppliers with mutually beneficial relationships, the higher the heterogeneity of platform resources. In addition, the suppliers in the platform themselves have survivability, which is reflected as an adaptability to respond to external stimuli and influences, ensuring that the evolution of the platform ecosystem tends to be in a balanced state (Liu et al., 2021). Based on this, this paper considers the complexity of the supply chain and the viability of the enterprise in the modeling process of organizational collaborative evolution of platform ecosystem.

Platform evolution in the competitive relationship model

In the competitive relationship model, suppliers with low resource heterogeneity compete for user resources in the same ecosystem. When the user scale is constant, the increase of the number of suppliers is limited by the user scale. When users and suppliers have cross-network externalities, the

increase in the number of suppliers will attract new users to join in. Therefore, this part is divided into two cases according to the variability of user scale.

Competitive relationship model of static user scale

Assuming that the user scale of the platform is constant, the Gause model is used to construct a competitive relationship model of the platform ecosystem to portray the evolution of the platform ecosystem, as in equations (1) and (2):

$$\frac{dx}{dt} = r_1 x \frac{(K_1 - x - \alpha y)}{K_1} \quad (1)$$

$$\frac{dy}{dt} = r_2 y \frac{(K_2 - y - \beta x)}{K_2} \quad (2)$$

Where X and Y represent suppliers providing similar services, the number of two types of suppliers at time t are x and y , which can reflect the complexity of the platform ecosystem to some extent; $\frac{dx}{dt}$ and $\frac{dy}{dt}$ represent the growth rate of the number of two types of suppliers over time; r_1 and r_2 represent the average growth rate of two types of suppliers in the state without the presence of each other, which reflects the viability of the enterprise; and K_1 and K_2 represent the maximum size of users that the two types of suppliers can have in the state of mutual independence, respectively, because the maximum number of users that suppliers can have is limited by human, financial, technical and other resources, so K_1 and K_2 are set as constants; α represents the competition coefficient of supplier Y to X , and β represents the competition coefficient of supplier X to Y . When the influence of competing enterprises on a certain enterprise is closer to of a certain enterprise itself, the more the value of α or β converges to 1.

Let $\frac{dx}{dt} = \frac{dy}{dt} = 0$ to obtain four sets of solutions: $h_1 = (0, K_2)$, $h_2 = [\frac{\alpha K_2 - K_1}{-1 + \alpha\beta}, \frac{\beta K_1 - K_2}{-1 + \alpha\beta}]$, $h_3 = (0, 0)$, and $h_4 = (K_1, 0)$, respectively.

The stability of the solution is judged by Jacobian matrix using Friedman's method. The equilibrium point is an evolutionary stable equilibrium point when and only when the equilibrium point satisfies both determinant $Det(J) > 0$ and trace $Tr(J) < 0$, and the corresponding game strategy of both sides is Evolutionary Stabilization Strategy (ESS). Eq. (1) and Eq. (2) find the partial derivatives of x and y , respectively, to obtain the Jacobian matrix.

$$J = \begin{bmatrix} -\frac{xr_1}{K_1} + \frac{(-x - \alpha y + K_1)r_1}{K_1} & -\frac{\alpha r_1 y}{K_1} \\ -\frac{\beta r_2 y}{K_2} & -\frac{yr_2}{K_2} + \frac{(-y - \beta x + K_2)r_2}{K_2} \end{bmatrix}$$

Substitute each group of feasible solutions into the matrix verification successively, and the conclusions can be obtained in the following table.

Table 1. Dynamic evolutionary equilibrium results of competing providers under static user

Balancing point	$Det(J)$	$Tr(J)$	Stability
h_1	$\frac{(\alpha K_2 - K_1)r_1 r_2}{K_1}$	$(1 - \frac{\alpha K_2}{K_1})r_1 - r_2$	When $\alpha K_2 > K_1$, f or ESS
h_2	$\frac{(\beta K_1 - K_2)(K_1 - \alpha K_2)r_1 r_2}{(-1 + \alpha\beta)K_1 K_2}$	$\frac{-\alpha K_2^2 r_1 - \beta K_1^2 r_2 + K_1 K_2 (r_1 + r_2)}{(-1 + \alpha\beta)K_1 K_2}$	When $\alpha K_2 < K_1 < \frac{K_2}{\beta}$ for ESS
h_3	$r_1 r_2$	$r_1 + r_2$	Unstable

h_4	$\frac{(\beta K_1 - K_2)r_1 r_2}{K_2}$	$(1 - \frac{\beta K_1}{K_2})r_2 - r_1$	When $\beta K_1 > K_2$ for ESS
-------	--	--	-----------------------------------

To sum up, under a certain scale of platform users, when the start-up platform introduces competitive suppliers, the number of independent users and competition coefficient of suppliers should be taken as important supplier evaluation indexes, and the scale of independent users of two types of competitive suppliers after the introduction of competitive suppliers is required to meet the $\alpha K_2 < K_1 < \frac{K_2}{\beta}$ relationship, so that when this condition is met, the platform will not be squeezed out after a period of evolution to reach a stable state, and the platform will be able to maintain the diversity of suppliers.

Competitive relationship model for dynamic user scale

Bilateral platforms often have cross-network externalities, and an increase in the number of suppliers usually leads to an increase in the scale of platform users. The two types of providers with competitive relationships not only compete for their respective user resources, but also attract more users to join the platform due to the improvement of competitive efficiency and product diversification. Therefore, we need to further investigate the evolutionary path of the scale of startup platforms with competing suppliers under the dynamic change of the number of users.

In two types of firms with competitive relationships, the scale of users of type K_1 suppliers increases with the increase in the number of suppliers of the same type, and it is assumed that the increase in the scale of X and Y firm class groups affects the scale of their respective users to the same extent, and let $K_1 = K_{10} + \lambda x$, $K_2 = K_{20} + \lambda y$, and λ denote the strength of cross-network externalities, and since x and y in this equation denote the total number of suppliers at the t moment, and λx and λy denote the respective user scale increments, therefore, assume $0 < \lambda < 1$; and since the number of suppliers is usually influenced by the scale of own users more than from competitors, assume $(1 - \lambda) > \alpha$, $(1 - \lambda) > \beta$, i.e., $(1 - \lambda)^2 > \alpha\beta$. The meanings of the other parameters remain unchanged, and substituting $K_1 = K_{10} + \lambda x$ and $K_2 = K_{20} + \lambda y$ into equations (3) and (4) yields.

$$\frac{dx}{dt} = r_1 x \frac{(K_{10} + \lambda x - \alpha y)}{K_{10} + \lambda x} \tag{3}$$

$$\frac{dy}{dt} = r_2 y \frac{(K_{20} + \lambda y - \beta x)}{K_{20} + \lambda y} \tag{4}$$

Let $\frac{dx}{dt} = \frac{dy}{dt} = 0$ to obtain four sets of solutions: $b_1 = (0, \frac{K_{20}}{1-\lambda})$, $b_2 = (\frac{(1-\lambda)K_{10} - \alpha K_{20}}{(\lambda-1)^2 - \alpha\beta}, \frac{(1-\lambda)K_{20} - \beta K_{10}}{(\lambda-1)^2 - \alpha\beta})$, $b_3 = (0,0)$, and $b_4 = (\frac{K_{10}}{1-\lambda}, 0)$, respectively.

By Friedman's discriminant method, when the Jacobian matrix satisfies $Det(J) > 0, Tr(J) < 0$, the local equilibrium point is the stable strategy of the system.

$$J = \begin{bmatrix} \frac{(A - x + \lambda x)r_1}{\lambda x + K_{10}} - \frac{x\lambda(A)r_1}{(\lambda x + K_{10})^2} & \frac{-\alpha r_1 x}{\lambda x + K_{10}} \\ \frac{-\beta r_2 y}{\lambda y + K_{20}} & \frac{(B - y + \lambda y)r_2}{\lambda y + K_{20}} - \frac{y\lambda(B)r_2}{(\lambda y + K_{20})^2} \end{bmatrix}$$

Among them, $A = -x - \alpha y + \lambda x + K_{10}$; $B = -y - \beta x + \lambda y + K_{20}$.

Substitute each group of feasible solutions into the matrix verification successively, and the conclusions can be obtained in the following table.

Table 2. Dynamic evolutionary equilibrium results of competing providers under static user scale

Balancing point	$Det(J)$	$Tr(J)$	Stability
-----------------	----------	---------	-----------

b_1	$\frac{((\lambda-1)K_{10} + \alpha K_{20})r_1 r_2}{K_{10}}$	$\frac{(\lambda-1)K_{10}(r_1 + (\lambda-1)r_2) + \alpha r_1 K_{20}}{(\lambda-1)K_{10}}$	When $K_{10} < \frac{\alpha K_{20}}{1-\lambda}$ for ESS
b_2	$\frac{[\alpha\beta - D^2][DK_{10} + \alpha K_{20}]}{[\beta\lambda K_{10} + CK_{20}][-\alpha]}$	$\frac{D[\alpha\beta(\lambda + D) + D^2]K_{10}K_{20}(r_1 + r_2) + \alpha K_{20}^2[Cr_1 + D\lambda r_2] + \beta K_{10}^2[D\lambda r + Cr_2]}{(\lambda-1)K_{10}}$	When $\frac{\alpha K_{20}}{1-\lambda} < K_{10} < \frac{(1-\lambda)K_{20}}{\beta}$
b_3	$r_1 r_2$	$r_1 + r_2$	Unstable
b_4	$\frac{((\lambda-1)K_{20} + \beta K_{10})r_1 r_2}{K_{20}}$	$\frac{\beta K_{10} r_2 + (\lambda-1)K_{20}((\lambda-1)r_1 + r_2)}{(\lambda-1)K_{20}}$	When $K_{10} > \frac{(1-\lambda)K_{20}}{\beta}$ for ESS

When the user scale and the number of suppliers have cross-network externalities, the platform introduces competitive suppliers with the judgment condition that the independent user scale of the two types of suppliers should meet the requirement of $\frac{\alpha K_{20}}{1-\lambda} < K_{10} < \frac{(1-\lambda)K_{20}}{\beta}$. At this time, after a period of time, the platform can guarantee the diversity of competitive suppliers.

Platform evolution in the reciprocal relationship model

In the reciprocal relationship model, suppliers cooperate with each other through certain business to improve the overall function of the ecosystem. Due to the complementary relationship of resources between enterprises, they will promote each other's growth rate. Similarly, due to the different ecological positions in the ecosystem in which the enterprises are located, the unequal power and the different quality of resources, both sides of the reciprocal enterprises will have certain effect differences on each other's growth promotion.

Reciprocal relationship model with static user scale

At constant platform user scale, the reciprocity model proposed by May is used to portray the evolution of two types of suppliers with complementary relationships in the ecosystem, as in equations (5) and (6).

$$\frac{dx}{dt} = r_1 x \left[1 - \frac{x}{K_1 + \alpha y} \right] \quad (5)$$

$$\frac{dy}{dt} = r_2 y \left[1 - \frac{y}{K_2 + \beta x} \right] \quad (6)$$

With X and Y representing suppliers with complementary relationships, their own user scales are K_1 and K_2 , respectively, and since both types of suppliers have complementary relationships, their respective user scales will increase to $K_1 + \alpha y$ and $K_2 + \beta x$ when both types of suppliers join the platform. the number of suppliers in both types is x and y at the moment of t . In addition, the meanings represented by $\frac{dx}{dt}$, $\frac{dy}{dt}$, r_1 and r_2 in Eq. are as described before; with α representing the the reciprocity coefficient of supplier Y to X and with β the reciprocity coefficient of supplier X to Y , the more the value of α or β converges to 1 as the supplier's influence on its complementary suppliers approaches its own influence.

Let $\frac{dx}{dt} = \frac{dy}{dt} = 0$ to obtain four sets of solutions: $f_1 = (0, K_2)$, $f_2 = (\frac{K_1 + \alpha K_2}{1 - \alpha\beta}, \frac{\beta K_1 + K_2}{1 - \alpha\beta})$, $f_3 = (0, 0)$, and $f_4 = (K_1, 0)$, respectively.

By Friedman's discriminant method, when the Jacobian matrix satisfies $Det(J) > 0, Tr(J) < 0$, the local equilibrium point is the stable strategy of the system.

$$J = \begin{bmatrix} -\frac{x r_1}{y \alpha_1 + K_1} + (1 - \frac{x}{y \alpha_1 + K_1}) r_1 & \frac{x^2 \alpha_1 r_1}{(y \alpha_1 + K_1)^2} \\ \frac{y^2 \alpha_2 r_2}{(x \alpha_2 + K_2)^2} & -\frac{y r_2}{x \alpha_2 + K_2} + (1 - \frac{y}{x \alpha_2 + K_2}) r_2 \end{bmatrix}$$

It is found that $f_1 = (0, K_2)$, $f_4 = (K_1, 0)$ and $f_3 = (0, 0)$ do not satisfy the stability conditions of the solution, which indicates that two types of suppliers with reciprocal relationships do not evolve to the situation where one supplier withdraws or both withdraw. Substituting $f_2 = (\frac{K_1 + \alpha K_2}{1 - \alpha\beta}, \frac{\beta K_1 + K_2}{1 - \alpha\beta})$ into the above Jacobian matrix yields $Det(J_2) = (1 - \alpha\beta)r_1r_2$, $Tr(J_2) = -r_1 - r_2$. Since the average growth rate of suppliers is positive for both and the reciprocity coefficient between firms $\alpha, \beta \in (0, 1)$, f_2 satisfies the stability condition of the solution.

Table 3. Dynamic evolutionary equilibrium results for reciprocal providers at static user scale

Balancing point	$Det(J)$	$Tr(J)$	Stability
f_1	$-r_1r_2$	$r_1 - r_2$	Unstable
f_2	$(1 - \alpha\beta)r_1r_2$	$-r_1 - r_2$	ESS
f_3	r_1r_2	$r_1 + r_2$	Unstable
f_4	$-r_1r_2$	$r_2 - r_1$	Unstable

According to the above analysis, the introduction of suppliers complementary to existing suppliers during the development of the platform is beneficial to the platform to improve its services and can steadily expand the number of suppliers on the platform. The number of suppliers in the stable state is positively correlated with the respective user scale of complementary suppliers and positively correlated with the intensity of complementarity.

Reciprocal relationship model for dynamic user scale

Suppliers with complementary relationships also increase their user scale due to platform synergies. Among the two types of firms with reciprocal relationships, the user scale of type K_1 suppliers increases with the number of suppliers of the same type. Assuming that the expansion of the scale of suppliers X and Y has the same degree of impact on their respective user scales, λ represents the strength of the cross-network externality, then $K_1 = K_{10} + \lambda x$, $K_2 = K_{20} + \lambda y$, which is substituted into the reciprocal relationship model (7) equation and (8) equation to obtain the reciprocal relationship model of dynamic user scale as follows.

$$\frac{dx}{dt} = r_1x \left[1 - \frac{x}{K_{10} + \lambda x + \alpha y} \right] \quad (7)$$

$$\frac{dy}{dt} = r_2y \left[1 - \frac{y}{K_{20} + \lambda y + \beta x} \right] \quad (8)$$

Let $\frac{dx}{dt} = \frac{dy}{dt} = 0$ to obtain four sets of solutions: $g_1 = (0, \frac{K_{20}}{1 - \lambda})$, $g_2 = (\frac{(\lambda - 1)K_{10} - \alpha K_{20}}{\alpha\beta - (\lambda - 1)^2}, \frac{(\lambda - 1)K_{20} - \beta K_{10}}{\alpha\beta - (\lambda - 1)^2})$, $g_3 = (0, 0)$, and $g_4 = (\frac{K_{10}}{1 - \lambda}, 0)$, respectively.

By Friedman's discriminant method, when the Jacobian matrix satisfies $Det(J) > 0, Tr(J) < 0$, the local equilibrium point is the stable strategy of the system.

$$J = \begin{bmatrix} F'(x) = r_1 + \frac{\lambda r_1 x^2}{E^2} - \frac{2r_1 x}{E} & \frac{\alpha r_1 x^2}{E^2} \\ \frac{\beta y^2 r_2}{F^2} & F'(y) = r_2 + \frac{\lambda r_2 y^2}{F^2} - \frac{2r_2 y}{F} \end{bmatrix}$$

Among them, $E = \alpha y + \lambda x + K_{10}$, $F = \beta x + \lambda y + K_{20}$.

Substitute each group of feasible solutions into the matrix verification successively, and the conclusions can be obtained in the following table.

Table 4. Dynamic evolutionary equilibrium results of reciprocal providers under dynamic user scale

Balancing point	$Det(J)$	$Tr(J)$	Stability
g_1	$(\lambda - 1)r_1r_2$	$r_1 + (\lambda - 1)r_2$	Unstable
g_2	$[(\lambda - 1)^2 - \alpha\beta]r_1r_2$	$(\lambda - 1)(r_1 + r_2)$	When $\lambda < 1 - \sqrt{\alpha\beta}$ for ESS
g_3	r_1r_2	$r_1 + r_2$	Unstable
g_4	$(\lambda - 1)r_1r_2$	$(\lambda - 1)r_1 + r_2$	Unstable

When the platform introduces suppliers with complementary relationship, the strength of self-network externality of suppliers and the strength of complementarity should meet the requirement of $\lambda < 1 - \sqrt{\alpha\beta}$. Otherwise, the number of suppliers in the platform will be in a long-term disorderly state.

Simulation Results and Discussion

In order to visualize the influence of the initial platform supply structure setting on the platform evolution, numerical simulation analysis is performed using Matlab software.

Simulation of evolutionary paths under the competitive relationship model

The impact of symmetry of the initial supply structure on the evolution of the platform structure

With a given user scale, the impact of symmetric and asymmetric structures on the evolutionary path of suppliers is explored in terms of competitive relationship strength, user scale, and initial platform supplier scale when the independent user scale and competitive intensity of the two types of suppliers satisfy $\alpha K_2 < K_1 < \frac{K_2}{\beta}$. In the asymmetric structure, it is assumed that the competitive advantage of X is higher than Y , $t = 0$ when $x = 10$, $y = 8$, $K_1 = 1000$, $K_2 = 800$, $\alpha = 0.2$, $\beta = 0.3$, $r_1 = 0.4$, $r_2 = 0.3$. In the symmetric structure, in order to avoid the disturbing effects of the difference in the initial structure scale and the difference in the platform user scale, the initial sum of the parameters is made equal, i.e., $x = y = 9$, $K_1 = K_2 = 900$, $\alpha = \beta = 0.25$, $r_1 = r_2 = 0.4$. The simulation results are shown in figure 1, where the solid line represents the class X supplier scale and the dashed line represents the class Y supplier scale. The evolutionary trajectories of X and Y in the symmetric structure overlap exactly and reach stability when the number of suppliers on both sides is 720. In the asymmetric structure, the side with relative advantage finally stabilizes at 894 and the other side stabilizes at 532.

In the case of dynamic changes in user scale, when the independent user scale and competition intensity of the two types of providers satisfy $\frac{\alpha K_{20}}{1-\lambda} < K_{10} < \frac{(1-\lambda)K_{20}}{\beta}$, let λ be 0.1 in both symmetric and asymmetric structures, and other parameter conditions remain unchanged. The evolution path of suppliers is shown in figure 2 and the evolution path of user scale is shown in figure 3. The number of two types of suppliers under the symmetric structure reaches stability at 783, and the total user scale of the platform is 1995 at this time; under the asymmetric structure, the number of suppliers with relative advantages is stable at 987 and the other side is 560, and the total user scale is 1957.

Combining figure 1, figure 2 and figure 3, it can be seen that the symmetry of the platform supply structure has an impact on the scale of both sides at the final stabilization, has no impact on the overall upward trend during the evolution, and has a weak impact on the scale of the platform including users. In the asymmetric platform structure, the party with relative advantage will first go through a rapid growth phase, and then experience a slow decline due to the platform capacity limitation before finally reaching a stable state. The total supplier scale in the symmetric structure is larger than the total supplier scale in the asymmetric structure. In addition, in the symmetric structure,

both suppliers can reach the evolutionary equilibrium point in a shorter period of time than in the asymmetric structure, and in the asymmetric structure, the party with comparative advantage will reach the evolutionary steady state first.

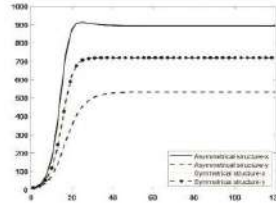


Figure 1: Static user scale supply structure symmetry

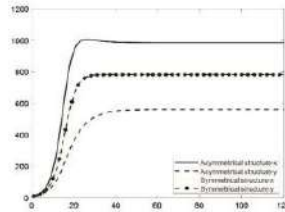


Figure 2: Dynamic user scale supply structure symmetry

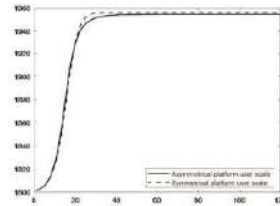


Figure 3: user scale from a dynamic perspective

The impact of the strength of the competitive relationship on the evolution of the platform

In the case of a given user scale, $t = 0$, when making $x = 10$, $y = 8$, $K_1 = 1000$, $K_2 = 800$, $r_1 = 0.4$, $r_2 = 0.3$. Set a less competitive group $\alpha = 0.2$, $\beta = 0.3$, and a more competitive group $\alpha = 0.5$, $\beta = 0.6$, the simulation results are shown in figure 4. The solid line X represents the number of scale of type firms and the dashed line Y represents the number of scale of type firms. When the steady state is reached, the number of suppliers in the more competitive group is stable at 857 and 286, respectively, and the number of suppliers in the less competitive group is stable at 894 and 532, respectively. It can be seen that when the competitive intensity increases, it causes a decrease in the number of platform supplier enterprises.

In the case of dynamic changes in user scale, order $\lambda = 0.1$, the other parameter conditions are exactly the same as those set at the time of strong and weak competitive comparison when the user scale is established, and the path of supplier evolution is obtained as shown in figure 5, and the path of user scale evolution is shown in figure 6. It can be seen that the change of competition intensity also has a significant impact on the supplier scale when the platform evolves and stabilizes, and the number of both suppliers reaches stability at 980 and 235 when the competitiveness is strong, and the total number of users of the platform is 1922; when the competitiveness is weak, the number of both suppliers reaches stability at 987 and 560, and the total number of users of the platform is 1995.

Based on figure 4, figure 5 and figure 6, it can be seen that the competitive intensity among suppliers in the platform will affect the stable state of the platform. Both the scale of suppliers and the scale of users are reduced. The degree of competition has little influence on the party with comparative advantage in the platform, but the number of the party with competitive disadvantage will be greatly reduced when the platform is stable, resulting in the decline of the overall scale of the platform. In addition, when competition increases, the time to reach the evolutionary stable state also increases with the increase of competition.

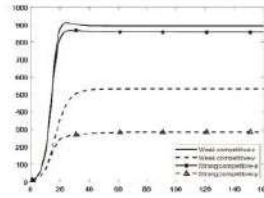


Figure 4: Competitive intensity in static view

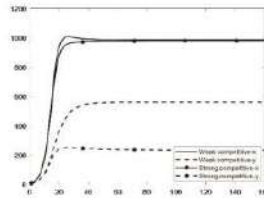


Figure 5: Competitive intensity from dynamic perspective

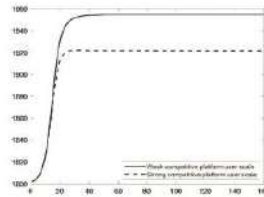


Figure 6: Competitive intensity on user scale from a dynamic perspective

The influence of supplier scale and cross-network externality on the platform evolution

In the case of dynamic changes in user scale, let $K_1 = 1000$, $K_2 = 800$, $\alpha = 0.2$, $\beta = 0.3$, $r_1 = 0.4$, $r_2 = 0.3$, set $\lambda_1 = 0.1$ and $\lambda_2 = 0.5$ reflect the influence of supplier scale and cross-network externality on the platform evolution, the simulation results are shown in figure 7 and the user scale is shown in figure 8. In the scenario with weaker cross-network externality, the number of suppliers at stability is 987 and 560, and the total number of platform users is 1995; in the scenario with stronger cross-network externality, the number of suppliers at stability is 1789 and 526, and the total number of platform users is 2958.

It can be seen that cross-network externality affects the scale of suppliers and users in the platform. In a competitive relationship, the cross-network externality will further increase the scale of the competitively advantaged party, while the scale of the relatively disadvantaged party will decrease slightly, but overall, the increase in cross-network externality will expand the overall supplier scale and the time to reach the steady state will be prolonged with the increase in cross-network externality; the user scale will increase high number with the increase in network externality.

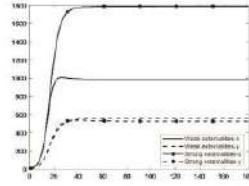


Figure 7: Influence of network externality strength under competition

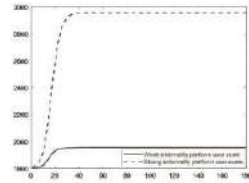


Figure 8: The impact of network externalities on user size from a dynamic perspective

Simulation of evolutionary paths under the reciprocal relationship model

The impact of symmetry of the initial supply structure on the evolution of the platform structure

In the case of a given user scale, the assumed advantage X in the asymmetric structure is higher than Y , $t = 0$ when $x = 10$, $y = 8$, $K_1 = 1000$, $K_2 = 800$, $\alpha = 0.2$, $\beta = 0.3$, $r_1 = 0.4$, $r_2 = 0.3$. In the symmetric structure, in order to avoid the disturbing influence brought by the difference in the initial structure scale and the difference in the total capacity of the maximum customers of the platform, etc., make the initial summation of its parameters equal, i.e., set $t = 0$ when $x = y = 9$, $K_1 = K_2 = 900$, $\alpha = \beta = 0.25$, $r_1 = r_2 = 0.4$. The simulation results are obtained as shown in figure 9, the solid line X represents the class supplier scale, while the dashed line Y represents the class supplier scale. The evolutionary trajectories of X and Y in the symmetric structure overlap exactly and reach stability when the number of suppliers on both sides is 1200. In the asymmetric structure, the side with relative advantage finally stabilizes at 1234, while the number of the other side reaches stability at 1170.

In the case of dynamic changes in user scale, let $\lambda = 0.1$ and other parameter conditions remain unchanged. The evolution process is obtained as shown in figure 10 and figure 11. In the steady state, the number of both types of suppliers under the symmetric structure is 1385; under the asymmetric structure, the number of enterprises on the side with relative advantage is stable at 1413 and 1360 on the other side; the number of users in the steady state is all about 2077.

Combining figure 9, figure 10 and figure 11, it can be seen that in the reciprocal relationship model, the supplier side with relative advantage in the platform grows at a faster rate, but the symmetry of the supplier structure does not have a significant effect on the time to reach the stable state of the platform or the scale of the supplier and user sides.

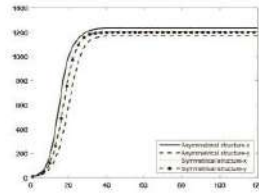


Figure 9: Static user scale supply structure symmetry

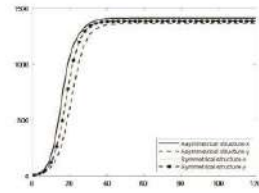


Figure 10: Dynamic user scale supply structure symmetry

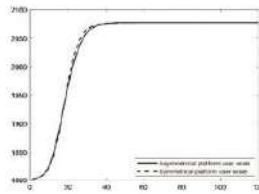


Figure 11: Platform symmetry on user scale from a dynamic perspective

The impact of the strength of the reciprocal relationship on the evolution of the platform

With a given user scale, let $x = 10$, $y = 8$, $K_1 = 1000$, $K_2 = 800$, $r_1 = 0.4$, $r_2 = 0.3$, and change only the complementary coefficients among suppliers, set the group with weaker complementarity $\alpha = 0.2$, $\beta = 0.3$; the group with stronger complementarity $\alpha = 0.5$, $\beta = 0.6$, the simulation results are shown in figure 12. When the evolution reaches stability, the number of suppliers in the group with stronger complementarity is stabilized at 2000, and the number of suppliers in the group with weaker complementarity is stabilized at 1234 and 1170, respectively. It is thus clear that an increase in complementarity causes an increase in the overall number of supplier firms when the platform is in a stable state.

In the case of dynamic change of user scale, let, the setting of other parameter conditions is exactly the same as that in the case of static strong and weak complementarity comparison. The simulation results are shown in figure 13 and figure 14. It can be seen from the figure that the change of complementary intensity also has a significant impact on the supplier scale when the platform evolution is stable. When the complementarity is strong, the number of suppliers reaches the stability at 2549 and 2588, respectively, and the total number of platform users is 2314. When the complementarity is weak, the number of suppliers reaches a stable level at 1413 and 1360 respectively, and the total number of platform users is 2077.

Based on figure 12, figure 13 and figure 14, it can be seen that the strength of complementarity among suppliers in the platform has an impact on the final stable scale of platform suppliers. When the two types of suppliers are stable, the scale difference is small or even the same, and the party that does not have a comparative advantage will eventually surpass the enterprise scale of the supplier that has a comparative advantage at the beginning. Enterprises with higher reciprocity can eventually reach a

higher stable scale through cooperation, but the time to reach stability is longer than that of enterprises with lower reciprocity.

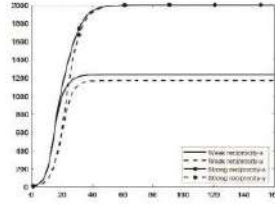


Figure 12:Static user scale complementarity intensity

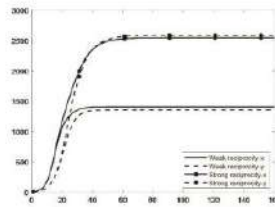


Figure 13:Dynamic user scale complementarity intensity

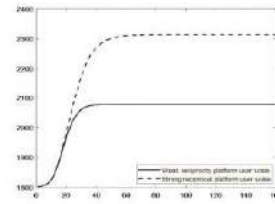


Figure 14:Dynamic user size complementarity intensity on user scale

The influence of supplier scale and cross-network externality on the platform evolution

In the case of dynamic changes in user scale, make $K_1 = 1000$, $K_2 = 800$, $\alpha = 0.2$, $\beta = 0.3$, $r_1 = 0.4$, $r_2 = 0.3$, set $\lambda_1 = 0.1$ and $\lambda_2 = 0.5$ two scenarios to analyze the impact of cross-network externalities on the final stable scale, the simulation results are shown in figure 15 and figure 16. In the scenario with weaker cross-network externalities, the number of supplier firms at stability is 1413 and 1360, and the total number of users is 2077, in the scenario with stronger cross-network externalities, the number of suppliers at stability is 3684 and 7157, and the total number of users is 5379. It can be seen that network externalities will have an impact on the scale of suppliers in the platform. From figure 15, it can be seen that the enhanced impact of cross-network externality has no effect on the rising rate of the scale of enterprises, but it will promote the stable scale of both sides of complementary enterprises, and when the cross-network externality reaches a certain intensity, it will even make the side that does not have relative advantage in the initial state eventually surpass the scale of the side that has relative advantage at the beginning. As can be seen from figure 16, the enhanced impact of externality will significantly affect the growth rate of subscriber scale and expand the scale of its steady state subscribers.

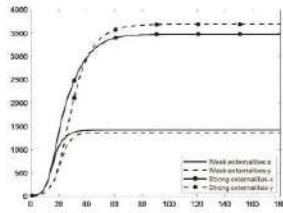


Figure 15: Network externality strength under reciprocity relationship

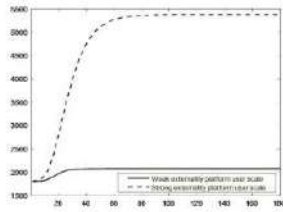


Figure 16: Network externality strength on user scale under reciprocity

Conclusion

This study focuses on the supply structure of start-up platform enterprises. Based on the competitive and complementary synergistic relationships between suppliers in the platform, the competitive and reciprocal relationship models of static user scale and dynamic user scale are constructed respectively to explore the evolutionary equilibrium point and its stability conditions. The effects of symmetry of supply structure, intensity of competition or reciprocity, and externalities of cross-network on platform evolution path are analyzed based on simulation. The main findings are as follows: First, in the competitive relationship model, under the static user scale, whether competing suppliers can symbiosis in the platform for a long time is affected by their respective user scale and competition intensity. However, when the user scale changes dynamically, it is also affected by the externalities of cross-network. In the reciprocal relationship model, when the user scale is static, complementary suppliers can symbiosis in the platform for a long time. However, when the user scale changes dynamically, the conditions of long-term symbiosis are affected by the externalities of cross-network and complementarity intensity, indicating that suppliers with complementary relationships are more likely to achieve collaborative development in the same platform. Secondly, in the case of cross-network externalities, in the competitive relationship mode, the change of user scale shows the law that the final synergy scale is restrained by competitive intensity, and the growth rate of user scale shows the law that the growth rate increases with the increase of network externalities. In the reciprocity relationship model, the change of user scale shows a law that the strength of reciprocity promotes the final synergy scale, and the growth rate of user scale also shows a law that the growth rate increases with the increase of network externalities. Thirdly, when the degree of competition or complementarity of the two types of suppliers is strengthened, or the influence of the externality of the cross network is enhanced, the polarization of the relatively dominant and the relatively inferior supplier in the stable state will be intensified in the competitive relationship mode. Among them, competition intensity has a more significant effect on the relatively inferior party, while the cross-network externality has a stronger effect on the development of the relatively superior party. In the reciprocity relationship mode, the influence of the two factors will increase the scale of both parties in the stable state, and even make the scale of the party originally at a comparative disadvantage surpass that of the party with the initial comparative advantage.

According to the research conclusions, this paper puts forward the following suggestions for enterprises in the process of platform transformation: First, when introducing competitive suppliers, the platform should choose enterprises with similar scale to the original suppliers, which is more conducive to expanding scale in a short time and reaching a stable state. Secondly, when introducing complementary suppliers, the platform should choose enterprises with stronger complementarity with original suppliers and more comparative advantages, so as to enhance resource heterogeneity and expand the scale of the platform.

Although this paper reveals the evolution process and influence mechanism of start-up platform under the competitive relationship mode and reciprocal relationship mode from static and dynamic aspects of user scale, it also has certain limitations: The relationship structure of many platforms will have both competitive and reciprocal enterprise groups, and each group is not only affected by the effect of one of the relationships. This study does not include the case that two synergistic relationships exist on the same platform.

Reference

- Agrawal, A. K., and Rahman, Z. 2015. "Roles and resource contributions of customers in value co-creation," *International Strategic Management Review*, (3:2), pp.144-160.
- Basole, R. C., and Karla, J. 2011. "On the evolution of mobile platform ecosystem structure and strategy," *Business & Information Systems Engineering*, (3:5), pp. 313-322.
- Bimpikis, K., Candogan, O., and Ehsani, S. 2019. "Supply disruptions and optimal network structures," *Management Science*, (65:12), pp.5504-5517.
- Bozarth, C. C., Warsing, D. P., Flynn, B. B., and Flynn, E. J. 2009. "The impact of supply chain complexity on manufacturing plant performance," *Journal of operations management*, (27:1), pp.78-93.
- Butzer, S., Schötz, S., and Steinhilper, R. 2016. "Remanufacturing process assessment—a holistic approach," *Procedia CIRP*, 52, pp. 234-238.
- Chopra, S., and Sodhi, M. 2014. "Reducing the risk of supply chain disruptions," *MIT Sloan management review*, (55:3), pp.72-80
- Greiner, T., and Sahm, M. 2018. "How effective are advertising bans? On the demand for quality in two-sided media markets," *Information Economics and Policy*, 43, pp. 48-60.
- Kim, D. Y. 2014. "Understanding supplier structural embeddedness: A social network perspective," *Journal of Operations Management*, (32:5), pp.219-231.
- Li, X., Cao, J., Liu, Z., and Luo, X. 2020. "Sustainable business model based on digital twin platform network: The inspiration from haier's case study in China," *Sustainability*, (12:3), pp.936.
- Liu, W., Zhang, J., Wei, S., and Wang, D. 2021. "Factors influencing organisational efficiency in a smart-logistics ecological chain under e-commerce platform leadership," *International Journal of Logistics Research and Applications*, (24:4), pp.364-391.
- Lu, G., and Shang, G. 2017. "Impact of supply base structural complexity on financial performance: Roles of visible and not-so-visible characteristics," *Journal of Operations Management*, 53, pp. 23-44.
- Manuj, I., and Sahin, F. 2011. "A model of supply chain and supply chain decision - making complexity," *International Journal of Physical Distribution & Logistics Management*, (41:5), pp.511-549.
- Ramaswamy, V., and Ozcan, K. 2018. "Offerings as digitalized interactive platforms: A conceptual framework and implications," *Journal of Marketing*, (82:4), pp.19-31.
- Tiwana, A. 2015. "Evolutionary competition in platform ecosystems," *Information Systems Research*, (26:2), pp. 266-281.
- Wright, J. 2004. "One-sided logic in two-sided markets," *Review of Network Economics*, (3:1), pp. 42-63.

E3.5 The Moderating Effects of Perceived Humanness on Contactless Service Robots

Kim, T., Kim, O.-K. Daniel, and Kang, J.

Ajou University, University of Massachusetts Boston, Ajou University

E-mail: tjnett@ajou.ac.kr, Daniel.lee@umb.edu, jykang@ajou.ac.kr

Abstract

Following the social changes resulting from the COVID-19 pandemic, companies are facing the challenge of finding optimal contactless service design. To this end, the study examines the impact of three levels of robot perceived anthropomorphism (Low, Mid, High) and two levels of robot perceived autonomy (Low, High) on consumer acceptance and fundamental processes in café service situations where interactions between consumers and service robots take place. Results from the experimental vignette method (EVM) involving 402 participants demonstrated that the level of perceived autonomy consumers expect varies depending on the service robots' levels of perceived anthropomorphism. We used a two-way ANCOVA and the PROCESS Macro Model 6 to analyze the data. Consumers reported high intentions of utilizing low level anthropomorphic robots with low autonomy and the highest intentions of utilizing medium-level anthropomorphic robots with high autonomy. However, they reported the lowest intentions of using high-level anthropomorphic robots, regardless of autonomy. These findings reflect the uncanny valley effect, which serially mediates consumer resistance and human identity threats. This study presents a managerial and practical guideline to help business practitioners optimize contactless service design to minimize consumer resistance and increase customer loyalty to contactless business establishments.

Keywords: Service Robot, Anthropomorphism, Autonomy, Uncanny Valley, Café

E3.6 Design business model for smart lifestyle mobile application

Choi, Elisa.^a Shin, Minsoo^b and Lim, Gyoo Gun.^c

^a School of Business, Hanyang University

E-mail: elisachoi@s@hanyang.ac.kr

^b School of Business,, Hanyang University

E-mail: minsooshin@hanyang.ac.kr

^c School of Business,, Hanyang University

E-mail: gglim@hanyang.ac.kr

Abstract

Due to the changes in life caused by COVID-19, the importance of a healthy lifestyle through a customized diet, close monitoring, the management convenience of the household as well as safety has increased. Data collection and analysis capabilities are more important than ever, as mobile applications continue to that manage different categories of lifestyles. This paper proposes a new platform business model by deriving meaningful keywords through news data collection and integrating three aspects of medical, dietary, and smart-home according to the changed lifestyle of individuals. The platform intends to not only to provide customized service value according to individual lifestyles, but also to facilitate the collection of personal data, thus making significant contributions to future research. More importantly, the platform will also create value for various stakeholders and enhance economic sustainability.

Keywords: Smart lifestyle, Mobile application, Business model innovation, Multi-sided platform

[DAY 2]

A4 [MFDS Session] Imported Food Safety Prediction

A4.1 AI can enhance screening and detecting the non-compliance food foreign facilities

Cho, S. G.^a, Kim, J. Y.^b, Kwon, S. H.^c and Cho, S. Y.^{d*}

^a National Food Safety Information Service

E-mail: sanggoo.cho@foodinfo.or.kr

^b National Food Safety Information Service

E-mail: kimjee@foodinfo.or.kr

^c National Food Safety Information Service

E-mail: shkwon@foodinfo.or.kr

^d National Food Safety Information Service

E-mail: sycho2k@foodinfo.or.kr

Abstract

Free Trade Agreement has increased the global food trade at tremendous rate every year. With the annual trade in food growing exponentially, imported food controls need to be strengthened to protect consumer health and ensure fair trade. This study employe a supervised learning prediction model to detect nonconformity in advance of processed food manufacturing and processing businesses. The study was conducted according to the standard procedure of machine learning, such as definition of objective function, data preprocessing and feature engineering and model selection and evaluation. After applying the feature extraction methods, the machine learning algorithm was applied to data by deriving the company's risk, item risk, environmental risk, and past violation history as feature variables. Based on the results of this study, it is expected that the official food control for food safety management will be enhanced and geared into the data-evidence based management as well as scientific administrative system.

Keywords: machine learning, import food safety, the surveillance of foreign facilities, feature engineering

Introduction

Free Trade Agreement has increased the global food trade at tremendous rate every year. With the annual trade in food growing exponentially as shown in Figure 1, imported food controls need to be strengthened to protect consumer health and ensure fair trade.

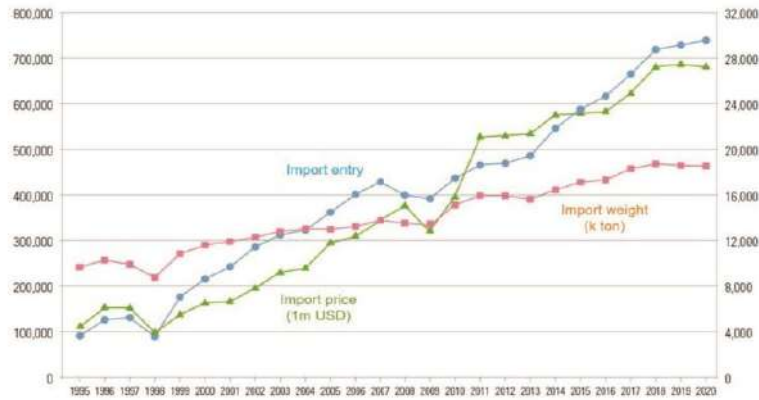


Figure 1. The Food Imports by volumes, weights, price, 1995-2020

The sudden import food accidents can cause enormous social and economic losses. Therefore, predictive system to forecast the compliance of food import with its preemptive measures will greatly improve the efficiency and effectiveness of import safety control management. The Ministry of Food and Drug Safety (MFDS) has enforced 'The Special Act on Imported Food Safety control' in 2018 to contribute to fair food trade and to improve public health by ensuring the safety of imported food. MFDA has also authorities to conduct the on-site inspections of a foreign food facility to prevent hazards of imported food and withhold the suspicious imported food. The foreign manufactures have been registered into foreign supplier verification program. The Imported food has made up a substantial and growing portion of the South Korea food supply.

In fiscal year 2021, imported food entry lines, which is an import shipment that is listed as a separate item on an entry document, totaled approximately 720 thousand with ever growing hike up. MFDS has a huge data accumulated from the past regarding importers enough to implement the computerized risk based system to make a decision to conduct on-site audit on the foreign supplier in advance. The analysis of big data and the application of analytical techniques are also used to extract meaningful information from a large amount of data. Unfortunately, not many studies have been done regarding analyzing the import food and its implication with understanding the big data of food import. The purpose of this paper is to extract a supervised learning prediction model to detect nonconformity in advance of processed food manufacturing and processing businesses.

Method

Goals

The study was conducted according to the standard procedure of machine learning, such as definition of objective function, data preprocessing and feature engineering and model selection and evaluation as shown in Figure 2.

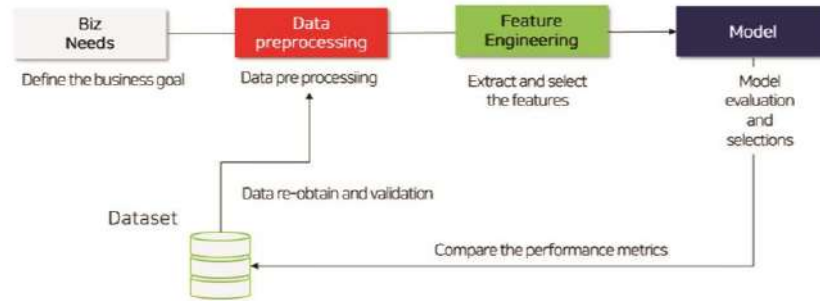


Figure 2. The research approach methodology

The dependent variable was set as the number of supervised on-site inspections and the past failure rate to import food over the past five years from 2017 to 2021, and the objective function was to maximize the probability of detecting the nonconforming companies. The machine learning system provides MFDS with new improved tolls that hold imported foods to the same standards as domestic foods and prevent unsafe food from entering the country. MFDS can categorize the foreign food facilities and facilitate the efficient and effective inspection of foreign food facilities

Data pre-processing

The Data was obtained from two sources. The first one is the results of check lists to conduct on-site audit profiles of foreign facilities across more than 100 countries. The second source is food import entries, which are aggregation of whole food import entry line, each portion of an import shipment that is listed as a separate item on an entry document. After applying the feature extraction methods, the machine learning algorithm was applied to the data by deriving the company’s risk, item risk, environmental risk, and past violation history as feature variables. The cause and effect diagram, also known as an Ishikawa or "fishbone" diagram, was utilized as a graphic tool used to explore and display the possible causes of a violation result.

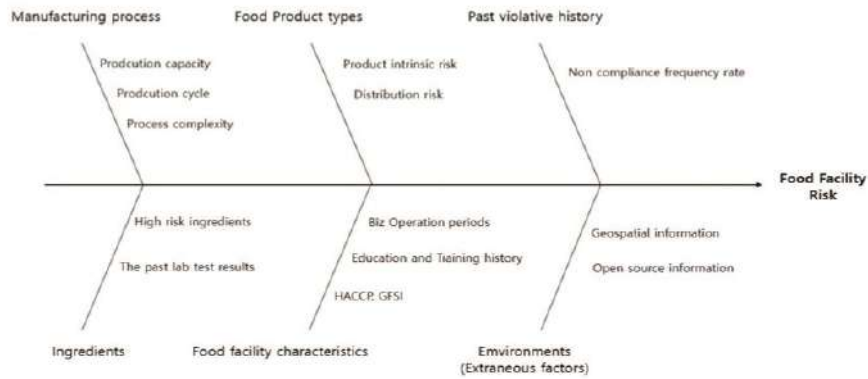


Figure 3. The cause and effect analysis framework

The classic fishbone diagram when causes group naturally under the categories of Materials, Methods, Equipment, Environment, and People. This study grouped the possible causes to affect the on-site violation result as six categories; manufacturing process, food product types, past violation history, ingredients, food facility characteristics characteristics, extraneous factors as shown in Table 1. Cause and effect diagram.

Table 1. The Relevant categories and sub factors to influence predictive power

Category	Sub factors
manufacturing process	Production capacity, product cycle, the complexity of process, Logistic complexity, etc.
food product types	The intrinsic risk to product items, the complexity of raw materials, number of product type, etc.
past violation history	Frequency base sliding time series
ingredients	High risk ingredients, the past lab test history
food facility characteristics	Operating periods, number of employees, revenues, export amounts, HACCP, etc.
extraneous factors	Temperatures, humidity, food accidents, natural disasters, etc.

The relevant information related to on-site inspection results, violation frequencies, facility capacities and occurrence of detection, etc. were converted into features to be an input of machine learning algorithms to optimize the prediction errors. Feature engineering and selection is conducted on categorical and numerical data to be converted.

Predictive Models

The Logistic regression, random forest and gradient boosting model was selected as candidate models as a results of training several machine learning algorithms such as Naïve Bayes, K-nearest neighbors, Support Vector Machines, Multi-Layer Perceptron, Light GBM, etc. The f1-score of the logistic regression was a little higher than those of other models as shown in Table 2.

Table 2. The performance metrics of models (k-fold=5)

	AUROC	Recall macro	AP	F1	MCC
Logistic Regression	73.92%	69.11%	27.61%	33.67%	26.38%
Random Forest	76.42%	69.75%	33.92%	31.28%	24.87%
Gradient Boosting	76.72%	54.83%	29.61%	17.74%	17.74%

Results

When data is imbalanced, the AUROC (Area Under Receiver Operation Characteristics Curve) might not reflect the true performance of the classifier. The definition of the False Positive Rate (FPR, or Recall), is the number of false positives divided by the number of negative samples. The Precision-Recall(PR) curve, which is similar to the ROC curve (Receiver Operation Characteristics) but with one of the axis changed from FPR to precision. The Precision-Recall curve can be used as an alternative metric to evaluate the classifier when the data is imbalanced shown in Figure 4. Therefore, this study evaluates the Random Forest model as the best model to meet research goals.

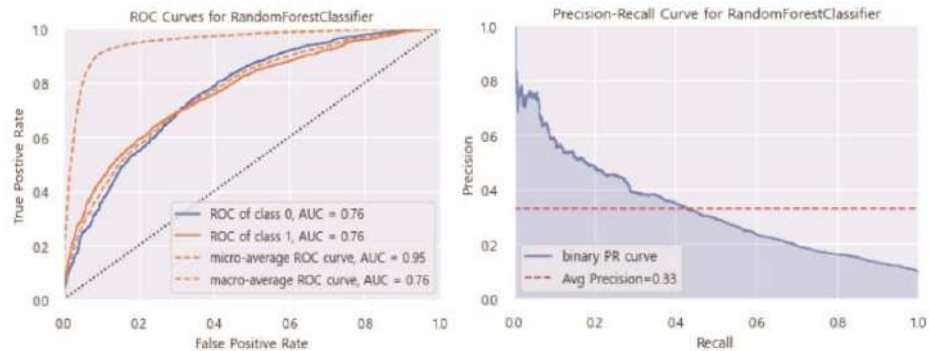


Figure 4. ROC and PR curve of Random Forest Model

Conclusion

Based on the results of this study, it is expected that the official food control for food safety management will be enhanced and geared into the data-evidence based management as well as scientific administrative system. The predictive model will reduce the burdens of the inspection of import food and increase the non-conformity rate, which will have a great effect on the efficiency of the food import safety control and the speed of import customs clearance.

Acknowledgements

This research was supported by a grant (21163MFDS516) from Ministry of Food and Drug Safety in 2022.

References

- Cho, S. G., and Choi, G. H. 2018. "Study on Anomaly Detection Method of Improper Foods using Import Food Big Data," *The Korean Journal of BigData* (3:2), pp. 19-33.
- Ganganwar, V. 2012. "An Overview of Classification Algorithms for Imbalanced Datasets," *International Journal of Emerging Technology and Advanced Engineering* (2:4), pp. 42-47.
- Bekkar, M., Djemaa, H. K., and Alitouche, T. A. 2013. "Evaluation Measures for Models Assessment over Imbalanced Data Sets," *Journal of Information Engineering and Applications* (3:10), pp. 27-38.
- Zou, Q., Xie, S., Lin, Z., Wu, M., and Ju, Y. 2016. "Finding the Best Classification Threshold in Imbalanced Classification," *Big Data Research* (5), pp. 2-8.
- Singh, D. K., and Goel, N. 2020. "Analysing Data Mining Techniques on Bank Customers for Credit Score," *2020 8th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions) (ICRITO)*, pp. 1293-1295.

A4.2 Determination of Manufacturing Process Similarity of Imported Food Products Using Word2Vec Algorithm

Jun-Hyun Oh^{a}, Sang-Soon Kim^b, Mi-Kyung Park^c, and Young-Duk Kim^d*

^{a}Department of Plant and Food Sciences, Sangmyang University, Cheonan, Chungnam, 31066, South Korea*

E-mail: junhyunoh@smu.ac.kr

^bDepartment of Food Engineering, Dankook University, Cheonan, Chungnam, 31116, South Korea

E-mail: ssk@dankook.ac.kr

^cSchool of Food Science and Biotechnology, Kyungpook National University, Daegu, 42988, South Korea

E-mail: parkmik@knu.ac.kr

^dICT Research Institute, DGIST, Daegu 42988, South Korea

E-mail: ydkim@dgist.ac.kr

* Corresponding author

Abstract

Word2Vec algorithm is one of the most widely used models of word embeddings, searching for word-to-word associations and representing word data in vector numbers. The goal of this study was to investigate the efficacy of Word2Vec algorithm as a rapid and accurate method for determining “the identical food from the same manufacturer” (IFSM) for imported food items in South Korea. The accuracy of Word2Vec algorithm was determined by correlating the cosine similarity to the manually determined manufacturing process, and the accuracy changes from the Word2Vec algorithm were also investigated by using the weights selected from critical control points (CCPs) of the process. The Word2Vec algorithm determined the manufacturing processes as “same process” with the accuracy of greater than 70%, when the cut-off value cosine similarity is set as 0.85. When the cosine similarity is less than 0.85, the user weight was applied. The accuracy was dependent upon the CCPs; when the CCPs are shared (or same) in the processes, the similarity increased, however when the CCPs were missed or not shared (or different), the similarity decreased.

Keywords: Imported foods, manufacturing process, critical control point, Word2Vec algorithm, cosine similarity

A4.3 Anomaly Detection in Imported Food Customs Clearance using Variational Autoencoder

Park, S. U.
Kyonggi University
E-mail: supark@kgu.ac.kr

Abstract

Anomaly detection is the task of detecting data that has a biased value unlike most data in a given data set. It is often used in situations where the number of targets to be detected is very small, such as credit card fraud detection. In this paper, we propose to use anomaly detection to detect improper items among imported food declaration lists. As an algorithm for anomaly detection, we want to compare the simple logistic regression and the dimensionality reduction-based methods using PCA. In particular, among the deep learning techniques that have recently received a lot of attention, VAE(variational autoencoder) is also applied to compare the results.

Keywords: Anomaly detection, machine learning, deep learning, VAE

Introduction

Anomaly detection is also called outlier detection or novelty detection (Chandola et al., 2009). These two methods are similar in that they are not supervised learning, but there is a slight difference in the method. Outlier detection is usually used to detect outliers in the training data after they have been trained with the data containing the outliers. Of course, it is possible to detect outliers in new data using the learned rules for outliers. On the other hand, novelty detection usually uses normal data to learn a range for normal data. For new data, it is used to detect data that is out of the range of these normal data. The fields where anomaly detection is mainly used include intrusion detection in the security field, fraud detection in the financial field (Ahmed et al, 2016; Rezapour and Mohammad, 2019), and detection of defective products in the manufacturing industry. The process of detecting defective goods on the imported foods is similar to the above field in many ways. First, the proportion of defective goods in the entire list is very low. Second, defective food is similar to defective products in the manufacturing industry. Therefore, it can be said that there is a basis for expecting good results when anomaly detection is applied to the detection of defective goods in the imported food customs.

In this study, to examine the applicability of anomaly detection to the detection of nonconforming objects of imported food, PCA-based and VAE-based dimensionality reduction techniques(Chalapathy and Chawla, 2019;) are applied, and the results are compared with logistic regression, a representative supervised learning technique.

Experiments setting and data explanation

The basic data on customs clearance of imported food used in the experiment is a total of 25 columns including input variables and a target variable. In the experiment, 129442 sampled data were used. The total number of normal cases is 128,176 and the number of defective cases is 1,266 which is only 0.978% of the total cases. That is, it can be seen that the data set is very imbalanced.

Anomaly detection models

We used Logistic Regression, dimensionality reduction with PCA and dimensionality reduction with VAE to compare the performance of supervised learning and dimensionality reduction method.

Logistic regression was used to measure the performance of supervised learning. In the experiment, the dimensionality reduction model using PCA and the model using VAE were used as anomaly detection models.

In addition to overall accuracy which is the most basic metric, we used precision, recall, and f1-score as the performance evaluation metrics for the proposed models.

Results of anomaly detection

Table 1 shows the performance evaluation results of the three models. Logistic regression showed the lowest performance at 95% in accuracy, but showed superior performance in recall and f1-score more than doubled compared to other models. On the other hand, while PCA and VAE showed high performance in accuracy, performance fell short of logistic regression in precision, recall, and f1-score. VAE showed slightly better performance than PCA in recall, but lower in f1-score.

Table 1. Anomaly detection performances

Model	Accuracy	Precision	Recall	F1-score
Logistic Regression	0.95	0.07	0.33	0.12
PCA	0.98	0.06	0.04	0.05
VAE	0.98	0.04	0.05	0.04

Conclusion and future research

In this paper, anomaly detection method was applied to detect defective food in imported food customs clearance. The performance was measured for the dimensionality reduction method using PCA and the dimensionality reduction method applying VAE based on deep learning, but the performance fell short of logistic regression, a supervised learning method.

The overall poor performance is because feature engineering has not yet been completed. That is, features that express the characteristics of the imported food have not been sufficiently secured. It is expected that all three models will be able to show better performance when feature engineering is completed in the future. In addition, VAE requires learning of latent vectors that can fully reflect the distribution of normal data. It is expected that better learning through various fine tuning will show better results.

References

- Ahmed, M., Mahmood, A.N. and Islam, M.R., 2016. A survey of anomaly detection techniques in financial domain. *Future Generation Computer Systems*, 55, pp.278-288.
- Chalapathy, R. and Chawla, S., 2019. Deep learning for anomaly detection: A survey. *arXiv preprint arXiv:1901.03407*.
- Chandola, V., Banerjee, A. and Kumar, V., 2009. Anomaly detection: A survey. *ACM computing surveys (CSUR)*, 41(3), pp.1-58.
- Pang, G., Shen, C., Cao, L. and Hengel, A.V.D., 2021. Deep learning for anomaly detection: A review. *ACM Computing Surveys (CSUR)*, 54(2), pp.1-38.
- Rezapour, M. and Mohammad, M., 2019. Anomaly detection using unsupervised methods: credit card fraud case study. *Int J Adv Comput Sci Appl*, 10(11), pp.1-8.

Lessons from Feature Engineering and Machine Learning Modeling for Determination of Defective Health Functional Foods*

Submission Type: Extended Abstract

Lee, K. S.^a and Sohn, K. S.^b and Kim, H. J.^c and Bak, Y. R.^d and Shin, Y. J.^e and Kwon, O. B.^f

^a Department of Big Data Analytics Graduate School, Kyung Hee University
E-mail: nowksu@khu.ac.kr

^b Department of Management Graduate School, Kyung Hee University
E-mail: miroo1215@khu.ac.kr

^c Department of Big Data Analytics Graduate School, Kyung Hee University
E-mail: dunhill@khu.ac.kr

^d Department of Big Data Analytics Graduate School, Kyung Hee University
E-mail: yyam1020@khu.ac.kr

^e Department of Management Graduate School, Kyung Hee University
E-mail: yoonjong12@khu.ac.kr

^f School of Management, Kyung Hee University
E-mail: obkwon@khu.ac.kr

Abstract

Health functional foods must be reviewed for safety before being sold to consumers. During inspection at the point of import, unsafe health functional foods are difficult to identify. Machine learning models can help provide the knowledge needed to extract samples that need to be examined. However, the most popular machine learning model, GLM, produces some outliers and is vulnerable to the limitations of customs clearance data, which is known for high nonlinearity and class imbalance. Therefore, a more suitable algorithm is required. The purpose of this study is to select an optimal machine learning model in terms of both accuracy and explainability of results according to the characteristics of health functional foods. The results of our analysis suggest that our approach will be applicable to other inspection problems with data characterized by outliers, nonlinearity, and class imbalance.

Keywords: health functional foods, inspection problems, machine learning, data imbalance

Introduction

Health functional foods must be reviewed for safety before being sold to consumers (Kim et al., 2006; Lobo et al., 2010). During inspection at the point of import, unsafe health functional foods are difficult to identify. Lack of knowledge of which products should be inspected results in random inspection, limiting detection of defective products, increasing the number of inspections, and causing inefficiency. However, knowledge of which cases should be extracted and inspected can be gained using a machine learning model. In the past, generalized linear modelling has been used for selection of potentially defective health functional foods for inspection. However, using the GLM, it is difficult to assume

* This research was supported by a grant (21163MFDS516) from Ministry of Food and Drug Safety in 2022.

randomness for the residuals. In addition, results using this method are vulnerable to nonlinearity and outliers (Warne, 2020). Moreover, the prediction accuracy using the GLM is generally not high. The purpose of this study is to select the optimal machine learning model considering both its accuracy in terms of defect determination and explainability of results according to the characteristics of health functional foods. Because real-time inspection is sometimes required for rapid learning, we also examine elapsed time. The results of this study will be useful for solving other inspection problems involving data with many outliers, severe nonlinearity, and class imbalance.

Method

Preprocessing

Data was obtained from public institutions in charge of customs clearance of health functional foods. Since our intention was to compare the GLM with other models using the variables in the data, the same data was used in all models. However, in this study, variables were modified so as to improve predictive power. First, among the 64 variables, those with a missing value ratio of more than 50% or a very high correlation coefficient between independent variables were dropped out. The remaining variables were changed as follows:

First, we performed binning of variables. Taxable price, net weight, date of receipt, name of exporting country, and item name were changed into taxable value (low, normal, high), net weight (light, normal, heavy), time of day (dawn, morning, daytime, evening, night), season (spring, summer, autumn, winter), the continent to which the exporting country belongs, and item group.

Second, the researchers entered "<item name> defect detection" as a keyword in Google and used the search volume as a risk variable for each item.

Third, date-related data such as shipment date, arrival date, and receipt date, and shipping distance data such as the elapsed time between date of arrival and date of shipment (arrival date – shipment date), elapsed time between the arrival date and date of entry into port (arrival date – the date of entry), elapsed time between the date of receipt and date of delivery (date of receipt – date of delivery), total days required (date of receipt – date of shipment), and days required versus distance (total required days ÷ shipping distance) were converted into variables helpful in determining defective products.

Fourth, data for all variables was converted to a nonconformity ratio. For example, the name of the country of manufacture may not affect which products are identified as defective, but the nonconformity ratio of past cases of defective goods coming from a given country of origin may do so. Thus, we used the likelihood value for each variable, both as a variable and as a classifier, as follows:

$$x \rightarrow \Pr(x)$$

$$\Pr(x) = \log(\tau(x) \times \lambda(x))$$

where $\tau(X)$, $\lambda(X)$ indicates the frequency and nonconformity ratio of feature X .

Models

We compared the following models in terms of their ability to detect defective products: logistic regression, decision tree, random forest, naïve Bayes, MLP, LightGBM, XG Boost, Cat Boost, and explainable boosting machine. Data from January 2016 to the third quarter of 2021 was used as training data and test data, and data from the fourth quarter of 2021 was used as the validation set. A five-fold cross-validation method was used for training and test data selection and model optimization.

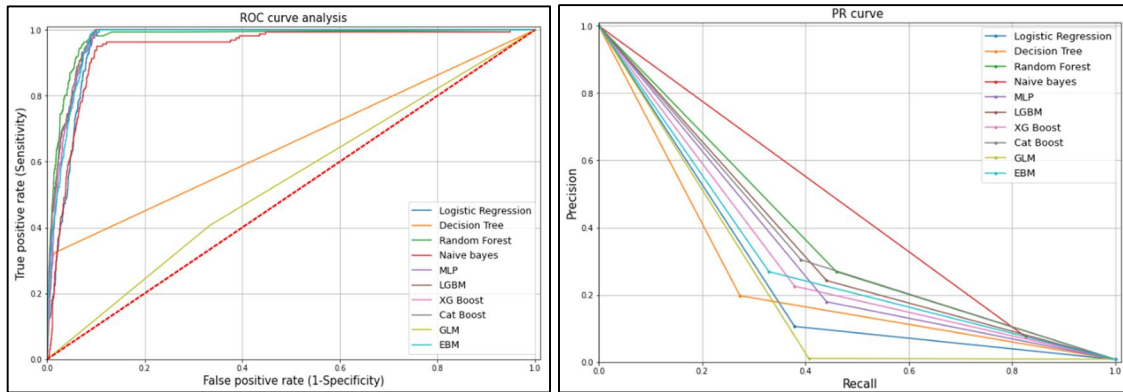
As performance evaluation metrics, we utilized overall accuracy, precision, recall, the F1-score, AUC, and Mathew correlation coefficient as accuracy indicators. In particular, we examined the role of recall, because it is important to find defective products, and because of the severe data imbalance. Clearly, recall is more important in identifying defective products than other metrics. In addition, required time and explainability were considered.

Results

Table 1 and Figure 1 illustrate the results of performing nine tests using all types of ML models examined in this study. In the case of GLM, a comparative model, the results were obtained by performing model updates at 15-day intervals using the original dataset.

Table 1. A Sample Table

Model	AUC	Accuracy	Precision	Recall	F1-score	MCC	Elapsed Time (min)	Explainability	CM
GLM	0.53	0.66	0.01	0.4	0.02	0.014	-	high	4.00
Random forest	0.97	0.98	0.27	0.46	0.34	0.34	10	fair	9.14
Cat Boost	0.97	0.98	0.3	0.39	0.34	0.34	6	fair	8.29
LightGBM	0.97	0.98	0.24	0.44	0.31	0.32	1	fair	8.00
XG Boost	0.97	0.98	0.22	0.37	0.28	0.28	5	fair	6.57
EBM	0.66	0.98	0.26	0.32	0.29	0.29	160	high	6.21
MLP	0.97	0.98	0.18	0.44	0.25	0.27	186	low	6.57
Decision tree	0.65	0.98	0.19	0.27	0.22	0.22	1	high	4.29
Logistic regression	0.96	0.97	0.1	0.37	0.16	0.19	1	fair	4.00
Naïve Bayes	0.94	0.92	0.07	0.82	0.13	0.23	0.3	low	4.43



(a) ROC curve

(b) PR curve

Figure 1. Modified Research Model

Conclusion

Several lessons were learned from the results of this study. First, in severely imbalanced datasets with outliers, feature engineering can be more important than the problem of selecting the optimal machine learning algorithm. Because it is difficult to acquire inspection knowledge *a priori*, it may be better to recognize each variable as a classifier, searching for causal relationships by combining classifiers. Second, when the target of machine learning is temporal data, fair comparison in terms of training and validation performance is made possible by separating the data into different sets for each time period. In other words, the most desirable model is that which predicts the future well only by learning from past data. Third, predictive performance could be improved by including public data such as social data in the acquired internal dataset. In fact, the variables obtained using Google were among the most

important. In future, we intend to conduct research using deep learning algorithms for further performance comparison. Finally, in order to solve the data imbalance problem, we plan to devise a method of automatically generating risk cases using GAN or an autoencoder.

References

- Kim, J. Y., Kim, D. B., & Lee, H. J. 2006. "Regulations on Health/Functional Foods in Korea," *Toxicology*, (221:1), pp. 112-118.
- Lobo, V., Patil, A., Phatak, A., and Chandra, N. 2010. "Free Radicals, Antioxidants and Functional Foods: Impact on Human Health," *Pharmacognosy Reviews*, (4:8), p. 118.
- Warne, R. T. 2020. *Statistics for the Social Sciences: A General Linear Model Approach*. Cambridge University Press.

[DAY 2]

B4 [Special Session] KMU-KIISSS AI
Professional Certificate Program

B4.1 딥러닝을 이용한 코로나 전후 기간 항공 수요 예측 비교

손용성
국민대학교 경영대학원
AI빅데이터전공
dkbs12@kookmin.ac.kr

국문초록

최근 시계열 데이터의 분석 및 활용에 있어, 전통적인 시계열 관련 통계 기법만을 사용하거나 또는 전통적인 기법과 머신러닝 기법을 혼합한 접근법 보다는 순수 머신러닝 모형을 사용하는 것이 더 뛰어난 성능을 보이고 있다. 본 연구에서는 2015년 5월부터 2021년 12월까지 한국지역의 항공 수요 관련 데이터에 기반하여, 다양한 딥러닝 모델들의 코로나 발생 이전과 이후에 대한 예측 성능을 비교하였다. 공변량을 활용하지 않은 순수 시계열 모형의 경우에는 ARIMA 모형을 Baseline으로 LSTM과 N-BEATS 모형의 항공 수요 예측 성능을 비교하였으며, 특정 이벤트, 정적 공변량, 시간 의존적인 공변량 (Time Varying Covariate)을 모형에 반영하기 위해 DeepAR, TFT(Temporal Fusion Transformer) 방법론들을 적용하여 예측성능에 대한 비교 분석을 진행하였다. 결론적으로 코로나 발생 이후 시기에 대한 예측도는 모두 저조했으나, DeepAR 및 TFT 모델은 타 모델에 비해 비교적 sMAPE 기준 우수한 모습을 보였다.

주제어

딥러닝, 머신러닝, 성능비교, 코로나, 항공수요

B4.2 다변량 시계열 데이터를 이용한 암호화폐 가격 예측

이기현

국민대학교 경영대학원

AI빅데이터전공

lkh0125@kookmin.ac.kr

국문초록

최근 주목받고 있는 암호 화폐는 다양한 요인에 의해 가격이 결정됨에 따라 가격 변동성이 높아 가격 예측이 어려운 분야이다. 본 연구에서는 암호 화폐의 가격 예측에 있어, 공변량의 효과를 파악하여 시사점을 제공하고자 한다. 이를 위해 과거 5년 동안의 가상화폐 거래 지표, 시장 참여자의 투자 심리를 나타낸 공포-탐욕 지수, 그리고 금리, 유가, 금시세, 원자재 가격등의 경제 산업지표 등 암호화폐 가격 결정에 영향을 미치는 다양한 요인을 반영할 수 있는 학습데이터를 활용하였으며, RNN 기반의 LSTM, 순수 deep learning 모형인 N-BEAT, Attention 기반 구조의 TFT(Temporal Fusion Transformers), 그리고 LSTM을 기반으로 한 확률 모형인 DeepAR 등을 활용하여 가상화폐 중 하나인 이더리움의 가격 예측 성능을 비교 분석하였다. 본 연구의 목적이 암호 화폐 가격 예측에 있어, 공변량의 효과를 파악하는 데 있어 첫번째로, 공변량이 없는 LSTM 모형을 Baseline 모델로 하여 경제 지표 등의 정형 변수들이 암호화폐 가격 예측에 미치는 영향을 확인한 후 다음으로, 암호화폐와 관련된 뉴스 데이터에서 자연어 처리를 통해 얻은 비정형 데이터를 공변량으로 활용하여 시장의 감성이 가상화폐 가격예측에 미치는 영향도를 확인 하였다.

주제어

가격 예측, 다변량분석, 딥러닝, 시계열분석, 암호화폐

B4.3 딥러닝 기반 시계열 기법을 활용한 유통제품 수요예측

전은하
국민대학교 경영대학원
AI빅데이터전공
eunhaj02@kookmin.ac.kr

국문초록

유통 공급망 관리에 있어서 재고 결품과 과 재고 보유를 막기 위해 관련 수요 예측은 기업의 수익 구조와 밀접한 관련이 있어 많은 관심을 받고 있는 제이다. 특히 본 연구에서 주목하고 있는 외식업의 경우 그 특성상 다양한 제품군을 취급할 뿐만 아니라 취급하는 품목들의 수명주기가 대체로 짧아 정확한 수요 예측에 기반한 유통 공급망 관리가 필수적이라고 할 수 있다. 이에 따라 본 연구에서는 2011년 1월 부터 2016년 6월 중순까지 4만 2840개 품목에 대한 월마트 데이터를 기반으로 정확한 수요 예측을 할 수 있도록 다양한 모형을 개발하고 그 성능을 비교하였다. 특히, 유통 제품의 수요 예측은 시간에 따른 변화를 반영하는 시계열 예측임에 따라 다양한 공변량을 활용하기 위해 XGBoost, Catboost, LightGBM등 앙상블(ensemble) 기법을 활용하였으며, 특히 최근 multi-scale 데이터에 대해 좋은 예측 성능을 보여주는 Deep AR, N-BEATS와 Transformer를 활용한 TFT 모형을 해당 수요 예측에 적용, 각 모형의 성능과 특성을 비교 분석하였다.

주제어

딥러닝, 시계열 분석, 앙상블모형, 유통공급망관리, 수요예측

[DAY 2]

C4 [ICEC-Paper Session] Live Commerce

C4.1 Is Live Commerce Transforming the Shopping Experience?: A Study on Perceived Value of live Commerce, Interaction with Seller, Trust in Seller and E-WOM Intention

Choi, E. and Jeon, S.

Gachon University

E-mail: eunleye@gmail.com, smjeon@gachon.ac.kr

Abstract

Due to the current COVID-19 pandemic, there is a trend worldwide for consumers to prefer e-commerce instead of brick-and-mortar stores. In this regard, 'live commerce', which is the integration of real-time interaction and commerce, is in the spotlight. Compared to the forecast that the size of the domestic live commerce market will exceed 10 trillion won in 2023, there are significantly fewer studies. Therefore, this study examined how the value of live commerce and consumer motives predict E-WOM intentions, which are active consumer behaviors. Live commerce values are classified into hedonic values, utilitarian values, symbolic values and emotional values. It was also explained by applying the means-object chain theory and the use and satisfaction theory. The seller, who plays a major role in live commerce, was set as a parameter between the dependent variable E-WOM intention. At this time, the study was established by classifying the interaction with seller and trust in seller. Also, by using the perceived risk as a moderating variable, it was examined whether there was an effect between the perceived values and the seller. The subjects of this study's questionnaire responses were 410 people who used live commerce.

Keywords: Live commerce, Perceived value, E-WOM intention, Mean end chain theory, Perceived risk

Introduction

Currently, offline stores are declining worldwide due to the COVID-19 pandemic. Due to health and safety concerns, consumers tend to prefer e-commerce. In this regard, 'live commerce', which is the integration of real-time interaction and commerce, is in the spotlight. Through the use of live commerce, e-commerce has shifted from a product-centric environment to a social, hedonistic, and customer-centric environment (Wongkitrungrueng & Assarut 2018). According to eBest Investment & Securities, the domestic live commerce market is expected to grow to about KRW 8 trillion by 2023, and Kyobo Securities also predicted that the size of the domestic live commerce market will exceed KRW 10 trillion by 2023. In this study, to examine the value of live commerce and consumer motives, the motive and value of using live commerce were analyzed by applying the Means-End Chain Theory and Uses and Gratification Theory. The purpose of this study is to examine how the value of these motivations predicts the intention of E-WOM, which is an active consumer behavior in the future. It also discusses the mediating role of trust and interaction with streamers in live commerce and whether perceived risks affect relationships.

Literature Review

Perceived Value

Perceived value is one of the most powerful forces in the market for understanding consumer behavior (Zeithaml, 1988; Dodds et al., 1991). According to Zeithaml (1988), value arises from the link between what the customer receives (quality, benefit, value, utility) and what the customer sacrifices for the benefit (price, sacrifice).

According to Zeithaml (1988), value arises from the link between what the customer receives (quality, benefit, value, utility) and what the customer sacrifices for the benefit (price, sacrifice). Therefore, value judgment is a factor that induces consumer preference, which increases consumers' desire to participate in various shopping activities (Overby & Lee, 2006).

Hedonic Value

Hedonic value is a value that customers receive based on pleasant experiences and pleasures (Jarvenpaa & Todd, 1997). According to Parsons (2002), most online shoppers believe that online shopping provides a way out of their daily life. The real-time interaction of live commerce and the ability to view products in video make shopping activities more enjoyable and attractive.

Utilitarian Value

Utilitarian value refers to the degree to which a product/service achieves its intended purpose. It can save effort, money and time (Rintamäki, Kanto, Kuusela, & Spence, 2006), and it can improve convenience in terms of accessibility, search, ownership and transaction (Seiders, Berry, & Gresham, 2000). Live commerce was born to compensate for the disadvantage of not being able to physically test products in existing online shopping.

Symbolic value

According to Smith and Colgate (2007), Symbolic value refers to the psychological meaning that customers give to products. Consumers are creating their own identity through the shopping process. Customers can make themselves innovative and trendy by engaging in live commerce, a relatively modern method of online commerce. Consumers are also more likely to shop where they meet like-minded people, so they can engage in live commerce chat windows (Massicotte, Michon, Chebat, Sirgy, & Borges, 2011).

Emotional value

Emotional value can be defined as the ability to induce feelings of pleasure or pleasure derived from the experience of something new and different created by a product. (Sweeney and Soutar, 2001) The emotional value of service is derived from the interaction between employees and customers (Smith & Colgate, 2007). Live commerce allows consumers to communicate in real time with other consumers and sellers anytime, anywhere, providing enjoyment while reducing boredom or loneliness.

Perceived risk

Perceived risk is that the perceived risk of online commerce is uncertain about seller identity, fear of opportunism, and uncertainty of product quality, which affects reliability (Goode & Harris, 2007). contains the title, abstract and keywords), all text, figures, tables, references and appendices.

Seller (Streamer)

Interaction with seller

Interaction with seller (interaction between seller and consumer) has an element in which interaction occurs due to real-time communication between the streamer and the consumer due to the nature of live streaming media (Etemad-Sajadi 2016). Live commerce allows consumers to engage in real-time two-way communication with sellers (Wohn, Freeman, & McLaughlin, 2018).

Trust in seller

Trust in seller: A site's ability to provide truthful information and meet expectations, perceptions of the company's good intentions, and impressions of the system constitute online trust (Bart, Shankar, Sultan, & Urban). , 2005). The lack of face-to-face interaction between customer and seller and between

customer and product is one of the most important aspects of customer trust in online commerce (Brynjolfsson & Smith, 2000).

E-WOM Intention

Ultimately, E-WOM has a greater impact on purchasing decisions than traditional marketing communications (De Bruyn and Lilien, 2008). De Bruyn and Lilien (2008) study that consumers are more likely to trust and rely on the opinions and recommendations of other users. BrightLocal (2017) found that 85% of consumers trust online reviews more than personal recommendations.

Uses and Gratification Theory (U&G Theory)

The Uses and Gratification (U&G) theory first developed in the field of mass communication is used to explain how individuals are induced to use specific media by psychological and social motives (Katz et al., 1973). According to U&G theory, individuals actively use media and select media types according to their needs and motives (Katz et al., 1973; Rubin, 2002). U&G theory also distinguishes between sought satisfaction and obtained satisfaction. The satisfaction that an individual seeks may differ from that obtained from experience (Li et al., 2019). Therefore, in this study, U&G theory was used as a basis for understanding the motivation of live commerce. We will be able to adapt and develop items and scales that are suitable for the context of live commerce based on the application of uses and gratifications theory to the social media and online shopping domains. The uses and gratifications theory can be applied to social media platforms and online shopping in order to develop items and scales that are suitable for the context of live commerce.

Means-End Chain Theory (MEC Theory)

The purpose of the MEC theory is to explain consumer motivations arising from personal relevance that individuals attach to products (Gutman, 1997). According to theory, product attributes are the means by which consumers obtain the desired end or value from the benefits (or consequences) of consumption. Therefore, when choosing to consume a product, consumers will cognitively evaluate the attributes of the product in terms of the consequences of using the product and subsequent means to achieve significant personal value (Gutman, 1997). Referring to <Figure 1>, the characteristics of Means-End Chain Theory are explained.

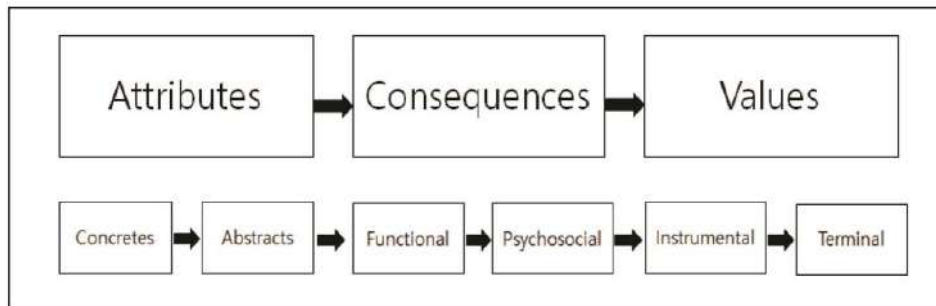


Figure 1. Means-End Chain Model

In this study, perceived values were classified into 4 categories: Hedonic, Utilitarian, Symbolic, and Emotional.

- Social, Free coupon, Event, Game, Stress out → *Hedonic value*
- Visual information, Time-saving, Money-saving, Quick response → *Utilitarian value*
- Adventure, Trendy, Social, Smart, Ideal product, Early adapter → *Symbolic value*
- Lonely, Fun, Comfortable, Stable, Depressed, Boring → *Emotional value*

Based on these characteristics of live commerce, four values were created.

Research Model and Hypotheses

Although there have been several studies on the characteristics of live commerce in previous studies, studies on actual consumer motives and values and the influence of sellers, a key factor, have not been conducted much. Therefore, in this study, live commerce, which is rapidly emerging due to variables created by grafting the means-purpose chain theory and the use and satisfaction theory, was explored. In particular, variables that match the characteristics of live commerce, such as symbolic value and emotional value, were used except for the hedonic value and utilitarian value, which were used a lot in the past. In addition, studies on E-WOM intention, which have a large influence on consumer purchases, were also lacking. Therefore, this study examines the effect of the value perceived by consumers of live commerce on the intention of E-WOM, and examines the mediating effect of the seller and the moderating effect of perceived risk in the relationship with <Figure 1> and the research model composed together. The hypotheses of this study are as follows.

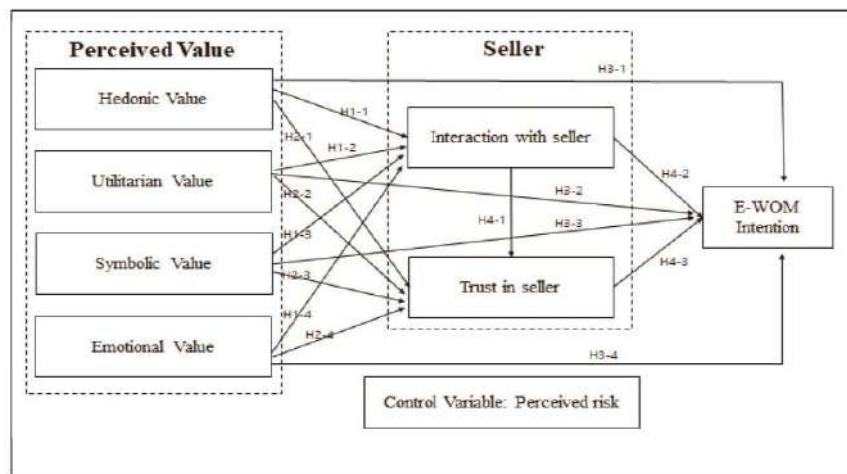


Figure 2. Research Model

Hypothesis 1-1~4. Perceived values (hedonic, utilitarian, symbolic, emotional) will influence interaction with seller.

Hypothesis 2-1~4. Perceived values (hedonic, utilitarian, symbolic, emotional) will affect trust in seller.

Hypothesis 3-1~4. Perceived values (hedonic, utilitarian, symbolic, emotional) will influence the E-WOM intention.

Hypothesis 4-1. The interaction with the seller will affect the Trust in seller.

Hypothesis 4-2. Interactions with seller will affect E-WOM intention.

Hypothesis 4-3. Trust in seller will affect the E-WOM intention.

Hypothesis 5. Perceived risk may have a moderating effect.

Data Analysis and Results

Internal reliability, convergent validity, and discriminant validity were used to evaluate the quality of the measurement model (Sarstedt et al., 2017). Structural equation modeling using AMOS 24 software was adopted to analyze the data. A confirmatory factor analysis (CFA) was performed to validate the study configuration. As reported in Appendix A, the CFA results showed satisfactory model fit (χ^2/df

= 1, 748 < 3, RMSEA = 0.042 < 0.05, CFI = 0.962 > 0.95, IFI = 0.967 > 0.95, GFI = 0.904 > 0.90, NFI = 0.915 > 0.90). All standardized factor loadings were almost all significant above 0.70, indicating good reliability for all measures. Cronbach's alpha and synthetic reliability (CR) were applied to measure the internal reliability of the construct. The results in Table 1 show that both the Cronbach's alpha value and the synthetic reliability value of each construct exceed the recommended minimum of 0.7, suggesting that each construct has a high internal reliability (Gefen et al., 2000). Convergent validity was used to measure the degree of correlation between constructs.

Test convergence validity using mean variance extraction (AVE) and item loading. The AVE values for all configurations ranged from 0.5045 to 0.7145, exceeding the acceptable level of 0.5 (Chin, 1998). Also, all item loading values exceed the required value of 0.7. Therefore, the results show that the convergent validity is also satisfied. This is considered adequate validity based on the proposed AVE value higher than 0.5 (Fornell & Larcker, 1981). According to Fornell and Larcker (1981) criteria, to determine satisfactory discriminant validity, each construct must have a higher correlation with its own construct than the others.

For the study sample, a survey was conducted from November 1 to 15, 2021, targeting consumers nationwide who have used live commerce. To analyze this, SPSS 25 and AMOS 25 programs were used for analysis. As a result of the study, only the emotional values of hypotheses 1-4 were rejected in the relationship between the perceptual values of hypotheses 1-1 to 4 and the interaction with the seller. All the hypotheses were accepted in the relation between the perceptual value and the seller's reliability, hypotheses 2-1 to 4. As a result of examining whether the perceptual value of hypotheses 3-1~4 affects the intention of E-WOM, the symbolic value of hypothesis 3-3 and the emotional value of hypothesis 3-4 were rejected. Hypothesis 4-1, interactivity with sellers, affects reliability with sellers, so the hypothesis was adopted. Hypothesis 4-2, the relationship between interaction with sellers and intention of E-WOM, was rejected. It was verified that the seller's reliability with hypothesis 4 affects the intention of E-WOM, and the hypothesis is accepted. Hypothesis 5 had a moderating effect on perceptual risk, and at this time, it was found that it only had an effect on emotional value and seller's reliability. The verification result was composed as shown in <Figure 3>.

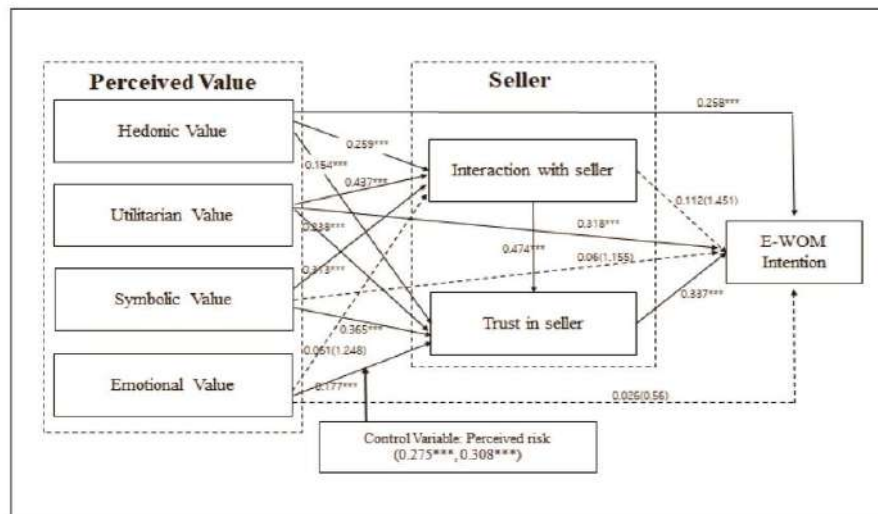


Figure 3. Structural Model Testing Results

Moderating effect

Table 1. Moderating effect

Hypothesis	Path*	Perceived Risk				Unconstrained model	Constrained model	$\Delta \chi^2$ (1)=3.84	Result
		Low		High					
		β	t-value	β	t-value				
H2-1	HV → TS	0.242	3.308***	0.031	0.362	χ^2 (838)=2102.781	$\Delta \chi^2$ (1)>2.450	Not supported	
H2-2	UV → TS	0.298	3.836***	0.065	0.486		$\Delta \chi^2$ (1)>1.5070	Not supported	
H2-3	SV → TS	0.349	4.779***	0.345	3.335***		χ^2 (838)=2100.349	$\Delta \chi^2$ (1)>0.0180	Not supported
H2-4	EV → TS	0.275	3.183***	0.308	3.613***		χ^2 (838)=2104.253	$\Delta \chi^2$ (1)<3.9220	Supported
H5	TS → EW	0.293	3.948***	0.266	2.6		χ^2 (838)=2100.825	$\Delta \chi^2$ (1)>0.4940	Not supported

*HV=Hedonic value, UV=Utilitarian value, SV=Symbolic value, EV=Emotional value, TS=Trust in seller, EW=E-WOM intention.

***p<.001

First, the difference between the constrained model and the unconstrained model, which constrains that the path coefficients (factor load and regression number) are the same, is shown in <Table 1>, and the amount of change in χ^2 is 3.84. Since the difference in degrees of freedom of all hypotheses except H2-4 is less than 3.84, it is not significant and is rejected. In other words, it appears that there is no moderating effect between the perceived value of perceived risk (Hedonic value, Utilitarian value, Symbolic value) and the reliability of the seller and the trust in the seller and the E-wom intention. However, in H2-4 (Emotional value and reliability of seller), the degree of freedom between the constrained model and the non-constrained model shows that 3.9220 has a more moderate effect on the size than 3.84.

Second, <Table 1> is a multi-group analysis that has a statistically significant positive effect on the seller's reliability in the case of the low group, which perceives the perceived risk as low in the non-constrained model, and even in the case of the high group with high perceived risk. It was found to have a statistically significant effect on the reliability of the seller.

Taken together, it can be seen that the path of the significant difference is that the perceived risk forms an influence only on the emotional value and trust in the seller. Specifically, the result showed that there was a more significant influence in the perceived risk high cluster ($\beta=0.308$, $t=3.613$, $p < .05$) than in the low perceived risk group ($\beta=0.275$, $t=3.183$, $p < .05$) has been confirmed.

Conclusion

This study focused on the characteristics of live commerce and consumer motivation. It provides customers with a useful, fun and meaningful shopping experience that overcomes the shortcomings of

traditional online shopping. In this study, the relationship between perceived value of live commerce, interaction with sellers, trust in seller and E-WOM intention was analyzed. Our findings revealed various mechanisms by which the hedonic, utilitarian, symbolic, and emotional values of live commerce are linked with trust in seller and E-WOM intention. It was found that the hedonic value and the utilitarian value have a direct positive (+) effect on the E-WOM intention. This finding is consistent with previous studies of E-WOM behavior. We found that customers who perceived something interesting and useful were more likely to exhibit a high level of engagement. However, according to the results of this study, symbolic value and emotional value did not directly affect the intention of E-WOM. This means that hedonic and utilitarian values are practical, realistic, and present value that can be obtained from the seller. On the other hand, symbolic and emotional values seem to be because future benefits are presented based on perceived similarity and intimacy between customers and sellers or other customers, rather than the product itself. Also, all perceived values were found to have an effect on trust in sellers. Likewise, the hedonistic value of live commerce expressed through pleasure and pleasure in the way of presenting and imagining products and the practical value of obtaining and checking product information easily and accurately led to trust in sellers and E-WOM intentions. It was found that when there is no trust in the seller, symbolic value and emotional value do not affect the E-WOM intention, whereas simply interacting with the seller does not affect the customer's E-WOM intention.

This research explored that interaction is basic in the present age, where social media and live streaming are developed, and furthermore, it is necessary to build trust to influence the active behavior of consumers. Theoretically, it is significant that the MEC theory and U&G theory were combined and the mediation with the seller, who plays a major role in live commerce, was investigated by using symbolic and emotional values as variables in addition to the hedonistic and practical values that have been widely used in the past. Practically, since the hedonistic value and the practical value have a direct effect on E-WOM intention, it provides the meaning that it would be good to use events or time sales with good quality and interesting products for consumers. In addition, considering that trust in sellers is an important parameter, it is suggested that sellers should not stop selling one-time products but continuously communicate with consumers and give their opinions.

References

- Bart, Y., Shankar, V., Sultan, F., and Urban, G. L. 2005. "Are the drivers and role of online trust the same for all web sites and consumers? A large-scale exploratory empirical study," *Journal of marketing*, (69:4), pp. 133-152.
- BrightLocal, 2017. "Local Consumer Review Survey 2017," Retrieved 16 February 2021 from <https://www.brightlocal.com/learn/local-consumer-review-survey/>
- Brynjolfsson, E., and Smith, M. D. 2000. "Frictionless commerce? A comparison of Internet and conventional retailers," *Management science*, (46:4), pp. 563-585.
- Chin, W. W. 1998. "The partial least squares approach to structural equation modeling," *Modern methods for business research*, (29:2), pp. 295-336.
- De Bruyn, A., and Lilien, G. L. 2008. "A multi-stage model of word-of-mouth influence through viral marketing," *International journal of research in marketing*, (25:3), pp. 151-163.
- Dodds William, B., Monroe, K. B., and Dhruv, G. 1991. "The effects of price, brand and store information on buyers' product evaluations," *Journal of Marketing Research*, (28:3), pp. 307-319.
- Etemad-Sajadi, R. 2016, "The impact of online real-time interactivity on patronage intention: The use of avatars," *Computers in human behavior*, 61, pp. 227-232.
- Fornell, C., and Larcker, D. F. 1981. "Structural equation models with unobservable variables and measurement error," *Algebra and statistics*.
- Goode, M. M., and Harris, L. C. 2007. "Online behavioural intentions: an empirical investigation of antecedents and moderators," *European Journal of Marketing*.
- Gutman, J. 1997. "Means-end chains as goal hierarchies," *Psychology & marketing*, (14:6), pp. 545-560.
- Jarvenpaa, S. L., and Todd, P. A. 1996. "Consumer reactions to electronic shopping on the World Wide Web," *International Journal of electronic commerce*, 12, pp. 59-88.

- Katz, E., Blumler, J. G., and Gurevitch, M. 1973. Uses and gratifications research. *The public opinion quarterly*, (37:4), pp. 509-523.
- Li, Y., Yang, S., Zhang, S., and Zhang, W. 2019. "Mobile social media use intention in emergencies among Gen Y in China: An integrative framework of gratifications, task-technology fit, and media dependency," *Telematics and Informatics*, 42, 101244.
- Massicotte, M. C., Michon, R., Chebat, J. C., Sirgy, M. J., and Borges, A. 2011. "Effects of mall atmosphere on mall evaluation: Teenage versus adult shoppers," *Journal of Retailing and Consumer Services*, (18:1), pp. 74-80.
- Overby, J. W., and Lee, E. J. 2006. "The effects of utilitarian and hedonic online shopping value on consumer preference and intentions," *Journal of Business research*, (59:10-11), pp. 1160-1166.
- Parsons, A. G. 2002. "Non-functional motives for online shoppers: why we click," *Journal of Consumer marketing*.
- Rintamäki, T., Kanto, A., Kuusela, H., and Spence, M. T. 2006. "Decomposing the value of department store shopping into utilitarian, hedonic and social dimensions: Evidence from Finland," *International Journal of Retail & Distribution Management*.
- Rubin, A. M. 2002. "The uses and gratifications perspective of media effects. U J. Bryant i D. Zillmann (Ur)," *Media effects: Advances in theory and research*, str. 525-548.
- Sarstedt, M., Ringle, C. M., & Hair, J. F. 2017. "Partial least squares structural equation modeling," *Handbook of market research*, (26:1), pp. 1-40.
- Seiders, K., Berry, L. L., and Gresham, L. G. 2000. "Attention, retailers! How convenient is your convenience strategy?," *MIT Sloan Management Review*, (41:3), pp. 79.
- Smith, J. B., and Colgate, M. 2007. "Customer value creation: a practical framework," *Journal of marketing Theory and Practice*, (15:1), pp. 7-23.
- Sweeney, J. C., and Soutar, G. N. 2001. "Consumer perceived value: The development of a multiple item scale," *Journal of retailing*, (77:2), pp. 203-220.
- Wohn, D. Y., Freeman, G., and McLaughlin, C. 2018. "Explaining viewers' emotional, instrumental, and financial support provision for live streamers," in *Proceedings of the 2018 CHI conference on human factors in computing systems*, pp. 1-13.
- Wongkitrungrueng, A., and Assarut, N. 2020. "The role of live streaming in building consumer trust and engagement with social commerce sellers," *Journal of Business Research* (117), pp. 543-556.
- Zeithaml, V. A. 1988. "Consumer perceptions of price, quality, and value: a means-end model and synthesis of evidence," *Journal of marketing* (52:3), pp. 2-22.

C4.2 The effect of live streaming commerce quality on customers' purchase intention: Extending the elaboration likelihood model with herd behavior

Yang, Q.^a and Lee, Y. C.^{b*}

^a College of Economics, Jiaying University

E-mail: yangqin05@yeah.net

^{b*} Department of Information Management, Dongguk University

E-mail: chanlee@dongguk.ac.kr

*Corresponding author

Abstract

The goal of this study is to examine how live streaming commerce technology quality (vicarious expression and visibility), experience quality (immersion, emotion, symbolic value, and admiration), and customer herd behavior affect customers' purchase intention in a live streaming commerce scenario. We proposed an integrated research model based on the elaboration likelihood model (ELM) and herd behavior. Our findings indicate that good technology and experience quality lead customers to discount their own information, and then customers will imitate other peers. Customers' herd behavior positively affects their purchase intention. Furthermore, discounting own information positively mediates the indirect link between live streaming commerce quality, imitation, and customers' purchase intention. This study is one of the first to combine live streaming commerce quality and herd behavior in order to investigate customers' purchase intention in the context of live streaming commerce. It highlights the value of incorporating herd behavior into ELM and adds to the body of knowledge by providing a deeper insight into customers' purchase intention in the live streaming shopping scenario.

Keywords: Live streaming commerce quality, Technology quality, Experience quality, Elaboration likelihood model, Herd behavior, Customers' purchase intention

1. Introduction

The idea of real-time live streaming commerce is a business model in which a streamer sells goods and services directly to customers via online video streams in which the streamer exhibits, discusses, and responds to audience inquiries in real time. In the last few years, live streaming commerce has had a big impact on the retail industry in China. According to a recent survey by Statista.com, China's live streaming commerce industry has grown, with revenues estimated to reach 4.9 trillion yuan by 2023. Beyond China, this movement is spreading to other countries. In December 2020, TikTok partnered with Walmart to host its first livestream selling event. Additionally, Amazon debuted its live platform, which allows influencers to promote products and interact with potential buyers. A comprehensive review of the live streaming commerce literature reveals two significant research gaps. To begin, past research has emphasized the relevance of trust-related variables (e.g., trust in streamers or products), psychology-related variables (e.g., attachment to streamers or platforms, psychological distance, etc.), and relationship variables (e.g., swift guanxi, tie strength). One crucial component (i.e., herd behavior) has been overlooked. Herd behavior is frequently a beneficial tool in marketing and, when employed correctly, can result in increased sales and changes to the social structure. Second, previous research has mainly focused on technology, social, technical-social, or streamer-related factors; however, integrated studies that examine key technological (i.e., technology quality), experiential (i.e., experience quality), and herd behavioral (i.e., discounting own information and imitation) determinants of live streaming commerce purchase intention are lacking. For instance, Gao et al. (2021) analyzed how the live streaming commerce persuasive message was processed by the viewers. Zhang et al. (2022) examined customers' intention to continue using live streaming commerce from a trust standpoint. Guo

et al. (2021) investigated the relationship between trust and consumer engagement, as well as the mediation impact of swift guanxi. Additionally, Wongkitrungrueng and Assarut (2020) explored customer engagement in terms of perceived value and trust associated with live streaming commerce. In the study of Kang et al. (2021), they investigated the dynamic influence of interaction on customer engagement behavior based on tie strength in live streaming commerce. Lu and Chen (2021) examined customers' buying intentions through analyzing uncertainty reduction. As a result, it is necessary to fill these gaps in order to acquire a more complete understanding of how and when purchase intention emerges. Theoretically, this study gives additional information on how to cultivate and sustain customers' herd behavior by simultaneously examining the influence of critical technological and experiential determinants. We extended ELM with herd behavior and applied it to connect live streaming commerce quality factors and customers' herd behavior factors to investigate customers' purchase intention. The ELM theory provides insight into how viewers process information. Furthermore, we posit that herd theory is an effective theoretical lens through which to view the world.

2. Theoretical background and hypotheses development

2.1. Technology quality and experience quality

In this study, technology quality is measured as a second construct consisting of vicarious expression and visibility. Chen et al., (2019) identified four functions of vicarious expression: analogy mapping, trialability, vicarious experience demonstrability, and transferring. First of all, analogous mapping describes some characteristics that are similar between a viewer and a streamer, which can enrich viewers' experiences (Yi and Davis, 2003). Through analogy, viewers are able to see the streamer as a substitute for themselves, thus solving the problem of individual differences. Second, trialability refers to streamers' ability to test products in response to viewer requests (Moore and Benbasat, 1991). Thirdly, vicarious experience demonstrability implies that streamers can demonstrate the appearance and psychological experience of products to viewers. Fourthly, transferring implies that the streamer is acting in place of the customer. Visibility is another critical technological factor of live streaming commerce. Visual communication in live shopping allows customers to see the true reflection of streamers, effectively reducing the perceived distance between them and the streamers (Lv et al., 2018), presenting emotional closeness and enabling social connection. As a result, vicarious expression and visualization enable streamers' charms and emotions to be conveyed directly through the screen, which improves customer sense of identity and engagement, resulting in a pleasant experience for the customer. Live streaming shopping environments with higher quality technology allow customers to feel more at ease and enjoy a more immersive shopping experience (Yim et al., 2017). Feelings and thoughts connected to a service are a reflection of how people experience the service. In this way, vivid representations of products can evoke emotional responses and assist customers with their decision-making.

As a result of live streaming shopping, consumers can create their own identities, symbolic value, social codes, and relationships. In light of this, customers tend to value shopping experiences that can reflect and enhance their personal identity through a shopping mode with high technology quality (Wongkitrungrueng and Assarut, 2020). Lastly, admiration is another aspect that contributes to attracting customers. Customers' obsession with the streamer stems in large part from their admiration for her/him, and customer admiration motivates them to purchase products displayed by the streamer. In this study, we aim to understand how consumers' perception of technology quality affects their admiration. Based on the above, we propose:

H1: In live streaming commerce, technology quality is positively associated with experience quality.

2.2. Live streaming commerce quality and discounting own information

In this study, we use discounting own information and imitation as two herd factors. Discounting own information refers to the extent to which a customer will not rely on his or her own information when making a live streaming purchase decision, but instead will refer to other customers. Different customers feel differently when viewing live streaming (Huang et al., 2009). As a result of the vicarious expression, customers are able to see the anchor as a substitute for themselves, and this solves the problem of individual differences. The lack of personalization created by traditional information technology can be effectively compensated by this. Moreover, visibility allows customers to see the real reflection of streamers in live shopping, thereby reducing perceived distance between streamer and customer (Lv et al., 2018), creating psychological closeness and fostering social connection (O'Riordan et al., 2016). Live streaming shopping with high technology quality enables streamers, customers, and other peers communicate efficiently. In light of this, we anticipate there may be a strong relationship between technology quality and discounting own information. Therefore, this study postulates the following hypothesis:

H2: In live streaming commerce, technology quality is positively associated with discounting own

information.

The concept of emotional trust refers to a subjective assessment of characteristics about one's partner (Hansen, Morrow Jr., & Batista, 2002) and associates. Customers who experience a pleasant emotional state while watching live streaming shopping will be more inclined to participate more actively in shopping activities and exhibit a more positive attitude toward the products presented. In this case, customers are more likely to trust the streamer and other peers when they have a positive mental state and a positive experience, thus relying on the herd and being less attentive to their own information. In general, consumers prefer to shop at places where they can associate with others of their own kind. With live streaming shopping, streamer and viewers coexist on the same platform. Accordingly, social identification---a self-defining process that serves to represent belongingness to a group of people and establish self-efficacy (Bhattacharya & Sen, 2003)---can occur in relation to the individual (seller) and a larger group of people (others customers). Admiration for streamer leads to increased customer attitudes and greater participation and loyalty (Trivedi and Sama, 2020). Additionally, customers watching the live streaming will unconsciously show their admiration emotion through the screen bullets, causing them to resonate at an emotional level and further increasing their admiration. Hence, admiration emotion can contribute to the psychological bond between streamer and viewer. Customers are more likely to build positive relationships with the streamer they admire and have positive attitudes toward the products the streamer recommend, therefore are less likely to rely on their own information and to trust the streamer's. Based on this, the following hypothesis is proposed:

H3: In live streaming commerce, experience quality is positively associated with discounting own information.

2.3. Discounting own information, imitation, and purchase intention

In this research, imitation is defined as the extent to which a customer imitates other customers' product choices or decisions when viewing live streaming. Customers who discount their own information are more likely to imitate the activities of others, rather than making a decision entirely on the basis of their own information and ideas. In situations where a consumer has dismissed his or her own thoughts, it is appropriate for the customer to replicate the actions of other people in similar circumstances (Thies et al., 2016). We argue that when the quality of live streaming commerce increases, imitation becomes an acceptable alternative strategy through discounting own information, as customers might conclude that the streamer and other peers provide better and more complete information to them on everything related to live streaming shopping. Thus, we propose that:

H4: In live streaming commerce, discounting own information is positively associated with customers' tendency to imitate the behavior of others.

Additionally, we propose that customers' decision to purchase products and services from live streaming commerce is positively associated with herd factors. This is consistent with the notion that herding may have an effect on how individuals make decisions (Duan et al., 2009). Accordingly, we suggest that discounting one's own information may be positively associated with live streaming commerce purchase intention. When a customer discounts his/her own information, he/she needs to seek out external information to increase the likelihood of making the right choice. When it comes to live streaming commerce, this means the customers are likely to refer to and even rely on online recommendations from other people (Zhang et al., 2014). As a result, the influence of external information may outweigh the influence of his own information in this scenario. As a result, the consumer will have a strong predisposition to accept recommendations made by others in the live streaming commerce platform. Thus, we propose the following hypothesis.

H5: In live streaming commerce, discounting own information is positively associated with customers' purchase intention.

2.4. Imitation and purchase intention

Banerjee (1992) describes a logical strategy for imitation as "adopting the behavior of others," which in this context means choosing to acquire things based on the preferences of other customers on a live streaming commerce platform. In the field of finance, some investors replicate the investment strategies of professional investment managers in order to avoid being perceived as incompetent if their investments generate low returns (Scharfstein, D. S., & Stein, 1990). People may prefer the odds of being mistaken along with everyone else over the danger of making an uncommon prediction that turns out to be the only correct forecast, and they may consider imitation to be an effective approach for dealing with uncertainty (Field et al., 2006). A variety of informational cues, including the content and volume of online reviews, are frequently provided in live streaming commerce. The use of these cues may have an influence on herding behavior and lead to a strong tendency to imitate others' behaviors. Customers who have a strong proclivity to imitate others' actions can use online informational cues to determine the quality and popularity of products (Park, Lee, & Han, 2007). Through evaluating how other customers have reviewed products,

customers can learn about and follow the purchasing behaviors of others. In light of these considerations, we claim that imitation is likely to have an impact on customers' purchase intentions when they are engaged in live streaming commerce. Thus, the following hypothesis is proposed:

H6: In live streaming commerce, imitation is positively associated with customers' purchase intention.

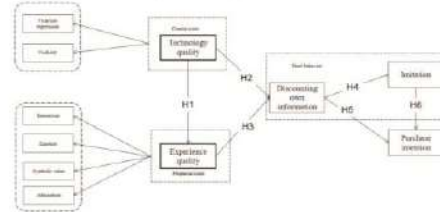


Figure 1. Research model

3. Research methodology

3.1. Measurement development and data collection

Among these five constructs, technology quality and experience quality are multidimensional constructs. We adopted measurement items of technology quality and experience quality from Sun et al. (2019), Li et al. (2021) and Zhang et al. (2022). And we developed the measurement items of immersion, emotion, distinctive, and peer communication for experience quality by reviewing the study of Hu et al. (2019). Items assessed herd behavior (i.e. discounting own information and imitation) by referring Erjavec and Manfreda (2021). At last, we measured and developed the items of customers' purchase intention according to the research from Sun et al. (2019). A Likert 5-point scale (from 1=strongly disagree to 5=strongly agree) was applied to measure these items. To verify these hypotheses, we conducted a survey to evaluate our research model. The questionnaire contains respondents' demographic characteristics and self-report items. We first extracted the measurement items from previous studies and translated these items into Chinese. Then we adopted the principle of back-translation to maintain the accuracy of the intended meaning of the items. After confirming the questionnaire, we distributed the questionnaire to several selected experts to check the clarity of each measurement item.

The survey was conducted via a famous and reliable online survey provider and the surveying period lasted from early October 2021 to late November 2021. Finally, 872 samples were collected. We checked the IP address and time spent answering each respondent's survey to assure the validity of the collected questionnaire. Finally, 845 valid questionnaires remained. The effective recovery rate was 96.9%. As shown in Table 1, among all valid samples, 381 were male (45.1%), and 464 were female (54.9%). Most of the respondents were between 20 and 29 (n=345, 40.8%), and most of them had an undergraduate education background (n=437, 51.7%). As to the occupations, 198 of them are students (23.4%), 174 are self-employed (20.6%), 338 are working in private or state-owned companies (40%). Respondents with a monthly income of between 3000-9000 RMB were 498 (59%). As for the use period of live streaming shopping, most have used more than 1 year (n=502, 59.4%).

4. Data analysis and results

Considering the research model, research purpose, and data characteristics, we adopted covariance-based structural equation modeling (CB-SEM) for assessing the proposed model since it can provide us with complete resources for verifying the hypotheses. We analyzed the data using SPSS 20 and AMOS 20 to evaluate the measurement and the structural model.

4.1. Measurement model

We evaluated the measurement model by assessing the value of the factoring loading, composite reliability (CR), and average variance extracted (AVE). From the findings shown in Table 2, we can see that item loadings are greater than 0.6, which meets the criterion. The cut-off values for CR and AVE are 0.7 and 0.5, respectively. As listed in Table 1, it shows that the CR value is higher than 0.7, and the AVE value is higher than 0.5. Therefore, all values demonstrated good validity and reliability.

Table 1. Construct validity, factor loading, CR, and AVE.

Constructs	Items	Item loadings	CR	AVE
Vicarious expression	VE1	0.748	0.824	0.61
	VE2	0.784		
	VE3	0.763		

Visibility	VIS1	0.798	0.853	0.593
	VIS2	0.791		
	VIS3	0.803		
	VIS4	0.796		
Immersion	IMME1	0.718	0.813	0.592
	IMME2	0.781		
	IMME3	0.782		
Emotion	EMO1	0.765	0.835	0.628
	EMO2	0.747		
	EMO3	0.806		
Symbolic value	SV1	0.811	0.799	0.57
	SV2	0.775		
	SV3	0.649		
Admiration	ADM1	0.794	0.804	0.58
	ADM2	0.757		
	ADM3	0.758		
Discounting own information	DOI1	0.760	0.817	0.599
	DOI2	0.751		
	DOI3	0.723		
Imitation	IMI1	0.817	0.847	0.580
	IMI2	0.758		
	IMI3	0.737		
	IMI4	0.784		
Purchase intention	PI1	0.865	0.834	0.628
	PI2	0.702		
	PI3	0.784		

In the next step, we evaluated the discriminant validity. According to previous research, the square root of the AVE should be higher than the correlations among the constructs. As shown in Table 2, the diagonal (in bold) values represent the square root of the AVE, and other values represent the correlations among the constructs. From the results, we can find that the square root of AVE is higher than all off-diagonal values, indicating a good discriminant validity of the measurement model.

Table 2. Discriminant validity.

	EQ	TQ	DOI	IMI	PI
EQ	0.789				
TQ	0.497**	0.773			
DOI	0.553**	0.492**	0.774		
IMI	0.392**	0.397**	0.478**	0.762	
PI	0.421**	0.333**	0.514**	0.505**	0.792

Note: *, $p < 0.05$; **, $p < 0.01$. EQ=experience quality, TQ=technology quality, DOI=discounting own information, IMI=imitation, PI=purchase intention. Values in bold represent the square root of the AVE.

4.2. Common method bias test

Podsakoff et al. (2003) suggested that common method variance may exist in the single-source data. To check the existence of common method bias (CMB) in the collected data, we performed Harman's single-factor test. All the measurement items were loaded into a principal component without rotation. It is suggested that the problem with CMB exists if the total variance of one factor exceeds 50%. The first factor accounts for 33.14% of the variance, less than 50% in this study. Thus, the data does not have a problem with CMB.

4.3. Structural model

To verify the relationships between the constructs proposed in the research model, we assessed the structural model. Through the analysis, we found that all paths were positive and significant at the 0.05 level. Table 4 displays the standardized path coefficients between constructs, the significance levels of the constructs, and the explanatory power (R^2) of each construct. The rule of thumb indicates that an R^2 value

of 25%, 50%, and 75% represents weak, average, and substantial explanatory power, respectively. In our study, the R² values of experience quality, technology quality, imitation, and purchase intention were 50.6%, 54.5%, 36.4%, and 52.9%, respectively, indicating an acceptable level of explanation. As shown in Table 4, technology quality is positively associated with experience quality with a path coefficient of 0.712 (p<0.001). Technology quality explained 50.6% of the variance in experience quality, indicating H1 was supported. Experience quality is positively related to discounting own information with a path coefficient of 0.45 (p<0.001), and technology quality is positively associated with discounting own information with a path coefficient of 0.347 (p<0.001). Experience quality and technology quality explained 54.5% of the variance in discounting own information, proving H2 and H3 were supported. Furthermore, discounting own information positively affects imitation with a path coefficient of 0.60 (p<0.001) and explained 36.4% of the variance in imitation, supporting H4. In addition, discounting own information positively influences purchase intention with a path coefficient of 0.533 (p<0.001). At last, imitation positively affects purchase intention with a path coefficient of 0.282 (p<0.001). Discounting own information and imitation explained 52.9% of the variance in purchase intention. H5 and H6 were supported. Details of the hypotheses testing can be found in Table 3.

Table 3. Hypotheses test results.

Hypothesis	Path	β	P-value	R ²	Remarks
H1	TQ → EQ	0.712	<0.001	0.506	Supported
H2	EQ → DOI	0.45	<0.001	0.545	Supported
H3	TQ → DOI	0.347	<0.001		Supported
H4	DOI → IMI	0.603	<0.001	0.364	Supported
H5	DOI → PI	0.522	<0.001	0.529	Supported
H6	IMI → PI	0.282	<0.001		Supported

In addition to the above analysis, we further evaluated the mediating effect of discounting own information between technology quality, experience quality, imitation, and purchase intention. A mediating effect can be used to improve the performance of the research model by adding a mediator to the basic linear regression. To that end, we introduced discounting own information into our research model. This study applied a bootstrapping method to verify the mediating effect of discounting own information between technology quality, experience quality, imitation, and purchase intention. It is suggested that when the upper and lower confidence interval (95% CI) does not contain zero, the mediating variable is supposed to have a mediating influence between an independent variable (X) and a dependent variable (Y). The results revealed that discounting own information significantly mediates the relationship between experience quality and imitation ($\beta=0.271$) and experience quality and purchase intention ($\beta=0.235$). Furthermore, discounting own information significantly mediates the relationship between technology quality and imitation ($\beta=0.209$) and the relationship between technology quality and purchase intention ($\beta=0.181$).

5. Conclusions

5.1. Theoretical implications

This study provides several theoretical implications for the existing live streaming commerce research. First and foremost, to the best of the authors' knowledge, it is the first to simultaneously investigate the technical and experiential factors that influence customers' purchase intention in the live streaming commerce context through an integrated ELM-herd behavior research framework. By reviewing the limited research in the live streaming commerce area, we can find that factors topics and theories have been discussed focused on customer trust (Chen et al., 2020; Guo et al., 2021; Zhang et al., 2022), social cognitive theory and customers' repeated viewing (Lim et al., 2015), uncertainty reduction and purchase intention (Lu and Chen, 2021), customer perceived values (Wongkitrungrueng and Assarut, 2020), persuasive message (Gao et al., 2021). Second, the results demonstrated how quality factors could play a critical role in facilitating customers to discount their own information in live streaming shopping. The results demonstrated the significant relationship between technology quality and experience quality, providing empirical evidence that this framework can be applied in the live streaming commerce research field. Third, we confirmed the mediating effect of discounting own information between technology quality, experience quality, imitation, and purchase intention. Although many studies have emphasized the importance of herd behavior in information system (Erjavec and Manfreda, 2022; Vedadi et al., 2021), empirical research on herd behavior in the live streaming shopping context has been lacking. This study filled this gap by providing empirical evidence of the interdependence between live streaming commerce quality, herd behavior, and customers' purchase intention.

5.2. Practical implications

In addition to theoretical contributions, this study provides several important implications for live streaming commerce operators as well. First, in a supportive live streaming shopping platform, customers may have an extraordinary shopping experience that can never be obtained in traditional e-commerce platform, leading them to enjoy the shopping process. The intimacy and emotional connection with the streamer and other peers and pleasant climate will also encourage the customers follow other customers' product choice. This indicates that facilitating and maintaining a supportive climate is a critical issue that live streaming shopping operators should consider. Second, live streaming shopping operators should also conduct market research and develop know-how to capture psychological characteristics of customers. The positive experiences in live streaming shopping will bring mutual trust and emotional connection between streamer and customer as well as between customer and customer, making the customers commit to the relationship and increasing their participation with live streaming shopping. Third, the results proved that discount own information mediated the relationship between live streaming commerce quality, imitation, and purchase intention. These findings provided suggestions to live streaming shopping operators on making the message persuasive. For instance, operators could focus more on developing a mechanism that might persuade potential customers to become actual buyers by seeing other peers in their wider social circles doing so. At last, to promote imitation effects in buying in live streaming shopping, operators should emphasize the similarities between the early customers and potential customers.

5.3. Limitations and future research

Although this study provides valuable implications for both research and practice, this study has some limitations. First, we only surveyed customers from China, and cultural differences may also exist in other countries. Additionally, as we know, technical mechanism may differ in different live streaming commerce platforms from different countries. Future studies may investigate the proposed research model in different countries and conduct comparative studies. Third, since the literature in the live streaming commerce area is relatively limited, this study extended theories and constructs from previous e-commerce, social commerce, and information system research. In future research, it is suggested to develop constructs that are unique in the live streaming commerce context.

References

- Banerjee, A. V. (1992). A simple model of herd behavior. *The quarterly journal of economics*, 107(3), 797-817.
- Bhattacharya, C. B., & Sen, S. (2003). Consumer-company identification: A framework for understanding consumers' relationships with companies. *Journal of Marketing*, 67(2), 76-88.
- Chen, Y., Lu, Y., Wang, B., & Pan, Z. (2019). How do product recommendations affect impulse buying? An empirical study on WeChat social commerce. *Information & Management*, 56(2), 236-248.
- Chen, C. D., Zhao, Q., & Wang, J. L. (2020). How livestreaming increases product sales: role of trust transfer and elaboration likelihood model. *Behaviour & Information Technology*, 1-16.
- Duan, W., Gu, B., & Whinston, A. B. (2009). Informational cascades and software adoption on the internet: an empirical investigation. *MIS quarterly*, 23-48.
- Erjavec, J., & Manfreda, A. (2021). Online shopping adoption during COVID-19 and social isolation: Extending the UTAUT model with herd behavior. *Journal of Retailing and Consumer Services*, 102867.
- Field, J. M., Ritzman, L. P., Safizadeh, M. H., & Downing, C. E. (2006). Uncertainty reduction approaches, uncertainty coping approaches, and process performance in financial services. *Decision Sciences*, 37(2), 149-175.
- Gao, X., Xu, X. Y., Tayyab, S. M. U., & Li, Q. (2021). How the live streaming commerce viewers process the persuasive message: An ELM perspective and the moderating effect of mindfulness. *Electronic Commerce Research and Applications*, 49, 101087.
- Guo, L., Hu, X., Lu, J., & Ma, L. (2021). Effects of customer trust on engagement in live streaming commerce: mediating role of swift guanxi. *Internet Research*.
- Hansen, M. H., Morrow Jr, J. L., & Batista, J. C. (2002). The impact of trust on cooperative membership retention, performance, and satisfaction: an exploratory study. *The international food and agribusiness management review*, 5 (1), 41-59.

- Hu, T., Dai, H., & Salam, A. F. (2019). Integrative qualities and dimensions of social commerce: Toward a unified view. *Information & Management*, 56(2), 249-270.
- Huang, P., Lurie, N. H., & Mitra, S. (2009). Searching for experience on the web: An empirical examination of consumer behavior for search and experience goods. *Journal of marketing*, 73(2), 55-69.
- Kang, K., Lu, J., Guo, L., & Li, W. (2021). The dynamic effect of interactivity on customer engagement behavior through tie strength: Evidence from live streaming commerce platforms. *International Journal of Information Management*, 56, 102251.
- Lim, J. S., Hwang, Y., Kim, S., & Biocca, F. A. (2015). How social media engagement leads to sports channel loyalty: Mediating roles of social presence and channel commitment. *Computers in Human Behavior*, 46, 158-167.
- Lu, B., & Chen, Z. (2021). Live streaming commerce and consumers' purchase intention: An uncertainty reduction perspective. *Information & Management*, 58 (7), 103509.
- Lv, Z., Jin, Y., & Huang, J. (2018). How do sellers use live chat to influence consumer purchase decision in China?. *Electronic Commerce Research and Applications*, 28, 102-113.
- Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information systems research*, 2(3), 192-222.
- O'Riordan, S., Feller, J., & Nagle, T. (2016). A categorisation framework for a feature-level analysis of social network sites. *Journal of Decision systems*, 25 (3), 244-262.
- Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: a critical review of the literature and recommended remedies. *Journal of applied psychology*, 88(5), 879.
- Scharfstein, D. S., & Stein, J. C. (1990). Herd behavior and investment. *The American economic review*, 465-479.
- Sun, Y., Shao, X., Li, X., Guo, Y., & Nie, K. (2019). How live streaming influences purchase intentions in social commerce: An IT affordance perspective. *Electronic Commerce Research and Applications*, 37, 100886.
- Thies, F., Wessel, M., & Benlian, A. (2016). Effects of social interaction dynamics on platforms. *Journal of Management Information Systems*, 33(3), 843-873.
- Trivedi, J., & Sama, R. (2020). The effect of influencer marketing on consumers' brand admiration and online purchase intentions: An emerging market perspective. *Journal of Internet Commerce*, 19(1), 103-124.
- Vedadi, A., Warkentin, M., & Dennis, A. (2021). Herd behavior in information security decision-making. *Information & Management*, 58 (8), 103526.
- Wongkitrungrueng, A., & Assarut, N. (2020). The role of live streaming in building consumer trust and engagement with social commerce sellers. *Journal of Business Research*, 117, 543-556.
- Yi, M. Y., & Davis, F. D. (2003). Developing and validating an observational learning model of computer software training and skill acquisition. *Information systems research*, 14(2), 146-169.
- Yim, M. Y. C., Chu, S. C., & Sauer, P. L. (2017). Is augmented reality technology an effective tool for e-commerce? An interactivity and vividness perspective. *Journal of Interactive Marketing*, 39, 89-103.
- Zhang, M., Liu, Y., Wang, Y., & Zhao, L. (2022). How to retain customers: Understanding the role of trust in live streaming commerce with a socio-technical perspective. *Computers in Human Behavior*, 127, 107052.
- Zhang, K. Z., Zhao, S. J., Cheung, C. M., & Lee, M. K. (2014). Examining the influence of online reviews on consumers' decision-making: A heuristic-systematic model. *Decision Support Systems*, 67, 78-89.

C4.3 Rethinking determinants of purchase intention: Towards CBEC in emerging markets

Jie, J.^a, Ling, L.^b and Li, W.^{c*}

^a School of Economics and Management, Chongqing University of Posts and Telecommunications

E-mail: jianjie@cqupt.edu.cn

^b School of Economics and Management, Chongqing University of Posts and Telecommunications

E-mail: 615762643@qq.com

^c School of Economics and Management, Chongqing University of Posts and Telecommunications

E-mail: wanli@cqupt.edu.cn

Abstract

In the contemporary cross border e-commerce (CBEC) environment, consumers are confronted with a growing number of failing decisions. Since cross border consumers have unique consumption awareness and habits compared with traditional local consumers, they will search product information from multiple channels to evaluate products. However, in the face of the complex impact of the epidemic, the previous influencing factors may not be suitable for the new environment. In addition, consumer purchase intention (CPI) in emerging markets often lack accurate measure. The purpose of this study is to explore the determinants of CPI in CBEC. Using the data derived from emerging market, this study finds that multi-level (i.e., product-specific, platform-specific, and trust-specific) factors have positive effects on CPI.

Keywords: Cross-border e-commerce, emerging market, consumer purchase intention

C4.4 Advertising Value of Gaming Influencers

Schultz, C. D.^a

^a Department of Business Administration and Economics, University of Hagen
E-mail: carsten.schultz@fermini-hagen.de

Abstract

The rise of social media has created a new phenomenon in influencers. Beyond fashion and food influencers, gaming influencers are another type of influencers who use streaming platforms to engage with their community while playing online games. Based on the advertising value model and strategic brand management, the study identifies the potential of gaming influencers to create advertising value and subsequently induce positive attitudes towards the advertised brands. A randomly assigned experimental online survey yielded a final sample of 365 participants in high congruence with an online streaming platform. The empirical results confirm the effects of ad entertainment, informativeness, irritation, and credibility on advertising value. Subsequently, together with the perceived brand quality, awareness, and image, the advertising value of gaming influencers contributes to the brand attitude. The attitude towards the gaming influencer also directly affects the brand attitude necessitating a fit between the influencer and the advertised brand.

Keywords: E-sport, gaming, influencer, social media, streaming, twitch

C4.5 Understanding users' negative emotions and continuous usage intention in short video apps indulging

Xusen Cheng^a, Xiaowei Su^b, Alex Zarifis^c, Jian Mou^d

^a School of Information, Renmin University of China
E-mail: xusen.cheng@ruc.edu.cn

^b School of Information, Renmin University of China
E-mail: su_xiao_wei@126.com

^c University of Cambridge, University of Nicosia
E-mail: zarifis.a@unic.ac.cy

^d School of Business, Pusan National University
E-mail: jian.mou@pusan.ac.kr

Abstract

Short video use is booming in China, gradually changing people's living habits and the way they get information. However, excessive addiction to watching short videos will also bring some negative emotions to individuals, and may affect users' intention to continue using them, which previous studies rarely focused on. In this paper, we develop a conceptual theoretical model that shows how the negative effects of overuse of short videos create negative emotions for users. These negative emotions reduce the willingness of a user to continue using short video applications. This model contributes to the literature by combining flow theory with the illusion control theory and applying it to the field of human-computer interaction.

Keywords: Short video, flow theory, illusion of control theory, negative emotion, continuous usage intention

Introduction

In recent years, with the development of China's telecommunications network, particularly mobile Internet, short videos have gradually become an indispensable part of people's entertainment. Compared with news reports and long video, short video is fragmented, intuitive and concise. Short videos attract users of different ages, but young people are the largest user group. According to the results of "the 49th China statistical report on Internet development" as of December 2021, the number of users of online videos (including short videos) in China had reached 975 million, an increase of 47.94 million compared with December 2020, accounting for 94.5% of the total number of netizens. Among them, the number of short video users was 934 million, up 60.8 million from the end of 2020, accounting for 90.5% of the total netizens (CNNIC, 2022). With the popularization of intelligent terminal applications and the influx of a large amounts of capital into the short video field, the related products are constantly updated and iterated. New short video application platforms keep emerging, such as the game short video platforms "Hu Ya" and "Dou Yu". News and information short video platforms "Headline Video" and "Pear Video"; Entertainment and social short video platforms "Kuai shou", "Dou yin" and "Tencent video"; Video production tools "Mei pai", "Miao pai", "Capcut" and so on.

The Internet has changed the way people interact and reshaped traditional communications media such as film, television, music and the telephone (Statista, 2022). The emergence of new digital technology created a new medium - short video. "Can't stop watching short video once beginning" is a common feeling when people use short videos. This kind of immersive watching experience is also known as

“flow experience”. The flow theory was first proposed by psychologist Csikszentmihalyi of The University of Chicago in 1975. He believed that people in a state of immersion would be deeply attracted by what they are doing and filter out all irrelevant perceptions. In this feeling of immersion an individual completely concentrates on the activity, so it is called “flow experience” (Csikszentmihalyi & LeFevre, 1989). Since the popularity of short videos emerged, most scholars have studied how these videos can increase user activity and immersion, how to make content, commercial marketing, system management, how to optimize the recommendation algorithm, video technology and other aspects. Short video applications use a series of recommendation algorithms to analyze the browsing data which is generated by the user in order to recommend preferred videos to the user (INSEAD Knowledge, 2019). Jacob et al. (2020) show that video storytelling and indexing techniques are used to retrieve the intended video clip from a longer video. A video storytelling technique is used to analyze the content of the video and to produce a description for it. The Cyberspace Administration of China (CAC, 2019) has passed a new order for short video apps to introduce anti-addiction parental controls for parents to control these apps and limit children’s use. Wu et al. (2021) found that users’ subjective well-being increases if they are active users but it decreases if they are passive users.

However, at present, few scholars have delved into the negative emotions of users after being overly immersed in watching short videos, and whether these negative emotions affect their willingness to continue using short video apps. Therefore, we tried to answer the following questions:

- (1) *What factors will cause users to have negative emotions after they overuse short video apps?*
- (2) *Will users’ perceived negative emotions affect their intention to continue using short video applications?*

By combining flow theory and illusion of control theory, a preliminary research model explaining the relationship between flow experience, illusion of control, and negative emotions is proposed. Finally, several hypotheses are recommended for further testing.

The rest of this article is organized as follows: In the second part, a literature review on short videos, flow theory and illusion of control theory is presented. The third part introduces the research model and hypotheses. In the last section, this paper concludes with recommendations for future work and the expected contribution.

Literature Review

Flow Theory

The flow theory originated from Csikszentmihalyi’s research on games in the 1960s. He defined “the overall experience that people feel when they fully participate in an activity” as immersion and believed that this is the main reason why people are willing to continue to participate in a certain activity (Csikszentmihalyi, 1975b). Csikszentmihalyi first proposed the theory of immersion in 1975 (Csikszentmihalyi, 1975a). He believed that people in the state of immersion would be deeply attracted by what they are doing and filter out all irrelevant perceptions. It is a kind of feeling of immersion in which individuals completely focus their attention on activities, which is also called “flow experience” (Csikszentmihalyi & LeFevre, 1989). In 1990, Csikszentmihalyi published “*The Psychology of Optimal Experience*”, a systematic introduction to flow theory and a reinterpretation of the concept of flow, based on previous research on flow theory. It is defined as “an experience so challenging that a person becomes so immersed in it that he forgets the passage of time and is unaware of his own existence”, and proposes that immersion consists of nine psychological characteristics: Balance of challenge and skill, clear goals, feedback, fusion of action and consciousness, concentration, perceptual control, loss of self-awareness, sense of time distortion, and the purposefulness of the experience itself. The function of flow experiences refers to the best experience people can get from the challenges and skills in a given environment (Leone & Burns, 2000; Kang et al., 2018). The process of flow experience is when their skills and the challenges they face are matched and the individual can feel the timely feedback of the activity (Huang & Liao, 2017).

With the expansion of flow theory, flow theory extends to the field of games and human-computer interaction. Immersion is first derived from the research on the pleasure experienced by players in real games. Immersion in games explains the reasons for players' engagement and their loyalty to games (Su et al., 2016). In 1996, Hoffman and Novak (1996) applied the concept of immersion to searching for information on a network for the first time and introduced the flow theory into the networks and virtual worlds, extending the flow theory to the field of human-computer interaction. They believe that immersion will enhance people's sense of control over the interaction and make people have a positive subjective experience. Flow experience constantly affects the behavior of Internet users. They set four dimensions of immersion: control, total involvement, curiosity and intrinsic interest. Flow experience is the user's perception during the interaction with the computer. Attention will be fully focused on the interaction, curiosity will be fully aroused, and the interaction process will be very interesting (Trevino & Webster, 1992; Jamshidi et al., 2018). Novak et al. (2000) used structural equation modelling to test the theoretical model of flow experience, and the results showed that faster interaction speed can bring a higher level of flow experience. At the same time, flow theory has been widely applied in studies in sports, education, the corporate office environment and other fields (Huang & Lin, 2017).

Illusion of Control Theory

The illusion of control was formally proposed for the first time in 1975 (Langer, 1975). The core idea is that situational factors (such as familiarity, competition, selection, etc.) or individual factors (such as desire for control, etc.) will make people overestimate their ability to control the process of completing something, which will lead to a perception of low risk, or the expectation of a higher probability of success than the real probability. Langer (Langer, 1975; Langer & Roth, 1975) and almost all the other researchers that have examined the illusion of control have employed statistical tests, but they cannot assess whether a person's or a group's expectations of individual success are too high relative to objective criteria. Presson and Benassi (1996) studied 29 papers before 1996 that cited Langer's earliest illusion of control theory, and calculated the effect size of influencing factors of illusion of control by using meta-analysis method. It was found that the effect size of all factors was positive. Presson and Benassi (1996) found that "since Langer's paper was published, illusion of control has become a catch phrase in studies in which researchers manipulate conditions that lead people to make nonveridical judgments of control, contingency, prediction ability, etc." (para. 5). Stefan and David (2013) used meta-analysis method to study 20 literatures applying the illusion of control theory from 1996 to 2010, and the results showed that the effect sizes of relevant influencing factors (such as gender, reinforcement frequency, culture and other 21 factors) were all positive. There is a connection between the frequency of reinforcement and the behavior that an individual misperceives as his or her own and the result. Alloy et al. studied the influence of reinforcement frequency on the illusion of control in uncontrollable situations, and found that the higher the reinforcement frequency, the more likely individuals were to have the illusion of control (Alloy & Abramson, 1979). Thompson et al. (2007) extended the application context of the illusion of control theory from an uncontrollable situation to a controllable situation. Burger and Cooper (1979) found that the more controlling individuals were, the more likely they were to overestimate their chances of winning. Thompson et al. not only proposed the theory of control heuristic, but also explained the mechanism of illusion of control through experiments (Thompson et al., 2007).

Research Model and Hypotheses

Drawing on the flow theory and illusion of control theory, the model proposed here takes short videos as an example to explain what factors will cause users to have negative emotions after they overuse these videos and how these negative emotions affect their intention to continue using short video applications. Our research model is shown in Figure 1.

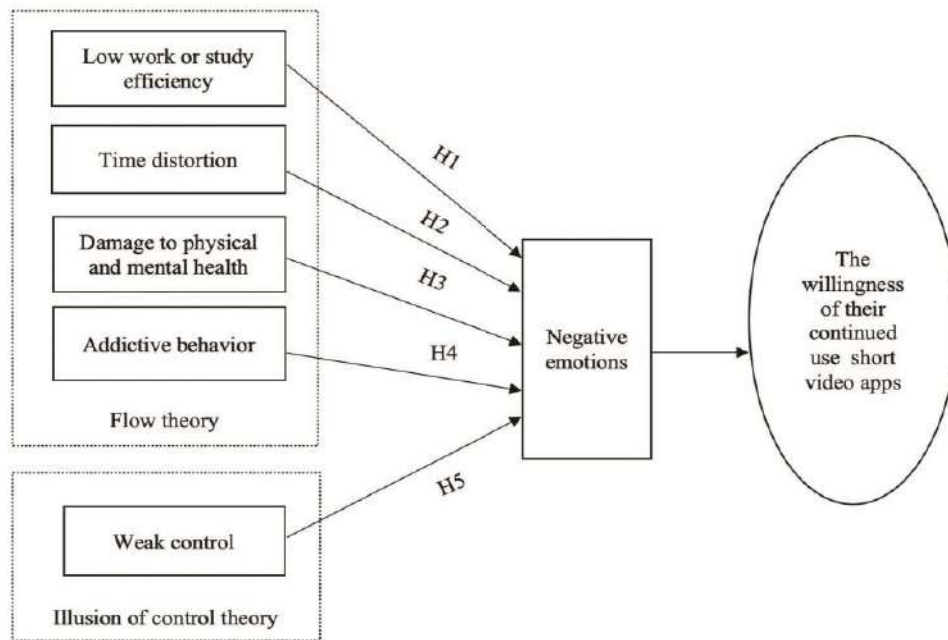


Figure 1. Research Model

The immersion factors and the willingness to continue using short video applications

Immersion itself is pleasant. In fact, immersion has two sides. In addition to sensory enjoyment and traffic contribution for developers, it also has certain negative effects, which can't be ignored for individuals and society.

Firstly, online immersion, either at work or at home, will reduce the user's work or study efficiency. If the immersion is not related to an employee's task, it may lead to a decrease in the efficiency at work (Sharafi et al., 2006). Therefore, we infer that the inefficiency in work or study caused by users' immersion in short videos can lead to negative emotions, which will affect their willingness to continue using short video apps.

Second, online immersion weakens users' perception of time, leading to time distortion. Thatcher et al. (2008) found that problematic Internet use, online procrastination and immersion all involve a lack of control over time spent online, and found that online procrastination is a moderating factor between problem and immersion. Similarly, Kaur et al. (2016) found that immersion on Facebook increased the level of regret experienced by users. Users generally regretted spending too much time on Facebook, which reduced the likelihood of users using Facebook again. Therefore, we infer that the time distortion caused by users' immersion in short videos can lead to negative emotions, which will affect their willingness to continue using short video apps.

Thirdly, online immersion will do harm to users' physical and mental health. When teenagers are immersed in online games and online pornography, social networks have a negative impact on their physical and mental health and interpersonal relationships (Chao & Yu, 2021). Therefore, we believe that the damage to physical and mental health caused by users' immersion in short videos can lead to negative emotions, which will affect their willingness to continue using short video apps.

Finally, online immersion can exacerbate addictive behaviors. Chang et al. (2014) found that users who experienced immersion were more likely to become addicted. Users who stay immersed in an experience for prolonged periods are more likely to develop addictive behaviors (Salehan & Negahban,

2013), which are well-known indicators of addiction (Gao et al., 2017). Psychological studies by Chou and Ting (2013) show that repetition promotes the pleasure of immersion and increases users' desire to maintain positive emotions, thus leading to mobile game addiction. Excessive use of Facebook may cause many psychological problems among college students, making them addicted to Facebook (Hong et al., 2014), and the more depressed college students are, the more likely they are to become addicted to Facebook (Lavin et al., 2004; Whang et al., 2003). Internet addiction was positively correlated with procrastination (Davis et al., 2002; Lavoie & Pychyl, 2001). Social interaction is the main cause of short video addiction, and it is more important than app dependency (Zhang et al., 2019). Therefore, this research suggests that addictive behaviors caused by users' immersion in short videos can lead to negative emotions, which will affect their willingness to continue using short video apps.

Therefore, we propose the following hypotheses:

H1: Users' inefficiency in work or study due to immersion in short videos can cause them to have negative emotions, thereby reducing their willingness to continue using short video apps.

H2: Users' time distortion due to immersion in short videos can cause them to have negative emotions, thereby reducing their willingness to continue using short video apps.

H3: Users' physical and mental health damage due to immersion in short videos can cause them to have negative emotions, thereby reducing their willingness to continue using short video apps.

H4: Users' addictive behavior due to immersion in short videos can cause them to have negative emotions, thereby reducing their willingness to continue using short video apps.

Illusion of control and the willingness to continue using short video applications

Illusion of control tends to make people overestimate their ability to control something, and individuals with a strong desire for control tend to overestimate their probability of winning. In most cases, this illusion of control will bring negative effects. When studying the influence of an individual's ability to control on the illusion of control, in uncontrollable and controllable situations, Gino et al. (2011) found the following: Individuals tend to overestimate their ability to control when they are unable to exert control or exert weak control; when they are able to exert high control, they tend to underestimate their ability to control instead. Therefore, we infer that the failure to control caused by users' weak ability to avoid overusing short videos, will affect users' willingness to continue using these video applications. Therefore, we suggest:

H5: The failure to control due to users' weak ability to avoid overusing short videos can cause them to have negative emotions, thereby reducing their willingness to continue using short video apps.

Research Method

Based on our theoretical research model, we will conduct a quantitative study and apply structural equation modelling (SEM). We have proposed the hypotheses through the literature review. In the next stage, no less than 300 questionnaires will be collected to test our research model and hypotheses. Measurements will be made using a seven-point Likert scale.

Expected Contributions

The purpose of this study was to understand what factors will cause users to have negative emotions after being overly immersed in watching short videos, and whether these negative emotions will affect their willingness to continue using short video applications. As discussed above, flow experience has two sides and excessive use of short videos can negatively impact users. Based on flow theory and illusion of control theory, we propose a preliminary model to explain how user's perceived negative emotions affect users' willingness to continue using short video applications. In terms of theoretical contribution, we introduce the concept of illusion of control theory into the field of human-computer interaction, enriching the application scenarios of illusion of control theory. We will use data analysis methods to determine whether negative emotions caused by using short videos affect users' willingness to continue using short video apps. In terms of practical contributions, our research is useful for short

video platforms and for potential users who intend to use short video platforms. Short video platforms should not only strive to fragment the time of users and increase the time that users are immersed in the platform, but also consider the negative emotions of users caused by excessive immersion and weak self-control. The platform should try to avoid these negative effects on users. Therefore, our research contributes to the future development of short video and the field of human-computer interaction. This research will also provide implications for investigating the app user behavior in COVID-19 influenced short video apps indulging, where there is a special context and may lead to new findings.

Acknowledgement

We would like to thank National Natural Science Foundation of China (Grant No. 72061147005) for providing funding for part of this research.

References

- Alloy, L. B., Abramaon, L. Y. 1979. "Judgment of contingency in depressed and nondepressed students: Sadder but wiser?" *Journal of Experimental Psychology* (108:4), pp. 441-485.
- Burger, J. M., Cooper, H. M. 1979. "The desirability of control," *Motivation & Emotion* (3:4), pp. 381-393.
- CAC, 2019. "China orders anti-addiction parental controls for short video apps," *Sekhose, Marcia, Hindustan Times*.
- Chang, E. C., Lv, Y., Chou, T. J., He, Q. W., Song, Z. Z. 2014. "Now or later: Delay's effects on post-consumption emotions and consumer loyalty," *Journal of Business Research* (67:7), pp. 1368-1375.
- Chao, C. M., Yu, T. K. 2021. "Internet Use and Adolescents' Physical and Mental Health: the Mediating Role of Self-consciousness and Peer Relationships," *International Journal of Mental Health and Addiction*, pp. 1-18.
- Chou, T. J., Ting, C. C. 2003. "The role of flow experience in cyber-game addiction," *Cyberpsychology & Behavior* (6:6), pp. 663-675.
- CNNIC, 2022. "The 49th China statistical report on Internet development," Retrieved from <http://www.cnnic.net.cn/hlwfzyj/hlwzxbg/hlwjtjbg/202202/P020220318335949959545.pdf>, pp. 43-44 (accessed 18 March 2022).
- Csikszentmihalyi, M. 1975a. "Enjoying games: Chess," *Beyond boredom and anxiety*, pp. 72-75. San Francisco: Jossey-Bass Publishers.
- Csikszentmihalyi, M. 1975b. "Play and intrinsic rewards," *Journal of Humanistic Psychology* (15:3), pp. 41-63.
- Csikszentmihalyi, M. 1990. "The psychology of optimal experience," New York, NJ: Harper and Row, pp. 13-14.
- Csikszentmihalyi, M. & LeFevre. 1989. "Optimal experience in work and leisure," *Personality and Social Psychology* (56:5), pp. 815-822.
- Davis, R. A., Flett, G. L., & Besser, A. 2002. "Validation of a new scale for measuring problematic Internet use: Implications for pre-employment screening," *Cyber Psychology and Behavior* (5:4), pp. 331-345.
- Gao, W., Liu, Z., Li, J., 2017. "How does social presence influence SNS addiction? A belongingness theory perspective," *Computer in Human Behavior* (77), pp. 347-355.
- Gino, F., Sharek, Z., Moore, D. A. 2011. "Keeping the illusion of control under control: Ceilings, floors, and imperfect calibration," *Organizational Behavior & Human Decision Processes* (114:2), pp. 104-114.
- Hoffman, D. L., Novak, T. P. 1996. "Marketing in hypermedia computer-mediated environments: Conceptual foundations," *Journal of Marketing* (60:3), pp. 50-68.
- Hong, F.Y., Huang, D.H., Lin, H.Y., Chiu, S.L. 2014. "Analysis of the psychological traits, Facebook usage, and Facebook addiction model of Taiwanese university students," *Telematics Inform* (31:4), pp. 597-606.
- Huang, T. L. & Liao, S. L. 2017. "Creating e-shopping multisensory flow experience through augmented-reality interactive technology," *Internet Research* (27:2), pp. 449-475.

- Huang, Y. M., & Lin, P. H. 2017. "Evaluating students' learning achievement and flow experience with tablet PCs based on AR and tangible technology in u-learning," *Library Hi Tech* (35:4), pp. 602-614.
- INSEAD Knowledge. 2019. "The TikTok strategy: using AI platforms to take over the world. INSEAD Knowledge," Retrieved from <https://knowledge.insead.edu/entrepreneurship/the-tiktok-strategy-using-ai-platforms-to-take-over-the-world-11776>.
- Jacob J., Elayidom M. S., Devassia V. P. 2020. "Video content analysis and retrieval system using video storytelling and indexing techniques," *International Journal of Electrical and Computer Engineering* (10:6), pp. 6019-6025.
- Jamshidi, D., Keshavarz, Y., Kazemi F., & Mohammadian M. 2018. "Mobile banking behavior and flow experience: An integration of utilitarian features, hedonic features and trust," *International Journal of Social Economics* (45:1), pp. 57-81.
- Kang, J. W., Lee H. & Young N. 2018. "The impact of restaurant patrons' flow experience on SNS satisfaction and offline purchase intentions," *International Journal of Contemporary Hospitality Management* (30:2), pp. 797-816.
- Kaur, P., Dhir, A., Chen, S., Rajala, R., 2016. "Understanding online regret experience using the theoretical lens of flow experience," *Computer in Human Behavior* (57), pp. 230-239.
- Langer, E. J. 1975. "The illusion of control," *Journal of Personality & Social Psychology* (32:2), pp. 311-328.
- Langer, E.J., & Roth, J. 1975. "Heads I win, tails it's chance: The illusion of control as a function of the sequence of outcomes in a purely chance task," *Journal of Personality and Social Psychology* (32), pp. 951-955.
- Lavin, M.J., Yuen, C.N., Weinman, M., Kozak, K. 2004. "Internet dependence in the collegiate population: the role of shyness," *Cyberpsychology & Behavior* (7:4), pp. 379-383.
- Lavoie, J. A. A., & Pychyl, T. A. 2001. "Cyberslacking and the procrastination superhighway: A web-based survey of online procrastination, attitudes, and emotion," *Social Science Computer Review* (19:4), pp. 431-444.
- Leone, C., & Burns, J. 2000. "The measurement of locus of control: Assessing more than meets the eye?" *Journal of Psychology* (134:1), pp. 63-76.
- Novak, T. P., Hoffman, D. L., & Yung, Y. F. 2000. "Measuring the customer experience in online environments: A structural modeling approach," *Marketing Science* (19:1), pp. 22-42.
- Pawlak, C., 2002. "Correlates of Internet Use and Addiction in Adolescents (Unpublished Doctoral Dissertation)," *The State University of New York, New York*.
- Presson, P. K., Benassi, V. A. 1996. "Illusion of control: A meta-analytic review," *Journal of Social Behavior & Personality* (11:3), pp. 493-510.
- Salchan, M., Negahban, A. 2013. "Social networking on smartphones: When mobile phones become addictive," *Computer in Human Behavior* (29:6), pp. 2632-2639.
- Sharafi, P., Hedman, L., Montgomery, H. 2006. "Using information technology: Engagement modes, flow experience, and personality orientations," *Computers in Human Behavior* (22:5), pp. 899-916.
- Statista 2022. "Internet," Retrieved from <https://www.statista.com/markets/424/internet/> (accessed 15 March 2022).
- Stefan, S., David, D. 2013. "Recent development in the experimental investigation of the illusion of control: A meta-analytic review," *Journal of Applied Social Psychology* (43:2), pp. 377-386.
- Su, Y. S., Chiang, W. L., Lee, C. T. J., Chang, H. C. 2016. "The effect of flow experience on player loyalty in mobile game applications," *Computers in Human Behavior* (63), pp. 240-248.
- Thatcher, A., Wretschko, G., Fridjhon, P. 2008. "Online flow experience, problematic Internet use and Internet procrastination," *Computer in Human Behavior* (24:5), pp. 2236-2254.
- Thompson, S. C., Nierman, A., Schlehofer, M. M. 2007. "How do we judge personal control? Unconfounding contingency and reinforcement in control judgments," *Basic & Applied Social Psychology* (29:1), pp. 75-84.
- Trevino, L. K. & Webster 1992. "Flow in computer-mediated communication: Electronic mail and voice mail evaluation and impacts," *Communication Research* (19:5), pp. 539-573.
- Wu, Y. L., Wang, X. N., Hong, S., Hong, M., Pei, M., Su, Y. J., 2021. "The Relationship Between Social Short-Form Videos and Youth's Well-Being: It Depends on Usage Types and Content Categories," *Psychology of Popular Media* (10:4), pp. 467-477.

Zhang X., Wu Y., Liu S. 2019. "Exploring short-form video application addiction: Socio-technical and attachment perspectives," *Telematics and Informatics* (42), pp. 1-15.

C4.6 The Influencing Factors of Cross-border Ecommerce Promoting The Transformation and Upgrading of Traditional Foreign Trade

Jie, J.^a, Kehong, L.^b and Ling, L.^c

^a School of Economics and Management, Chongqing University of Posts and Telecommunications

E-mail: jianjie@cqupt.edu.cn

^b School of Economics and Management, Chongqing University of Posts and Telecommunications

E-mail: 16272217557@qq.com

^c School of Economics and Management, Chongqing University of Posts and Telecommunications

Abstract

On the one hand, with the development and application of Internet technology, cross-border e-commerce(CBEC) independent stations and platforms have developed rapidly and gradually become the mainstream mode of foreign trade. On the other hand, in order to expand sales channels, a large number of traditional foreign trade enterprises began to transform and upgrade to CBEC. This paper aims to explore why traditional foreign trade enterprises choose CBEC for transformation and upgrading. The preliminary conclusion of this paper is that the asset specificity (talent, brand, material), uncertainty (behavior, environment), transaction frequency and trust of foreign trade have a great impact on the transformation choice of traditional foreign trade.

Keywords: Template, formats, instructions, length, conference publications

[DAY 2]

D4 [ICEC-Paper Session] Fintech & Blockchain & Cryptocurrency

D4.1 Factors Affecting the Success of Blockchain-Based Fundraising Projects*

Sun, Yair^a and Yang, Sung-Byung^b

^a Department of Business Administration, Kyung Hee University
E-mail: sunyan950414@khu.ac.kr

^b Department of Big Data Analytics, Kyung Hee University
E-mail: sbycmg@khu.ac.kr

Abstract

Blockchain is a revolutionary technology that can be applied to fundraising and address the problem of early-stage underfunding for firms. Collecting the most recent blockchain-based fundraising project data from 2019 to 2021, we will examine the impact of influencing factors comprehensively identified from prior literature on fundraising success. We will further reveal different influencing mechanisms depending on different types of fundraising models (i.e., ICO, IEO, IDO, and MLX) and exchanges (i.e., CEX, DEX, and Cross-List). Study 1 will use ANOVA to explore the differences between different fundraising models and exchanges in terms of fundraising success and performance after token listing. Study 2 will identify and examine the impact of influencing factors on fundraising success and token performance in general and specific fundraising models/exchanges. The research findings would have implications for both firms and investors, helping firms choose the most appropriate fundraising model and exchange while providing some helpful information for investors.

Keywords: Blockchain-based fundraising, fundraising success, initial coin offering, initial exchange offering, initial DEX offering, centralized exchange, decentralized exchange

**This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2020S1A5B8103855).*

D4.2 Mapping the Field of Nonprofit Crowdfunding: A Systematic Review with Bibliometric Analysis

Wang, Y.^a and Du, Z.^b

^a Business School of Sport, Beijing Sport University
E-mail: ryowang1999@163.com

^b Business School of Sport, Beijing Sport University
E-mail: duzhao@bsu.edu.cn

Abstract

Nonprofit crowdfunding allows fundraisers in need to raise donations from a broader audience without a commitment to give back. With the development of digital technologies, more and more fundraisers and donors are using online crowdfunding platforms to participate in nonprofit crowdfunding. To clarify the research content of nonprofit crowdfunding, this research conducted a systematic review of nonprofit crowdfunding based on bibliometric analysis. We analyzed 80 high quality journal articles. The findings showed that donors' giving behavior is dominated by their intrinsic motivations of compassion and trust. Therefore, the factors that influence the success rate of nonprofit crowdfunding are mainly reflected in the type of fundraiser and crowdfunding project, the professionalism of the crowdfunding platform, and the availability of regulatory. In addition, nonprofit crowdfunding can also exacerbate social inequality. Due to homogeneous data sources, we suggest that more perspectives and research tools are needed to further study nonprofit crowdfunding.

Keywords: Nonprofit crowdfunding, systematic review, bibliometric analysis, crowdfunding success

D4.3 The flexible impact of a tax relief on monetary donation—the disparity between contributions to campaigns and gifts to organizations

Watanabe, F.^a, Han, S. H.^b, and Wakabayashi, Y.^c

^a Graduate School of Management, Kyoto University
E-mail: f.watanabe@outlook.com

^b Graduate School of Management, Kyoto University
E-mail: han.hyunjeong.8r@kyoto-u.ac.jp

^c Faculty of Sociology, Bukkyo University
E-mail: wakabayashi.yasunaga.8a@kyoto-u.ac.jp

Abstract

With the COVID-19 pandemic, nonprofit fundraising is fast turning digital, and this shift will create the future normal in charitable and philanthropic giving. Nonprofit organizations now need an efficient method of collecting contributions through the internet. Obtaining tax-relief status is critical in conventional fundraising, but is this true in the "new normal" setting? Using transaction data from the Japanese digital fundraising site "Syncable," we investigated if the impact of tax relief, which is expected to enhance donations, is adjustable. A tax relief encourages relatively substantial online contributions to organizations, but its impact lessens in donations made via online fundraising campaigns. A tax relief may fail to enhance public benefit provision in the context of an online campaign, which has an implication for public policy.

Keywords: Monetary Donations, Online fundraising, Tax relief

D4.4 Leveraging the Predictive Power of Microblog Sentiment for Cryptocurrency Returns

Kim, G. S.^a and Lee, D. W.^b

^a Korea University Business School, Korea University
E-mail: kissu23@korea.ac.kr

^b Korea University Business School, Korea University
E-mail: mislee@korea.ac.kr

Abstract

Since the end of 2017, cryptocurrencies have shown significant price fluctuations in the short and long term, drawing great interest from academia and industry by bringing unprecedented profits and losses to investors. This interest in cryptocurrency seems to be focused on realizing short-term gains using large price fluctuations rather than investments based on the essential value of assets such as stocks. Twitter data have been increasingly used as an information delivery means that has a significant impact on cryptocurrency prices. Several academic studies tried to predict cryptocurrency price fluctuations by analyzing social sentiments in Twitter contexts. We selected cryptocurrencies of major categories, collected tweets that mentioned each cryptocurrency on Twitter, and conducted sentiment analysis using various algorithms. Next, we collected cryptocurrency-related news published during the same period, classified each tweet into Markets, Business, Technology, and Policy categories based on the news data, and applied the sentiment analysis results. As a result, the tweet sentiment belonging to the market category had a correlation with the cryptocurrency price returns and there is a two-way causal relationship between tweet sentiment and cryptocurrency price returns.

Keywords: Cryptocurrencies, microblog, classification, sentiment analysis, big data

Introduction

Cryptocurrency has not received much attention since Bitcoin was first released in January 2009 (Nakamoto 2008), but since the end of 2017, it has shown significant price fluctuations in the short and long term, drawing great interest from academia and industry by bringing unprecedented profits and losses to investors. This interest in cryptocurrency seems to be focused on realizing short-term gains using large price fluctuations rather than investments based on the essential value of assets such as stocks. On the other hand, compared to the rapidly growing cryptocurrency market, cryptocurrency investors used social media as a source of investment-related information because regulations related to cryptocurrency in each country were relatively slow and limited.

Social media and microblogging sites have progressively become entrenched in our social and economic ecosystems, with numerous online citizens proactively sharing and propagating contemporary issues and opinions. Twitter users tweet or retweet a variety of messages ranging from social and political controversies, breaking news, public debates, and new product releases to celebrity gossip. Twitter data (e.g., tweets and retweets) have been increasingly used as an information delivery means that has a significant impact on cryptocurrency prices. Several academic studies tried to predict cryptocurrency price fluctuations by analyzing social sentiments in Twitter contexts (Kraaijeveld and

De Smedt 2020; Li and Wang 2017). However, previous studies have only focused on sentiment scores for small number of tweets in relatively short-term periods, focusing on Bitcoin in predicting price changes of cryptocurrencies. Our research aims to determine the attributes of tweets that have a significant impact on cryptocurrency prices by examining Twitter data and cryptocurrency prices from various perspectives based on numerous tweet data.

Literature Review

Cryptocurrency is a type of digital currency created using encryption technology, and its value is stored and transmitted using blockchain technology. Recently, it is called a virtual asset. Starting with Bitcoin developed by Satoshi Nakamoto in January 2009, more than 13,671 cryptocurrencies have been issued so far, and are traded at about \$105 billion per day¹.

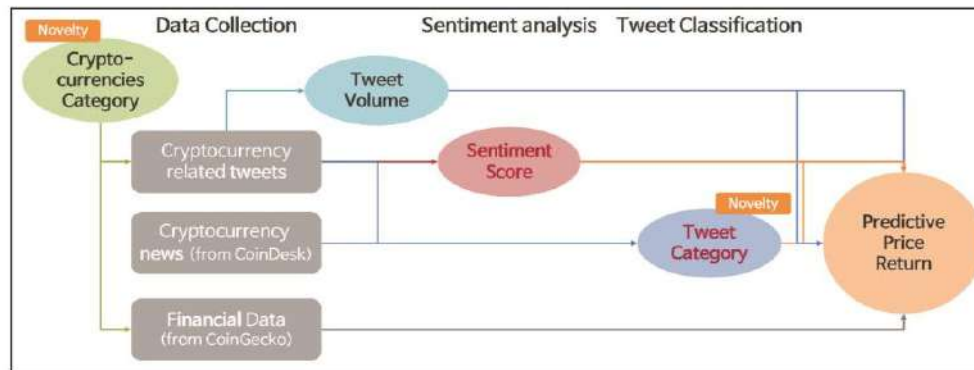
Sentiment analysis is a technique for grasping subjective information such as thoughts and emotions posted on a website or media such as social media, and the main goal is to assign positive, negative, or neutral emotional polarity scores to unstructured texts. This sentiment analysis can be used to check how sentiment affects individual behavior, and lots of research that have been applied and analyzed to the financial market have been actively conducted (Bollen et al. 2011; Deng et al. 2018; Luo et al. 2013).

Twitter is a data source mainly used for sentiment analysis, which is due to Twitter providing both news and investor sentiment.

Recently, sentiment analysis is being used as a method to predict the price of cryptocurrencies that have no fundamental value, but the focus is only on sentiment scores using a small number of tweets for a relatively short period of time, centered on major cryptocurrencies such as Bitcoin. In this research, after categorizing cryptocurrencies and tweets according to their characteristics, various attributes (sentiment score, volume) of tweets are applied to determine correlation and causation.

Methodology

This research is conducted in four stages as shown in Figure 1. In the first step, we collect tweets, news associated with cryptocurrencies and cryptocurrency's prices and trading volume data, and sentiment analysis is performed on the collected tweets. At the same time, each tweet is classified based on news data, correlation is examined using the sentiment analysis results of tweets corresponding to each category, and finally, the Granger causality test is conducted to find out whether predictive power exists.



¹ <https://www.coingecko.com/>

Figure 1. An Overview of Research Design

Data

Cryptocurrencies we will examine are categorized into five categories: (1) Bitcoin, (2) Smart Contract Platform (Ethereum, Binance Coin, and Solana), (3) DeFi (Terra, Chainlink, and DAI), (4) NFT (Axie-infinity, Sandbox, and Theta-network), and (5) Meme Tokens (Dogecoin, Shiba-inu, and Magic-internet-money). The 12 cryptocurrencies, excluding Bitcoin, were selected by referring to CoinGecko's 'Cryptocurrencies Categories', and three cryptocurrencies belonging to the four categories were selected based on market capitalization. The price, transaction volume, and market cap data of the selected cryptocurrency were collected using CoinGecko's API (Application Programming Interface).

Cryptocurrency-related tweets were collected using the name and abbreviation of each cryptocurrency hashtag. The collection period was set to include the recent bull market and bear market (2021-09 ~ 2022-02), and non-English tweets and Retweets were excluded. Based on this standard, Twitter data (including the number of tweets, tweet text, user information, etc.) was collected using the Twitter API, and the total number of collected tweets was 39,695,674.

Table 1. Descriptive Statistics of the Twitter Datasets

Cryptocurrency	Total Volume	Mean	STD	Min	Max
Bitcoin	13,508,148	74,630.65	15,221.72	39,694	122,253
Ethereum	8,366,593	46,224.27	16,614.85	23,374	107,517
Binance Coin	4,293,421	23,720.56	7,057.02	10,070	47,943
Solana	6,539,209	36,128.22	28,224.56	6,622	221,726
Terra	258,239	1,426.73	1,112.08	275	8,507
Chainlink	241,389	1,333.64	639.08	604	4,177
DAI	10,766	59.48	49.19	16	394
AxieInfinity	295,614	1,633.23	688.32	656	5,338
TheSandbox	179,542	991.94	1,165.94	118	7,976
ThetaNetwork	51,456	284.29	200.76	86	1,713
Dogecoin	3,195,829	17,656.51	5,982.89	9,782	53,865
ShibaInu	2,750,389	15,195.52	11,228.09	1,196	76,567
MagicInternetMoney	5,079	28.06	20.39	1	152

CoinDesk's cryptocurrency-related news data² was collected to categorize the collected tweets. For collection, a scraping program was implemented using Python, and news titles, subheadings, and descriptive data corresponding to each category (Markets, Business, Tech, Policy) were collected from December 2020 to February 2022 with a total of 11,694 news data.

Method

The collected tweet text goes through data cleansing and pre-processing for sentiment analysis and classification. In the data cleansing stage, URLs, mentions, hashtags, reserved words, and numbers

² <https://www.coindesk.com/>

unnecessary for analysis are removed, and in the preprocessing stage, stop words and punctuations are removed after tokenization of the sentence, and stemming or lemmatization stage is performed.

For text data that has been cleaned and pre-processed, various sentiment analysis algorithms are used to calculate the sentiment polarity score. The representatively used VADER algorithm is a vocabulary and rule-based sentiment analysis model and is suitable for analyzing emotions expressed in social media (Hutto and Gilbert 2014). The composite score calculated through this algorithm has a value between -1 (negative) and 1 (positive), and neutral has a value between -0.05 and 0.05.

Table 2. Descriptive Statistics of the Sentiment Datasets

Cryptocurrency	Mean Polarity	STD	Min	Max
Bitcoin	0.299672	0.038192	0.204995	0.411797
Ethereum	0.285074	0.049937	0.107596	0.430476
Binance Coin	0.405846	0.088355	0.190074	0.664934
Solana	0.469897	0.102741	0.147876	0.705274
Terra	0.282130	0.100357	0.054974	0.624627
Chainlink	0.156262	0.107716	-0.553564	0.406968
DAI	0.245735	0.077807	0.046673	0.576230
AxieInfinity	0.340109	0.079361	0.035671	0.676906
TheSandbox	0.271193	0.104571	0.031658	0.672722
ThetaNetwork	0.165290	0.089906	0.016738	0.591359
Dogecoin	0.248497	0.047614	0.110147	0.487684
ShibaInu	0.268962	0.061103	0.123759	0.479701
MagicInternetMoney	0.321137	0.124767	0.051268	0.700300

After classifying tweets into different categories of keywords, such as market impact (e.g., price, transaction), business impact (e.g., fund, investment), technology impact (e.g., blockchain, fork), or policy impact (e.g., regulation, bank) using diverse machine learning techniques and algorithms, we will analyze the impact of sentiment score and volume in different categories of tweets on cryptocurrencies price return.

To check the effect of tweet volume and Twitter sentiment on the cryptocurrency price return and trading volume in the four categories of tweets classified, we use a multi-time series technique called VAR (Vector Autoregression) (Lütkepohl 2007). The VAR model can understand the effect of a change in one variable on another endogenous variable, and it is easy to analyze the relative size of the contribution of the change of each endogenous variable to the overall change.

Prior to implementing the VAR model, the stationary data of each time series was checked through a unit root test. The ADF (Augmented Dickey-Fuller) test which is commonly used was performed, and the normality of time series data was secured through the first-order log difference. In addition, whether multicollinearity showing correlation between independent variables was confirmed through the VIF (Variance Inflation Factor). In addition, Johansen Cointegration test was performed to confirm the presence of cointegration.

To test the relationship between Twitter sentiment and cryptocurrencies price return at the portfolio level, the following model was established.

$$X_t = C_1 + \sum_{i=1}^{lag} \alpha_{1t} Y_{t-i} + \sum_{i=1}^{lag} \beta_{1t} X_{t-i} + \epsilon_{1t}$$

$$Y_t = C_2 + \sum_{i=1}^{lag} \alpha_{2t} X_{t-i} + \sum_{i=1}^{lag} \beta_{2t} Y_{t-i} + \epsilon_{2t}$$

C is the intercept, the coefficient α is the effect of the i -th lag of the variable Y on the variable X , the coefficient β is the effect of the i -th lag of the variable ϵ , and ϵ represents the error (white noise).

The independent variables are the total number of tweets (*TweetVolume*), sentiment polarity score (*PolarityScore*), positive tweet ratio (*PositiveRatio*), negative tweet ratio (*NegativeRatio*), and subjectivity variables, and the dependent variables are price return (*PriceReturn*) and explanations and calculations for each variables are as follows.

TweetVolume is the total number of tweets related to each cryptocurrency, and is the daily (t , interval) sum of tweets for each cryptocurrency (c).

$$TweetVolume_t = \ln \left(1 + \sum_t TweetVolume^c \right)$$

PolarityScore indicates the sentimental polarity score of the collected tweets, and *PositiveRatio* and *NegativeRatio* indicate the ratio of positive and negative tweets among the collected tweets, respectively. *Subjectivity* quantifies the amount of personal opinions and factual information included in tweets (Liu 2010; Loria). High subjectivity means that personal opinions are contained rather than factual information.

$$PolarityScore_t = \ln \left(1 + \frac{\sum_t VADERcompund^c}{\sum_t CollectedTweetVolume^c} \right)$$

$$PositiveRatio_t = \ln \left(1 + \frac{\sum_t PositiveTweetVolume^c}{\sum_t CollectedTweetVolume^c} \right),$$

$$NegativeRatio_t = \ln \left(1 + \frac{\sum_t NegativeTweetVolume^c}{\sum_t CollectedTweetVolume^c} \right)$$

$$Subjectivity_t = \ln \left(1 + \frac{\sum_t TextBlobSubjectivity^c}{\sum_t CollectedTweetVolume^c} \right)$$

PriceReturn and *TradingVolume* denote the price return and trading volume of the entire cryptocurrency.

$$PriceReturn_t = \ln \left(1 + \frac{\sum_t Price_t^c}{\sum_t Price_{t-1}^c} \right)$$

The control variables are trading volume, the total number of news, news sentiment polarity score, positive news ratio, negative news ratio, and news subjectivity variables were used.

Finally, a Granger-causality test is performed to determine which factors affect the price return (Granger 1969). The important part here is that Granger-causality does not represent an actual causal relationship, but rather finds a statistically significant pattern in lagged values of X and Y . This can be interpreted as “ X has predictive power with respect to Y ” (Mao et al. 2011).

Results

Table 3 shows the effect of Twitter sentiment for each category on price return, and **Table 4** shows the effect of price return on Twitter sentiment for each market category. The tweet sentiment of the market category on the price return is statistically significant at the 1% level in the 4th lag. An increase in the polarity score is associated with an increase in the price return, and an increase in the subjectivity is associated with a decrease in the price return.

Conversely, price return is statistically significant at the 1% level in the 1st lag for Twitter sentiment in the market category. An increase in price return was associated with a decrease in sentiment polarity score and positive tweets and an increase in negative tweets.

Table 3. Coefficient Estimates: The Effective of Sentiment on Price Return

Impulse	Response: Price Return			
	Markets	Business	Tech	Policy
Polarity Score				
Lag 1	0.531886	0.206078	-0.865369	0.334666
Lag 2	0.659720	-0.785437*	-0.445173	-0.460145
Lag 3	0.051134	-0.085112	0.856655	0.512954
Lag 4	2.822218**	0.022943	-0.922108	0.458578
Positive Ratio				
Lag 1	1.133545	-2.083588	1.491516	1.035689
Lag 2	-0.174160	1.004467	-0.739944	-2.060222
Lag 3	-1.371119	-0.168622	-1.515468	-1.299249
Lag 4	-0.530755	-2.907507	0.585556	-0.812033
Negative Ratio				
Lag 1	-1.195560	5.299597	-2.634738	-0.602579
Lag 2	0.282821	-4.950571	-0.502375	-5.739175
Lag 3	0.111779	-4.638176	5.385842*	1.609571
Lag 4	2.219307	4.805974	-4.300677	-1.494609
Subjectivity				
Lag 1	-1.312062	0.109040	0.327457	-0.166690
Lag 2	-1.516346	0.552291*	0.588061	-0.602514
Lag 3	0.684239	-0.035726	-0.313222	0.366872
Lag 4	-2.971129**	-0.021080	1.062147	0.029342

Note: ***p < 0.001, **p < 0.01, *p < 0.05

Table 4. Coefficient Estimates: The effective of Price Return on Sentiment

Impulse	Response: Sentiment			
	Polarity Score	Positive Ratio	Negative Ratio	Subjectivity
Lag 1	-0.067878***	-0.038859**	0.033549**	-0.014071
Lag 2	-0.045548*	-0.012451	0.027912*	-0.014589
Lag 3	-0.028998	0.015616	0.019104	-0.003200
Lag 4	-0.003459	-0.010090	0.017289	0.002677

Note: ***p < 0.001, **p < 0.01, *p < 0.05

Rinterpreting the results of the VAR model based on the Granger causality test results (Table 5), the increase in the sentiment polarity score has predictive power that the price return can increase after a while, and the increase in the price return has predictive power that the sentiment polarity score and the ratio of positive tweets may decrease and the number of negative tweets may increase in the next day.

Table 5. Statistics for Bivariate Granger Causality Tests on Markets Category

Relation	p-Value	Lags and p-Values
TweetVolume → PriceRetrun	0.3904	1(0.5400), 2(0.3904), 3(0.4339), 4(0.4842)
PolarityScore → PriceRetrun	0.0112*	1(0.0112), 2(0.0570), 3(0.0642), 4(0.0272*)
PositiveRatio → PriceRetrun	0.0040**	1(0.0040**), 2(0.0516), 3(0.0689), 4(0.0808)
NegativeRatio → PriceRetrun	0.0006***	1(0.0006***), 2(0.001***), 3(0.0013**), 4(0.0007***)
Subjectivity → PriceRetrun	0.4121	1(0.6862), 2(0.4706), 3(0.4121), 4(0.6299)
PriceRetrun → TweetVolume	0.5809	1(0.5809), 2(0.8578), 3(0.9737), 4(0.6059)
PriceRetrun → PolarityScore	0.0025**	1(0.0216*), 2(0.0025**), 3(0.0200*), 4(0.0281*)
PriceRetrun → PositiveRatio	0.0043**	1(0.0043**), 2(0.0046**), 3(0.0065**), 4(0.0216*)
PriceRetrun → NegativeRatio	0.0006***	1(0.0175*), 2(0.0006***), 3(0.053), 4(0.0156*)
PriceRetrun → Subjectivity	0.8167	1(0.8318), 2(0.8167), 3(0.8596), 4(0.9305)
Note: ***p < 0.001, **p < 0.01, *p < 0.05		

Conclusion

In this study, an empirical study was conducted using Twitter sentimental data to comprehensively investigate the relationship between microblogs and cryptocurrency price returns. First, we selected cryptocurrencies of major categories, collected tweets that mentioned each cryptocurrency on Twitter, and conducted sentiment analysis using various algorithms. Next, we collected cryptocurrency-related news published during the same period, classified each tweet into Markets, Business, Tech, and Policy categories based on the news data, and applied the sentiment analysis results.

As a result, it was confirmed that the tweet sentiment belonging to the market category had a correlation with the cryptocurrency prices. However, as a result of the Granger causality test, the direction is not one-way but two-way, so it can be said that Twitter sentiment affects the price of cryptocurrency, and on the contrary, cryptocurrency prices also affect Twitter sentiment.

Unlike stocks, in the case of cryptocurrencies whose fundamental value cannot be measured, it can be seen that investors trade according to emotional judgment or market conditions.

References

- Bollen, J., Mao, H., and Zeng, X. 2011. "Twitter Mood Predicts the Stock Market," *Journal of computational science* (2:1), pp. 1-8.
- Deng, S., Huang, Z. J., Sinha, A. P., and Zhao, H. 2018. "The Interaction between Microblog Sentiment and Stock Return: An Empirical Examination," *MIS quarterly* (42:3), pp. 895-918.
- Granger, C. W. 1969. "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods," *Econometrica: journal of the Econometric Society*, pp. 424-438.

- Hutto, C., and Gilbert, E. 2014. "Vader: A Parsimonious Rule-Based Model for Sentiment Analysis of Social Media Text," *Proceedings of the international AAAI conference on web and social media*, pp. 216-225.
- Kraaijeveld, O., and De Smedt, J. 2020. "The Predictive Power of Public Twitter Sentiment for Forecasting Cryptocurrency Prices," *Journal of International Financial Markets, Institutions and Money* (65).
- Li, X., and Wang, C. A. 2017. "The Technology and Economic Determinants of Cryptocurrency Exchange Rates: The Case of Bitcoin," *Decision support systems* (95), pp. 49-60.
- Liu, B. 2010. "Sentiment Analysis and Subjectivity," *Handbook of natural language processing* (2:2010), pp. 627-666.
- Loria, S. "Textblob: Simplified Text Processing." from <https://textblob.readthedocs.io/en/dev/>
- Lütkepohl, H. 2007. *New Introduction to Multiple Time Series Analysis*. Springer.
- Luo, X., Zhang, J., and Duan, W. 2013. "Social Media and Firm Equity Value," *Information Systems Research* (24:1), pp. 146-163.
- Mao, H., Counts, S., and Bollen, J. 2011. "Predicting Financial Markets: Comparing Survey, News, Twitter and Search Engine Data," *arXiv preprint arXiv:1112.1051*.
- Nakamoto, S. 2008. "Bitcoin: A Peer-to-Peer Electronic Cash System," *Decentralized Business Review*.

D4.5 Research on Health Crowdfunding: A Literature Review

Gu, Rui^a, Li, Jing^b, Xie, Tao^c

^a University of International Business and Economics
E-mail: gurui@uibe.edu.cn

^b University of International Business and Economics
E-mail: leejinglll@163.com

^c Soochow Futures Co., Ltd.
E-mail: 752319961@qq.com

Abstract

Health crowdfunding has become an important supplement to the health fundraising system and has attracted increasing attention from both researchers and practitioners. However, few efforts have been devoted to integrating the existing findings. This paper aimed to fill this gap. We conducted a systematic review of relevant literature and accordingly classified health crowdfunding into three types: health research crowdfunding, health innovation crowdfunding, and health expenses crowdfunding. Based on this classification, we reviewed the existing findings and discussed future research directions. This paper serves as a foundation for future research to conduct in-depth investigation and advances our understanding of health crowdfunding.

Keywords: Health crowdfunding, literature review, healthcare, medical care

Introduction

The concept of crowdfunding was first proposed in literature by Schwienbacher and Larralde (2010). Crowdfunding is “an open call, essentially through the Internet, for the provision of financial resources either in form of donation or in exchange for some form of reward and/or voting rights in order to support initiatives for specific purposes” (Schwienbacher and Larralde 2010). As an additional method of fundraising, crowdfunding has been widely employed to address various issues in multiple fields, such as health, entrepreneurship, and crisis response. As a combination of crowdsourcing and microfinance, health crowdfunding provides financial support in health area via donations or inputs in exchange for future products, services, or equity on an open Internet platform. Despite the support of critical illness insurance and medical assistance policies, heavily ill patients and their families are often unable to deal with catastrophic healthcare expenditures. Besides, given the limited financial resources, researchers and institutes often suffer insufficient financial support in developing new drugs and treatments for diseases (Dragojlovic and Lynd 2014). Undoubtedly, health crowdfunding has provided a promising channel of financing the stakeholders in the health arena and has demonstrated great potential of improving individuals’ well-being and the societal welfare as well (Gonzales et al. 2018).

Because of the practical significance, health crowdfunding has attracted much attention from academics in recent years. After analyzing the extant literature, we found that the few review articles have focused on the impact of health crowdfunding. Furthermore, they have collected papers published till 2017 and have thus missed the period when health crowdfunding was experiencing a fast growth. Against this background, we conducted a systematic review to obtain a holistic and systematic understanding of health crowdfunding and accordingly provided future research directions.

The rest of the paper is structured as follows. First, we describe the method used in the literature search and identification. Second, we offer the classification of health crowdfunding based on the previous

literature. Third, we conduct a comprehensive review by different types of health crowdfunding. Finally, we identify the gaps and propose the future research directions.

Methodology

We employed a two-stage approach to search and identify the relevant literature (Webster and Watson 2002). In the first stage, we searched the literature including journal articles and conference proceedings from Web of Science (WOS) Core Library and AISel using the key words "health crowdfunding," "medical crowdfunding," "healthcare crowdfunding," "medical care crowdfunding," "GoFundMe," "YouCaring," "Tencent Philanthropy," "healthcare," and "medical care". Consequently, we obtained 89 articles from WOS and 100 articles from AISel.

In the second stage, we applied the exclusion criteria to the initial set of articles. Specifically, we first excluded the articles that were not relevant to health crowdfunding, such as studies on charity crowdfunding and review-type papers by reading the abstract of the articles. We also excluded conference articles that were found to have been later published in journals. As a result, 141 papers were excluded from the collection. Then, based on the literature left, we identified 3 more papers by forward and backward literature analysis. Consequently, we identified a total of 51 articles.

Classification of health crowdfunding

Multiple terms such as health-related crowdfunding, health care crowdfunding, and health project crowdfunding (Lukk et al. 2018; Otero 2015) have been used in the literature. Health crowdfunding has also been defined differently in the literature and its definition is overlapping with medical crowdfunding since medical crowdfunding is a means of leveraging social networks to raise money for health-related expenses (Zenone and Snyder 2019).

In our literature collection, only three types of health crowdfunding were found, including health research crowdfunding, health innovation crowdfunding, and health expenses crowdfunding. In most papers, researchers do not distinguish between health expenses crowdfunding and health initiatives crowdfunding. They held the opinion that they are all health expenses crowdfunding (or medical crowdfunding). So a question arises: Is there a need to distinguish between health expenses crowdfunding and health initiatives crowdfunding?

According to Renwick and Mossialos (2017), health expenses campaigns are aimed at financing an individual's out-of-pocket expenses for medical services and products, while health initiatives are to provide benefits to the public or a special group of people. We can extract two differences here. One is the beneficiary being an individual vs. a not-for-profit health initiative, and the other is the purpose being financing out-of-pocket expenses for medical services and products vs. not-for-profit health programs. However, the two differences are sometimes difficult to identify. One reason is that not-for-profit health initiatives sometimes start a campaign on behalf of individuals. The second reason is that many not-for-profit health programs are also aimed at helping individuals compensate their out-of-pocket expenses. Thus, if the criterion is applied to distinguish them, many cross areas cannot be covered. Besides, little research focused on health initiatives. Given such a situation, we do not distinguish health expenses crowdfunding from health initiatives crowdfunding. Hence, we categorize health crowdfunding into three types: health research crowdfunding, health innovation crowdfunding, and health expenses crowdfunding.

Findings and discussion

General trends in literature

In recent years, health crowdfunding is getting increasing attention from academia. The earliest paper was published in 2014, and the literature amount reached a peak in 2019. Regarding methodologies, case study (12), econometric analysis (11), and textual analysis (13) are the main approaches to studying health crowdfunding and five papers used mixed methods. Regarding the types of health crowdfunding, 44, two, and five papers investigated health expenses, innovation, and research crowdfunding, respectively.

Health research crowdfunding

Health research crowdfunding refers to the crowdfunding for not-for-profit health research that typically focuses on treatments for rare or neglected diseases (Renwick and Mossialos 2017). Cancer research takes up a significant proportion of public funds allocated to medical research and this situation also occurs in medical research crowdfunding area. Although Aleksina et al. (2019) demonstrated that disease characteristics made little difference in crowdfunding results, many researchers still hold the opinion that rare diseases are sometime disadvantaged in crowdfunding area, as Dragojlovic and Lynd (2014) suggested that many donors supported research on a disease because they felt that they had a personal stake in the new treatments development. They may have the disease in the future, so they need scientists to develop the treatment just in case (Dragojlovic and Lynd 2014). Interestingly, research shows that the more innovative the project is, the lower the probability of raising the target sum (Aleksina et al. 2019).

In general, health research crowdfunding demonstrates to be a viable means of financing early-stage discovery (Dragojlovic and Lynd 2014), but some scientists are concerned that it may side step scientific peer review and increase patient exposure to the risks of scientifically unproven interventions (Del Savio 2017).

Health innovation crowdfunding

Health innovation crowdfunding is that people start campaigns for health ventures that need additional capital to get off the ground (Renwick and Mossialos 2017). The crowdfunded products include new drugs, devices, and equipment. Smith (2015) described the problems among medical device regulation in crowdfunding area by analyzing the case of Scanadu's "Scout" and proposed that crowdfunding sites should prevent unregulated medical devices being funded. Holmes et al. (2019) employed the data from Kickstarter and Indiegogo to investigate the crowdfunding success of pharmacy- and medication-related products. The result shows that media attention leads to continued success, while the presence of a medical professional on the project team or the inclusion of a product demonstration doesn't make a difference in crowdfunding success, which is different from health research crowdfunding.

Health expenses crowdfunding

The literature on health expenses crowdfunding accounts for the largest proportion of our collection. Health expenses crowdfunding is the process of using a crowdfunding platform to raise funds for individuals' medical treatment and related costs, including financial support if the intended recipient is unable to work due to their or family members' condition (Zenone and Snyder 2020). Health expenses crowdfunding have three characteristics: donation-based (Vassell et al. 2020), relying on socially mutual assistance (Xu and Wang 2019; Zenone and Snyder 2019), and raising money from a large number of people who make relatively small individual contributions (Coutrot et al. 2020).

There are many platforms operating campaigns for health expenses, such as GoFundMe, YouCaring, Wasti, and Tencent Gong Yi. GoFundMe is the biggest platform since it has been aggressively expanding and acquiring other platforms such as YouCaring (acquired in April 2018) and CrowdRise (acquired in January 2017). The empirical data are mainly from these platforms. With regard to the diseases, researchers have studied various diseases in crowdfunding in health expenses, covering both physical problems (e.g., Lyme disease (Vassell et al. 2020) and organ transplant (Durand et al. 2018b), and mental problems (e.g., addicted-related problems (Palad and Snyder 2019). Besides, some researchers concentrated on treatment therapies such as stem cell interventions (Snyder and Turner 2018) rather than diseases. Among the diseases or therapies, cancer is the most represented health issue requesting funds in health expenses crowdfunding (Coutrot et al. 2020).

Factors affecting crowdfunding outcomes

Research shows that donors have two tendencies when they treat diseases or requests in crowdfunding campaigns. The first is that campaigns for exceptional and acute needs are thought to be more common and more likely to be funded than chronic needs (Snyder et al. 2016). Also, patients suffering from more

severe medical conditions do not raise money faster (Proelss et al. 2020). The second is that socially unacceptable demand may be less likely to be funded (Snyder 2016). For example, campaigns which served not terminating a pregnancy raised more money than those seeking funds to access abortion related services (Zenone and Snyder 2020). This is because terminating a pregnancy or abortion is considered more stigmatized than the otherwise. Another example is transgender treatment, which is also considered stigmatized in many countries. And research shows that transgender campaigns met only 24% of their goal (Barcelos 2020), less than 33% on average (Coutrot et al. 2020).

The characteristics of initiators including name (Sisco and Weber 2019), gender (Sisco and Weber 2019), age (Proelss et al. 2020), location (Durand et al. 2018a), will all make a difference in crowdfunding results. The details are as follows. First, as for name, research shows that donors donate more to recipients who have the same last name as them (Sisco and Weber 2019). Second, as for gender, the conclusions are rather divergent. Lukk et al. (2018) found that being female were on average associated with negative effects, while Proelss et al. (2020) demonstrated that female patients had faster fundraising speed. This is probably originated the different data resource they employed. Lukk et al. (2018) collected the data from Kickstarter, Indiegogo, and Fundrazr, while Proelss et al. (2020) applied the data from Watsi. They are two different kinds of platforms. The former are mainly comprehensive crowdfunding platforms, operating campaigns not only raising money for medical expenses, but also for other products like high tech innovation, while Watsi represents a new kind of drone philanthropy, acting as intermediaries by promoting the stories of distant others (Kenworthy 2018). As different kinds of platform may attract different kinds of people, forming different crowd (Gleasure and Feller 2018) and these sites act both as a space for the generation and mobilization of affect and as a set of structures that affect periodically overcomes or exceeds (Famel 2015), it is plausible that conclusions may be different among different platforms. Third, when it comes to age, the conclusions from researchers are so consistent that patient age is negatively correlated with funding speed (Lukk et al. 2018). But there is one exception that older individuals in transgender treatment raise more funds (Barcelos and Budge 2019; Proelss et al. 2020). This reminds us of a possibility that the same characteristics may have differential influence in campaigns for different diseases. Fourth, as for location, individuals raised less money internationally (Barcelos and Budge 2019). Donors have preference for their own motherland. Finally, as for minorities, research shows that despite these minority populations being in greater need, they raises less money for medical crowdfunding (Burtch and Chan 2019; Lukk et al. 2018).

Factors in campaign arrangement mainly comprise two parts, including campaign presentation and initiators' behavior. With regard to campaign presentation, researchers mainly concentrated on how campaign description affects the crowdfunding results. First, emotional expression is significantly associated with fundraising amount. Among successful campaigns, words or pictures are generally more positive, leading to a higher speed of fundraising (Durand et al. 2018b; Kim et al. 2018). Second, narration perspective also matters in fundraising programs. Durand et al. (2018b) found that a third-person description perspective brings more donations. Other description related factors include readability (Proelss et al. 2020), length of description (Durand et al. 2018b), goal amount (Durand et al. 2018b), level of detail (Berliner and Kenworthy 2017), and use of images and videos (Ortiz et al. 2018).

In terms of behavior of initiators, they should first choose an appropriate platform. Research shows that the number of successfully funded health projects is higher when the platform is not investment-based or dedicated only to healthcare projects (Bassani et al. 2019). It doesn't mean that people should only choose comprehensive platforms because comprehensive platforms tend to have a larger size and have more campaigns. Initiators may face more competition and reduce the possibility to some degree. Also, regular update is positive related to the money raised for it makes the campaign more credible (Durand et al. 2018b). Besides, initiators should try their best to promote their campaigns, which will greatly increase the successful rate. Ortiz et al. (2018) found in the experiment that there was a dramatic increase in the contribution amount when the medium used was word-of-mouth, email, and phone since this way created a close link with others. For online promotion, sending campaign-specific messages (Ortiz et al. 2018) and attracting press coverage (Snyder 2016) can increase the successful rate as well.

Since crowdfunding is almost a complete online activities, social networks play a significant role in helping raise money (Ortiz et al. 2018). A stronger network of individuals and larger social network results a higher crowdfunding success rate. Distant supporters often donated to a campaign when it is

shared many times in their social networks (Kim et al. 2017). This phenomenon to some extent reveals the existence of the herd effect in crowdfunding area.

Motivation of donors

The donors' motivation is not purely altruism. Research showed that 21% of donations are made with anonymity, and 11% are not attributable to any egoistic goal (Sisco and Weber 2019). Donors are less likely to donate if the average reputation of previous donors is higher than their own. When previous donors devote more money, the donor will feel less sense of contribution and less reputation and thus choose to not donate (Proelss et al. 2020).

Benefits brought by health expenses crowdfunding

For initiators, they can benefit a lot from health expenses crowdfunding. On the surface, campaigns ameliorate the financial burdens caused by extraordinarily high healthcare costs, lack of insurance, and other related expenditure (Berliner and Kenworthy 2017). At the same time, the success of crowdfunding can lead to a reduction in personal bankruptcy filings (Burtch and Chan 2019). Furthermore, medical crowdfunding can bring beneficiaries not only financial support but also emotional support and also resurfaced the beneficiaries' more distant and dormant connections, increasing their social capital (Kim et al. 2017). For donors, they can know more about different diseases, understand their current situation and future trend (Ortiz et al. 2018). For society, health expenses crowdfunding compliments the current medical system and helps reallocate the medical resources. It sometimes can even be a substitution for medical care system (Bassani et al. 2019; Lukk et al. 2018). Also, it can be viewed as an indicator of future medical needs (Toscano et al. 2019).

Risks brought by health expenses crowdfunding

There are six types of ethical issues has been put forward, including fraud and misinformation, fairness, perpetuating systemic injustice, efficiency, privacy, and shifting health care's valuation (Snyder 2016). So the side effects of health crowdfunding should not be overlooked (Snyder 2016). First, in terms of fraud and misinformation, fraud can be divided into four categories of fraud, including faking or exaggerating one's own illness, faking or exaggerating another's illness, impersonation, and misapplication of funds (Zenone and Snyder 2019), which can damage the social trust and thus reduce the credibility of other campaigns in medical care industry (Freckelton 2018). Second, the fairness issue can also be reflected in the finding that socioeconomically advantaged people tend to raise more money than socially disadvantaged people (Burtch and Chan 2019). Third, crowdfunding brings about inequalities and injustices. For example, the transgender patients always has difficulty in fundraising (Barcelos 2020; Barcelos and Budge 2019). Fourth, efficiency issues imply the concerns that resources may be more efficiently used by other charity programs and organizations outside the crowdfunding system. However, no other research in our collection reveals such ethical issues. Fifth, privacy concerns are raised due to the openness of the Internet. Several researchers proposed such concern based on the data from China and Canada (Jin 2019; Palad and Snyder 2019). Sixth, the valuation of medical care is gradually transferring from public goods to a commodity, which is reflected in the case of Charlie Gard (Dressler and Kelly 2018). There is one side effect that need to be added in the list of ethical issues, i.e., harm to the patients themselves. The pressures inherent in receiving funds from external parties may threaten the ability to voluntarily consent to treatment (Dressler and Kelly 2018). Also, health crowdfunding may also harm the relationship since their close friends may feel pressured to donate money they could not afford (Barcelos and Budge 2019).

Future research directions

More study on health research crowdfunding and health innovation crowdfunding

The number of studies on health research crowdfunding and health innovation crowdfunding is rather limited. However, these two parts influence the provision side of health who provides patients with therapies, drugs, medical devices, and equipment. So can the two types of crowdfunding relieve the

uneven resource allocation in medical care area? What factors affect the results of these two types of crowdfunding? Are they the same with health expenses crowdfunding? All these questions have yet to be properly answered. We find that research on health expenses crowdfunding is generally analyzed from four perspectives, including factors affecting crowdfunding results, motivation of participants, benefits, and risks of crowdfunding. Therefore, it is a good choice to follow the track to have a deep understanding in crowdfunding for health research and health innovation.

Besides, we should pay more attention to the contradictory findings. Even based on the little literature on crowdfunding for health research and health innovation, we can find the conflict that the presence of a medical professional in their campaign description leads to an increase of donation raised in crowdfunding for health research crowdfunding (Koole et al. 2018) but makes no difference in health innovation crowdfunding (Holmes et al. 2019). This conflict is rather strange because innovation lies in the core of research and innovation generally involves research. The main difference between them is that health research is not for profit, while health innovation is profit-oriented. Is the performance of the presence of a profession affected by the for-profit vs. not-for-profit of a crowdfunding campaign?

Distinguishing between health initiatives crowdfunding and health expenses crowdfunding

In this paper, health initiatives crowdfunding is subsumed under the health expenses crowdfunding. Although there are many campaigns in the cross area of these two types, still some crowdfunding campaigns are purely health initiatives, such as raising money for a charity show for those patients or holding charity speeches to inform the public about the harm of certain diseases. Such campaigns are initiated by nonprofit organizations or some individuals, but their purposes are focusing on activities themselves rather than holding activities to raise money for someone in need. When the beneficiary and content of a campaign is changed, it may attract different groups of donors. Will the participants still react the same to the factors as they do in health expenses crowdfunding? Therefore, from a theoretical perspective, future researchers can find the boundary between health initiatives and health expenses crowdfunding, make the definition of health crowdfunding complete.

Digging deeper in health expenses crowdfunding

The literature on health expenses crowdfunding accounts for the largest proportion of our collection, but there remain some understudied questions/areas. First, we know that many factors influence the results of health crowdfunding and the motivation of donors, but the question of how these factors influence donors' motivation and then change the crowdfunding results is unanswered. Second, most of the extant studies have investigated the impact of a single factor on crowdfunding results. Researchers have seldom investigated the joint impact of the different factors. More efforts can be made in this area. Third, although in online fundraising area, donors seem not to be sensitive to efficiency ratios (price of giving, fundraising expenditure) (Saxton and Wang 2014), but police makers should pay attention to this index. Efficiency is one of the ethical issues in medical crowdfunding, which indicates that resources may be more efficiently used by other charity programs and organizations outside the crowdfunding system (Snyder 2016). Many crowdfunding platforms will charge service fee. Besides, some campaigns are initiated by individuals but also supported by certain nonprofit organizations who may charge other services fee, making the donations even less. In tradition fundraising activities, there is only one intermediary, but in crowdfunding area, there may exist two. So what is the real cost of online medical crowdfunding? Is crowdfunding really efficient? Finally, researchers can employ data involving different diseases and from different platforms in their empirical analysis. Different diseases and different platforms can bring different outcomes. Having a detailed research on it can help people, especially initiators, have a clear understanding of donors and thus start a targeted campaign efficiently.

Conclusion

With the rise of the Internet, health crowdfunding has been widely accepted. In order to have a holistic and systematic understanding of health crowdfunding, we collected 51 papers from WOS and AISeL. We proposed a typological framework to organize the existing literature. We have presented a comprehensive overview of the existing knowledge and pointed out the possible future research

directions. We hope that our study can help researchers and practitioners to gain a systematic overview of the literature and inspires more research to advance the development of health crowdfunding.

Acknowledgements

This research was supported in part by the National Natural Science Foundation of China (71501042), Social Science Foundation of Beijing City (17XCC008), and National Social Science Foundation of China (21AJL013).

References

- Aleksina, A., Akulenka, S., and Lubloy, Á. 2019. "Success Factors of Crowdfunding Campaigns in Medical Research: Perceptions and Reality," *Drug Discovery Today* (24:7), pp. 1413-1420.
- Barcelos, C. A. 2020. "Go Fund Inequality: The Politics of Crowdfunding Transgender Medical Care," *Critical Public Health* (30:3), pp. 330-339.
- Barcelos, C. A., and Budge, S. L. 2019. "Inequalities in Crowdfunding for Transgender Health Care," *Transgender Health* (4:1), pp. 81-88.
- Bassani, G., Marinelli, N., and Vismara, S. 2019. "Crowdfunding in Healthcare," *Journal of Technology Transfer* (44:4), pp. 1290-1310.
- Berliner, L. S., and Kenworthy, N. J. 2017. "Producing a Worthy Illness: Personal Crowdfunding Amidst Financial Crisis," *Social Science & Medicine* (187), pp. 233-242.
- Burtch, G., and Chan, J. 2019. "Investgating the Relationship between Medical Crowdfunding and Personal Bankruptcy in the United States: Evidence of a Digital Divide," *MIS Quarterly* (43:1), pp. 237-262.
- Coutrot, I. P., Smith, R., and Cornelsen, L. 2020. "Is the Rise of Crowdfunding for Medical Expenses in the United Kingdom Symptomatic of Systemic Gaps in Health and Social Care?," *Journal of Health Services Research & Policy* (25:3), pp. 181-186.
- Del Savio, L. 2017. "The Place of Crowdfunding in the Discovery of Scientific and Social Value of Medical Research," *Bioethics* (31:5), pp. 384-392.
- Dragojlovic, N., and Lynd, L. D. 2014. "Crowdfunding Drug Development: The State of Play in Oncology and Rare Diseases," *Drug Discovery Today* (19:11), pp. 1775-1780.
- Dressler, G., and Kelly, S. A. 2018. "Ethical Implications of Medical Crowdfunding: The Case of Charlie Gard," *Journal of Medical Ethics* (44:7), pp. 453-457.
- Durand, W. M., Johnson, J. R., Eltorai, A. E. M., and Daniels, A. H. 2018a. "Medical Crowdfunding for Patients Undergoing Orthopedic Surgery," *Orthopedics* (41:1), pp. 58-63.
- Durand, W. M., Peters, J. L., Kalagara, S., Osband, A. J., and Daniels, A. H. 2018b. "Medical Crowdfunding for Organ Transplantation," *Clinical Transplantation* (32:6), pp. 1-9.
- Famel, M. 2015. "Kickstarting Trans*: The Crowdfunding of Gender/Sexual Reassignment Surgeries," *New Media & Society* (17:2), pp. 215-230.
- Freckleton, I. 2018. "Responding Better to Desperate Parents: Warnings from the Alfie Evans Saga," *Journal of Law and Medicine* (25:4), pp. 899-918.
- Gleasure, R., and Feller, J. 2018. "What Kind of Cause Unites a Crowd? Understanding Crowdfunding as Collective Action," *Journal of Electronic Commerce Research* (19:3), pp. 223-236.
- Gonzales, A. L., Kwon, E. Y., Lynch, T., and Fritz, N. 2018. "'Better Everyone Should Know Our Business Than We Lose Our House': Costs and Benefits of Medical Crowdfunding for Support, Privacy, and Identity," *New Media & Society* (20:2), pp. 641-658.
- Holmes, T. M., Aungst, T. D., Smith, C. C., and Metcalf, M. D. 2019. "Crowdfunding Pharmacy- and Medication-Related Products: How Successful Is It?," *Journal of the American Pharmacists Association* (59:2), pp. 57-62.
- Jin, P. 2019. "Medical Crowdfunding in China: Empirics and Ethics," *Journal of Medical Ethics* (45:8), pp. 538-544.
- Kenworthy, N. 2018. "Drone Philanthropy? Global Health Crowdfunding and the Anxious Futures of Partnership," *Medicine Anthropology Theory* (5:2), pp. 168-187.
- Kim, J. G., Hong, H., and Karahalios, K. 2018. "Understanding Identity Presentation in Medical Crowdfunding," *the 36th CHI Conference on Human Factors in Computing Systems*, New York,

- USA: Assoc Computing Machinery, pp. 1-12.
- Kim, J. G., Vaccaro, K., Karahalios, K., and Hong, H. 2017. "'Not by Money Alone': Social Support Opportunities in Medical Crowdfunding Campaigns," in: *Proceedings of the 2017 ACM Conference on Computer Supported Cooperative Work and Social Computing*. Portland, Oregon, USA: Association for Computing Machinery, pp. 1997-2009.
- Koole, M. A. C., Kauw, D., Winter, M. M., and Schuurings, M. J. 2018. "A Successful Crowdfunding Project for Ehealth Research on Grown-up Congenital Heart Disease Patients," *International Journal of Cardiology* (273), pp. 96-99.
- Lukk, M., Schneiderhan, E., and Soares, J. 2018. "Worthy? Crowdfunding the Canadian Health Care and Education Sectors," *Canadian Review of Sociology-Revue Canadienne De Sociologie* (55:3), pp. 404-424.
- Ortiz, R. A., Witte, S., Gouw, A., Sanfilippo, A., Tsai, R., Fumagalli, D., Yu, C., Lant, K., Lipitz, N., Shepphird, J., Alvina, F. B., and Lin, J. C.-H. 2018. "Engaging a Community for Rare Genetic Disease: Best Practices and Education from Individual Crowdfunding Campaigns," *Interactive Journal of Medical Research* (7:1), pp. 1-11.
- Otero, P. 2015. "Crowdfunding: A New Option for Funding Health Projects," *Archivos Argentinos De Pediatría* (113:2), pp. 154-157.
- Palad, V., and Snyder, J. 2019. "'We Don't Want Him Worrying About How He Will Pay to Save His Life': Using Medical Crowdfunding to Explore Lived Experiences with Addiction Services in Canada," *International Journal of Drug Policy* (65), pp. 73-77.
- Proelss, J., Schweizer, D., and Zhou, T. 2020. "Economics of Philanthropy—Evidence from Health Crowdfunding," *Small Business Economics* (57:2), pp. 999-1026.
- Renwick, M. J., and Mossialos, E. 2017. "Crowdfunding Our Health: Economic Risks and Benefits," *Social Science & Medicine* (191), pp. 48-56.
- Saxton, G. D., and Wang, L. 2014. "The Social Network Effect: The Determinants of Giving through Social Media," *Nonprofit and Voluntary Sector Quarterly* (43:5), pp. 850-868.
- Schwienbacher, A., and Larralde, B. 2010. "Crowdfunding of Small Entrepreneurial Ventures," in *Handbook of Entrepreneurial Finance*, UK: Oxford University Press, pp. 369-391.
- Sisco, M. R., and Weber, E. U. 2019. "Examining Charitable Giving in Real-World Online Donations," *Nature Communications* (10), pp. 1-8.
- Smith, C. 2015. "Scouting for Approval: Lessons on Medical Device Regulation in an Era of Crowdfunding from Seanadu's 'Scout'," *Food and Drug Law Journal* (70:1), pp. 209-235.
- Snyder, J. 2016. "Crowdfunding for Medical Care Ethical Issues in an Emerging Health Care Funding Practice," *Hastings Center Report* (46:6), pp. 36-42.
- Snyder, J., Mathers, A., and Crooks, V. A. 2016. "Fund My Treatment!: A Call for Ethics-Focused Social Science Research into the Use of Crowdfunding for Medical Care," *Social Science & Medicine* (169), pp. 27-30.
- Snyder, J., and Turner, L. 2018. "Selling Stem Cell 'Treatments' as Research: Prospective Customer Perspectives from Crowdfunding Campaigns," *Regenerative Medicine* (13:4), pp. 375-384.
- Toscano, F., Golinelli, D., Guicciardi, S., O'Donnell, E., Rossi, S., Messina, G., and Fantini, M. P. 2019. "Crowdfunding for Unmet Medical Needs: The Case of Car-T and Gofundme," *European Journal of Public Health* (29), pp. 388-389.
- Vassell, A., Crooks, V. A., and Snyder, J. 2020. "What Was Lost, Missing, Sought and Hoped For: Qualitatively Exploring Medical Crowdfunding Campaign Narratives for Lyme Disease," *Health* (25:6), pp. 707-721.
- Webster, J., and Watson, R. T. 2002. "Analyzing the Past to Prepare for the Future: Writing a Literature Review," *MIS Quarterly* (26:2), pp. 13-23.
- Xu, K., and Wang, X. 2019. "'Kindhearted People, Please Save My Family': Narrative Strategies for New Media Medical Crowdfunding," *Health Communication* (35:13), pp. 1605-1613.
- Zenone, M., and Snyder, J. 2019. "Fraud in Medical Crowdfunding: A Typology of Publicized Cases and Policy Recommendations," *Policy and Internet* (11:2), pp. 215-234.
- Zenone, M. A., and Snyder, J. 2020. "Crowdfunding Abortion: An Exploratory Thematic Analysis of Fundraising for a Stigmatized Medical Procedure," *BMC Womens Health* (20), pp. 1-7.

D4.6 Stork Market and Cryptocurrency Market Prediction Modeling Research

Lee, S.^a, Park, J. G.^b and Lee, H.^{c*}

^a PrideLab

E-mail: stuyff77@gmail.com

^b PrideLab

E-mail: warrenpak@warrenpak.com

^{c*} School of Management, Tokyo University of Science

E-mail: hlee@rs.tus.ac.jp

* Corresponding author

Abstract

Investors' online search is an action to acquire investment information, which reflects their investment psychology and behavior. For this research Big data analysis was performed by extracting keywords for online search terms of participants in the stock market and cryptocurrency market. Time series analysis was conducted by extracting keywords that precede the market price, and then applied to a virtual investment model to verify their effectiveness. The implications were presented by comparing the investment prediction modeling for each market. Detailed research procedures are as follows. After extracting keywords of higher frequency from online reports related to the stock market and cryptocurrency, keywords with high correlation were selected through time series analysis between search volume by keyword and asset market index. Then, the return was verified by applying it to a virtual investment model based on the search volume of the selected keywords. As a result of the analysis, it was found that there was a significant difference in profitability compared to the case where keywords were extracted from texts that were directly related to each asset market. In the case of the stock market, it could be seen as a significant investment strategy because the search volume-based investment model could expect a high return on investment compared to the post-purchase strategy. On the other hand, in the cryptocurrency market, there was a limit to seeing the search volume-based investment model as a better investment strategy than the retention strategy after the retention.

Keywords: Big Data, Stock Investment Strategy, KOSPI, KOSDAQ, Cryptocurrency, Prediction Modeling

[DAY 2]

E4 [ICEC-Paper Session] IT/IS General

E4.1 Dark Side of Review Length: The Effect of Cognitive Load on Perceived Helpfulness of Rating Inconsistency

Yuqiu Wang^a and Kai Li^b

^a Business School, Nankai University

E-mail: wangyuqiu@mail.nankai.edu.cn

^b Business School, Nankai University

E-mail: likai@nankai.edu.cn

Abstract

Rating inconsistency (simply, RI), defined as the difference between review rating and average rating, is a major factor affecting review helpfulness. Extant literature mainly focuses on the magnitude of RI, but ignores the direction of RI. To this end, we, based on prospect theory, examine the heterogeneous effects of positive and negative RI. Furthermore, combined with information processing theory, we examine the negative moderating effect of review length. Finally, we explore the interplay between positive/negative RI, review length, and product heterogeneity. Depending on the dataset from JD.com, we find although positive and negative RI positively influence review helpfulness, the effect size of negative RI on review helpfulness is stronger. Besides, review length increases the cognitive burden on consumers, negatively moderating the aforementioned relationships. Furthermore, the analysis finds that the dark effect of review length on the perceived helpfulness of positive and negative RI is stronger for search and utilitarian products.

Keywords: Cognitive load, review helpfulness, positive RI, negative RI, review length, product types

E4.2 Understanding the Effect of Goal Setting in IS Compliance Intention Through Stress Theory: The Moderating Effect of Stress Coping

Inho Hwang¹, Sungho Hu², Sanghyun Kim³

¹ College of General Education, Kookmin University, Seoul, South Korea

² University Policy Research Institute, Korea University, Seoul, South Korea

³ School of Business Administration, Kyungpook National University, Daegu, South Korea

Abstract

This study proposes a research model that empirically investigates the relationships between variables (the difficulty and specificity) in goal setting of information security(IS) policies and two variables (role ambiguity and role conflict) associated with employees' IS related role stress, which then influences the compliance intention of IS. In addition, we examined the roles of coping style (task and emotion) as a moderator in the relationship between IS policy goals and IS role stress. We conducted a survey with employees in financial firms where IS policy and technology are strictly enforced in order to verify the research hypotheses. We performed structural equation modeling based on 266 samples. The results show that goal difficulty and goal specificity of IS policy decrease two types of employees' IS related role stress, which has a negative impact on IS compliance intention. Moreover, the results show that an employee's task coping has a moderating effect within the proposed relationship while emotion coping does not. The findings of the study suggest the importance of the conditions of an organization's IS policy goal setting and the importance of making the effort to decrease an employee's IS related stress in order to strengthen organizational compliance intention of IS.

Keywords: Information Security, Role Stress, Goal Setting, Coping Styles, Compliance Intention

1. Introduction

Information has become a core asset of today's organizations, and these organizations strictly adapt and implement various information technology and security policies in order to protect, manage, and control important information assets (AlHogail, 2015). For many organizations have a big interest in establishing cutting-edge information security technology and systems because it has a clear effect on minimizing unexpected and various security threats that occur within and outside the organization (Loch et al., 1992). However, organizations lack consideration for the employees that apply the organized information security technology and systems to their work (Hwang and Cha, 2018). Using complicated and unfamiliar information security technology may require adapting newer technologies, cause an additional work load, and increase the role stress due to strict security procedures (D'Arcy et al., 2014). For example, Tarafdar et al. (2007) claimed that employees experience role stress if information systems that they use at work are complicated and hard to apply to his/her job. Achieving the organizational goal becomes more difficult as role stress such as work overload due to additional work and conflict caused by performing work that contradicts the organization's requirements leads to a decrease in work productivity.

Previous research related to information security has suggested that improving an employee's information security compliance depends on focusing on the employee's rational choices, attitudes, motivation, and other attributes (Bulgurcu et al., 2010; Chen et al., 2012; Safa and Von Solm, 2016). However, what is missing in the current information security literature is related not only to organizational members' role stress, possibly influenced by security policy goals set by an organization, but also employees' coping styles that may have the potential to impact security compliance intention. That is, from the perspective of employees who apply the technology and processes based on the organization's security policy at work, there is a lack of research conducted on employees' role stress—a negative aspect of information security that can occur due to established information security environmental conditions.

Thus, the main purpose of this study is to develop and empirically validate a research model that investigates the negative impacts of factors in security policy goal setting (difficulty and specificity) on security-related role stress (role ambiguity and role conflict) and the negative impact on security compliance intention. Furthermore, this study proposes the moderating impact of coping style (task and emotion) on the relationship between role stress and compliance intention based on stress-coping related previous research and to verify whether individual coping can decrease compliance intention by role stress.

2. Literature Review

2.1 IS Policy Goal Setting

Goal-setting theory is a motivation theory that claims—under the assumption that people are rational actors—that people make efforts to achieve set goals (Locke and Latham, 2006). Goals are defined as “internal representations of desired end-states” (Austin and Vancouver, 1996). They determine the direction for intentional behavior, and if described in detailed, also tell where an individual should focus (Pinder, 1998). Goal attributes are divided into goal difficulty and specificity. Goal difficulty refers to the state of the goal being achievable, yet difficult to execute (Locke and Latham, 2006). Assuming that the individual accommodates the goal, difficulty is a factor that causes higher performance and better satisfaction because a difficult goal causes more effort and interest than an easier goal. Goal specificity refers to the state of the goal being specific enough to encourage objectives or actions (Vollmeyer et al., 1996). Goal specificity motivates better performance the more specific and challenging the goal is. Thus, when an individual or organization is setting goals, and when the goal is more difficult and specific than “do your best,” the better the work performance (Locke and Latham, 2006).

Security policy goal setting is a critical factor in improving an organization's information security management. The concept of information security policy is defined as the rules and guidelines for the

appropriate use of the organization's information security resources (Höne and Eloff, 2002). In other words, security policy explanations include an organization's information security vision and mission, an organization's standards and requirements for rule compliance, responsibility for security behavior, and the reporting procedures and testifying methods concerning security incidents (Kwok and Longley, 1999).

2.2 IS Related Role Stress

When employees are overloaded with work, role stress is caused (Salanova et al., 2013). Compared to explosively increasing information knowledge that should be used in an organization, because employees have time limitations, an overwhelming workload occurs and threatens frustration (Tarafdar et al., 2007). Role stress is defined as an awareness or feeling of personal dysfunction as a result of perceived conditions or happenings in the workplace and one's psychological and physiological reactions to these uncomfortable, undesirable, or threatening workplace conditions (Parker and DeCotiis, 1983).

Looking at employees' role stress types, role conflict is caused by limitations on unclear responsibilities, role ambiguity that occurs due to uncertainty of information, inconsistent work orders, and requiring hard to understand work performance, etc. (Ackfeldt and Malhotra, 2013; Tarafdar et al., 2007).

Role ambiguity is defined as unpredictability of the consequences of one's role performance and lack of information needed to perform the role (Ayyagari et al., 2011). Role ambiguity occurs when information needed to correctly perform a role is lacking when the organization's management expectation is vague or uncertainty related to work requirements exists (Behrman and Perreault, 1984). An organization's information security regulations concerning an employees' security compliance behavior changes along with the degree of information technology adapted by the organization.

Role conflict is a perception of incompatibility in the role's requirements, where incompatibility is judged relative to a set of conditions that impinge upon performance (Galluch et al., 2015). In other words, role conflict can occur when various requirements are asked to be met at work, and as a result, it refers to the difficulty that arises in complying with the requirements (Tarafdar et al., 2007).

2.3 Coping

Stress-coping styles vary based on the individual's situation and coping mechanisms. Although, individual coping styles based on the stress by the external environment differs based on the environmental conditions and the subject, typically, the coping styles that occur in the relationship between the organization and the individual are task coping and emotion coping (Lewin and Sager, 2009).

Task coping is defined as employees taking active and positive measures to change a stressful situation through making decisions or taking certain direct actions to resolve the problem (Endler and Parker, 1994; Higgins and Endler, 1995; Jung and Yoon, 2015). Thus, task coping refers to dealing with stress by individual experience or making efforts to find the cause of problem. Therefore, task coping is a source of positive and direct behavior that solves the stress-causing condition triggered by the environment (Folkman and Lazarus, 1980). Emotion coping refers to strategies such as ruminating, daydreaming, and emotional responses to stress (Endler and Parker, 1994; Higgins and Endler, 1995). In other words, emotion coping refers to a type of coping that adjusts the emotional pain experienced in the moment in order to change the relationship between life and the environment (Folkman and Lazarus, 1980), rather than directly deal with the situation that is causing the stress. Thus, problem-focused coping includes either developing a new behavior standard, or an internal strategy for change such as learning a new technology. On the other hand, emotion-focused coping tries to decrease the emotional pain experienced in a certain situation. When a certain problem occurs, the task coping style tries to find the cause of the problem and to find the positive solution for that cause.

2.4 IS Compliance Intention

Because an organization cannot control all of its employees' information security-related behaviors, the possibility of an information security threat by employees with access to the information system always exists (Bulgurcu et al., 2010; Chen et al., 2012; Hwang and Cha, 2018). Thus, in order to decrease the information security threat, the organization needs voluntary information security behavior from its employees, and security behavior is determined by the employees' degree of information security compliance intention (Safa and Von Solms, 2016). Bulgurcu et al. (2010) defined information security compliance intention as an employee's intention to protect the information and technology resources of the organization from potential security breaches, and Vance et al. (2012) defined the term as an employee's intention to protect the organization's information resources from internal and external threats. Thus, information security compliance intention is the employees' voluntary volition to protect information from security threats.

3. Research Hypotheses and Data Collection

3.1 Research Model and Hypotheses

The purpose of this research is to present that employees' role stress occurred by information security is the cause that has a negative influence on compliance intention, and to reduce security-related role stress. The research model is shown in Figure 1.

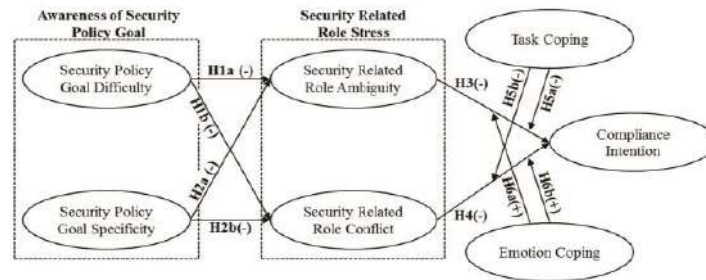


Figure 1. Modified Research Model

3.1.1. IS Policy Goal and IS Related Role Stress

Role stress occurs when the method of performing the task and the individual roles are ambiguous and can be alleviated by establishing organizational structure and goals (Lee and Schuler, 1980). In other words, the activity of goal setting for an organization's specific work decreases role stress by helping employees perceive the direction and procedures and the standard of the goal (Quick, 1979; Nicholles et al. 2016).

First, goal difficulty, which is an attribute of goal setting, is the degree of difficulty of attaining goals that can be achieved if an employee consistently makes the effort. It is a factor that decreases stress (Lee and Schuler, 1980; Nicholles et al., 2016; Quick, 1979). Quick (1979) claimed that in an organization employees each have their own task goals, and their role stress occurs in the process of achieving work performance. He provided his employees with goal-setting training for 8 months and verified that role conflict and role ambiguity of employees that accepted the task goal difficulty decreased. Second, goal specificity is a factor that could minimize the stress that occurs in the process of performing the related work by clarifying for the employees the way to achieve the goal and by making them believe that the goal is achievable (Vollmeyer et al., 1996). In the research, if the necessity to achieve a goal is perceived by the employees when the security policy goal difficulty and specificity are delivered to them, we judge that the stress on the organization's security-related work can be reduced. In this regard, we propose Hypothesis 1 and Hypothesis 2.

Hypothesis 1: IS policy goal difficulty negatively influences IS role stress (ambiguity and conflict).

Hypothesis 2: IS policy goal specificity negatively influences IS role stress (ambiguity and conflict).

3.1.2. IS Related Role Stress and IS Compliance Intention

Security-related role ambiguity occurs frequently, even in organizations with strictly enforced security policies and technology (Hwang and Lee, 2016). Employees experience anxiety due to the ambiguity of the priority between security compliance behavior and work performance, and they have a tendency to take an ambiguous attitude toward security behavior (Salanova et al., 2013). When work impediments caused by security behavior is perceived to be growing, employees engage in noncompliance behavior (Hwang et al., 2017). Moreover, D'Arcy et al. (2014) studied the relationship between information security-related stress and coping, and noncompliance intention. They verified that information security-related stress has a positive influence on emotional-focused coping that increases noncompliance intention.

Security-related role conflict decreases security compliance intention. Hwang and Cha (2018) claimed that security-related role stress occurs due to the difference between security-related behavior and individual performance. They verified that role stress decreases information security compliance intention. D'Arcy et al. (2014) verified that when an employee experiences security-related stress, the employee is lead to the process that increases information security policy-related violation intention.

In other words, the role stress caused by information security is expected to decrease an employee's role compliance intention. In this regard, we propose Hypothesis 3 and Hypothesis 4.

Hypothesis 3: IS role ambiguity negatively influences IS compliance intention.

Hypothesis 4: IS role conflict negatively influences IS compliance intention.

3.1.3. The moderating effect of coping styles

In the context of the stress that occurs at work, task coping helps employees identify the situation that causes the stress and decide on a goal-based positive behavior concept (Jung and Yoon, 2015). In other words, task coping presents a method for performing and controlling technology- and environment-based work, and those who lack task coping have trouble managing stress because it is difficult for them to cope flexibly with the role stress situation. Furthermore, if the level of task coping for the related technology and environment improves, the negative influence (e.g., behavior intention, performance, etc.) due to related stress recognition could be moderated (Galluch et al., 2015; Lewin and Sager, 2009).

Emotional coping is a style of dealing with stress by regulating the stress-causing environment and external factors of the situation (Folkman and Lazarus, 1980). As emotional coping is a coping style that tries to escape from the related environment to reduce the emotional pain experienced, those with such characteristics focus on minimizing the negative performance (Higgins and Endler, 1995). In other words, emotional coping alleviates the negative influence on an individual result by replacing the organization's role stress situation (role ambiguity and role conflict) with a situation different from work (Lewin and Sager, 2009). In this regard, we propose Hypothesis 5 and Hypothesis 6.

Hypothesis 5: Task coping moderates the relationship between IS role stress (ambiguity, conflict) and IS compliance intention.

Hypothesis 6: Emotional coping moderates the relationship between IS role stress (ambiguity, conflict) and IS compliance intention.

3.2 Measurement and Data Collection

IS policy goal difficulty reflected 4 items of Wright (2004), and IS policy goal specificity reflected 3 items of Wright (2004). IS related role ambiguity reflected 4 items of Ayyagari et al. (2011) and IS related role conflict reflected 4 items of Tarafdar et al. (2007). IS Compliance intention reflected 3 items

of Chen et al. (2012). Task coping reflected 4 items Endler and Parker (1994), and emotional coping reflected 4 items Endler and Parker (1994). All items were measured on a 7-point Likert scale: 1–strongly disagree to 7–strongly agree.

The survey targets were chosen as the employees of Korean financial institutions with specialized information security technology and policies. Also, the employees of the information security departments were excluded from the survey target because their work goal is to establish technology to minimize information security incidents and manage employee security. They understand and have the necessity for information security unlike other employees.

In order to select the target for data collection, we met officers ranked higher than manager of branch offices of financial institutions and presented the purpose and the necessity of the research and were authorized to survey their employees. After explaining the purpose and the methodology of the research to the workforce that participated at the branch offices, we distributed the survey and collected the responses and the survey papers. We visited 53 branch offices of financial institutions that had been contacted in advance, and we distributed the survey to 468 general employees at the offices. We collected a total of 280 responses.

4. Data Analyses and Results

4.1 Measurement Assessment - Reliability and Validity

We verified the propriety of the research model by verifying its reliability and validity. In order to test the reliability of the model, we measured Cronbach's alpha using SPSS 22.0.

And, we first assessed the convergent and discriminant validity of the measurement model through a confirmatory factor analysis (CFA), using AMOS 22.0. The result of the analysis demonstrates that all of the model's fit indices were appropriate relative to the recommended values ($\chi^2/df = 1.390$, GFI = 0.901, AGFI = 0.875, CFI = 0.985, NFI = 0.948, RMSEA = 0.038). Convergent validity was calculated by construct reliability and average variance extracted (AVE). The result of the construct reliability ranged from 0.845 to 0.960 and, AVE ranged from 0.578 to 0.857. Thus, the convergent validity is shown to be acceptable (Table 1).

Table 1. Results for Construct Validity and Reliability

Construct	Item	Mean	Std. Dev.	Factor Loading	Cronbach's Alpha	Construct Reliability	AVE
IS Policy Goal Difficulty	PGD1	5.19	1.28	.806	0.904	0.845	0.578
	PGD2			.847			
	PGD3			.782			
	PGD4			.664			
IS Policy Goal Specificity	PGS1	5.07	1.30	.764	0.920	0.859	0.671
	PGS2			.804			
	PGS3			.661			
IS Related Role Ambiguity	RA1	2.83	1.20	.838	0.951	0.923	0.750
	RA2			.843			
	RA3			.814			
	RA4			.827			
IS Related Role Conflict	RC1	2.74	1.26	.856	0.947	0.902	0.698
	RC2			.827			
	RC3			.870			
	RC4			.835			
IS Compliance Intention	CI1	5.66	1.12	.874	0.970	0.960	0.857
	CI2			.866			
	CI3			.870			
	CI4			.826			
Task Coping	TC1	5.15	1.19	.806	0.919	0.869	0.625
	TC2			.857			

	TC3			.848			
	TC4			.674			
Emotion Coping	EC1	4.20	1.43	.920	0.949	0.888	0.664
	EC2			.913			
	EC3			.946			
	EC4			.932			

Then, discriminant validity, which confirms the lack of a relationship among measures that theoretically should not be related, was tested. To test the discriminant validity, we compared the square root of the AVE with correlations among the latent variables. Table 2 shows the result of the discriminant validity test, which confirmed that the square root of AVEs on the diagonal was greater than all correlations among the latent variables. Therefore, the discriminant validity was demonstrated.

Table 2. Results for Discriminant Validity

Construct	1	2	3	4	5	6	7
IS Policy Goal Difficulty	0.761						
IS Policy Goal Specificity	.672**	0.819					
IS Related Role Ambiguity	-.437**	-.502**	0.866				
IS Related Role Conflict	-.383**	-.422**	.670**	0.835			
IS Compliance Intention	.558**	.575**	-.456**	-.426**	0.926		
Task Coping	.563**	.593**	-.429**	-.418**	.591**	0.790	
Emotion Coping	.102	.205**	-.077	-.043	.087	.093	0.815

Note. * $p < 0.05$, ** $p < 0.01$; values in bold type along the diagonal indicate the square root of the AVE

4.2 Structural Model Assessment

We tested the hypotheses using structural equation modeling with AMOS 22.0. We derived the fit indices for the structural model, path coefficients, and the R^2 of the endogenous variables.

First, we used the indices used in the CFA. Six common model-fit measures were used to estimate the measurement model fit. The values show that the fitness of the structural model is above the required level ($\chi^2/df = 2.101$, GFI = 0.900, AGFI = 0.869, CFI = 0.971, NFI = 0.947, RMSEA = 0.06).

Second, given the good fit, the proposed hypotheses were tested using standardized path coefficients (β). Figure 2 demonstrate the result of the model testing. The results of analyzing the hypotheses (H1a, H1b), which claim that the increase in the organization's security policy goal difficulty will decrease security role stress, demonstrates that each variable has a negative influencing relationship (H1a: $\beta = -0.197$, $p < 0.05$, H1b: $\beta = -0.195$, $p < 0.05$). Thus, H1a and H1b were supported. The result of analyzing the hypotheses (H2a, H2b), which claim that the increase in the organization's security policy goal specificity will decrease security role stress, demonstrates that each variable has a negative influencing relationship (H2a: $\beta = -0.386$, $p < 0.05$, H2b: $\beta = -0.302$, $p < 0.05$). Thus, H2a and H2b were supported. The result of analyzing Hypothesis 3 (H3) demonstrates that the two variables have a negative influencing relationship ($\beta = -0.332$, $p < 0.05$). This hypothesis claims that the increase in role ambiguity is employee security-related stress and information security compliance intention will decrease. Thus, H3 was supported. The result of analyzing the H4, which claims that the increase in role conflict, which is employee security-related stress, will decrease information security compliance intention, demonstrates that the two variables have a negative influencing relationship ($\beta = -0.213$, $p < 0.05$). Thus, H4 was supported.

Finally, we derived the R^2 values of the endogenous variables, as follows: role ambiguity (29.7%), role conflict (21.3%), and compliance intention (25.5%). The R^2 value denotes the percentage of the variance that is explained by each construct within the model.

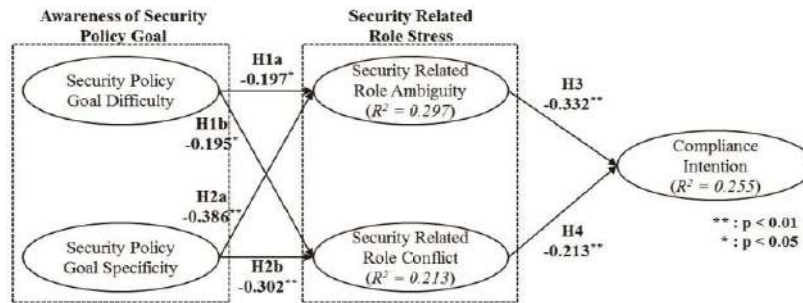


Figure 2. Results of the Structural Model

4.3 Moderation Effect

We verified the moderation effect based on individual coping styles (task coping and emotion coping) in dealing with the security-related stress that has a negative influence on information security compliance intention (H5a, H5b, H6a, and H6b). The method suggested by Carte and Russell (2003) was used to verify the moderation effect. Carte and Russell (2003) suggested judging the influence of each interaction effect by taking the driven F value of ΔR^2 as the level of significance when an interactive variable is applied and when not applied. Hypotheses 5a and 5b claim that task coping will have an alleviated moderation effect on the negative influence the security-related stress has on compliance intention, and hypotheses 6a and 6b claim that emotion coping will have reinforced moderation effect on the negative influence that the stress has on compliance intention. The results of analyzing the moderation effects are demonstrated in Table 3. The moderation effect of task coping was selected (H5a: $F = 14.556, p < 0.01$, H5b: $F = 20.226, p < 0.01$). The moderation effect of emotion coping was rejected (H6a: $F = -1.675, p > 0.05$, H6b: $F = -0.976, p > 0.05$).

Table 3. Summary of Moderating Effect Tests

	Path	Model	Path Coefficient & t-value	R^2	ΔR^2	F	Result
H5a	RA x TC → CI	No Interaction	RA → CI = -0.258 / -4.513** TC → CI = 0.484 / 7.871**	0.411	0.031	14.556**	Support ed
		Interaction	RA → CI = -0.181 / -3.032** TC → CI = 0.454 / 7.539** RA x TC → CI = 0.201 / 3.552**	0.442			
H5b	RC x TC → CI	No Interaction	RC → CI = -0.229 / -4.015** EC → CI = 0.501 / 8.110**	0.400	0.043	20.226**	Support ed
		Interaction	RC → CI = -0.168 / -2.961** EC → CI = 0.439 / 7.211** RC x EC → CI = -0.231 / 4.056**	0.443			
H6a	RA x EC → CI	No Interaction	RA → CI = -0.467 / -7.923** EC → CI = 0.044 / 0.771	0.223	-	0.005	Not Support ed
		Interaction	RA → CI = -0.458 / -7.742** EC → CI = 0.052 / 0.904 RA x EC → CI = 0.054 / 0.917	0.218			
H6b	RC x EC → CI	No Interaction	RC → CI = -0.438 / -7.385** EC → CI = 0.063 / 1.086	0.198	-	0.003	Not Support ed
		Interaction	RC → CI = -0.428 / -7.211** EC → CI = 0.074 / 1.281 RC x EC → CI = 0.067 / 1.129	0.195			

Note. *: $p < 0.05$, **: $p < 0.01$ / RA (Security Related Role Ambiguity), RC (Security Related Role Conflict), TC (Task Coping), EC (Emotion Coping), CI (Compliance Intention)

5. Conclusion

This study contributes to information security and organization research in several ways. This research integrates and applies goal-setting and stress-coping theories commonly used in psychology and sociology and in the field of information security. Not only does it suggest the method to minimize the decrease of the degree of employees' information security compliance, but it also presents an extended theoretical basis that can be used in information security. Most of the previous research on increasing the degree of an organization's internal information security focuses on the deterrence and prevention of employees' security noncompliance. This research, in order to deter and prevent security noncompliance, suggests strategies for enhancing employees' compliance intention for information protection by either presenting extrinsic motivation such as sanctions, social pressure, etc., and intrinsic motivation such as value congruence, effectiveness, etc., or presenting threat appraisals (vulnerability, severity, rewards, etc.) and appraisals of coping factors (self-efficacy, response efficacy, response cost). However, research on decreasing the stress that occurs when one complies with information security was lacking. Therefore, this research presents information security-related role stress (role ambiguity and role conflict) based on stress-coping theory, and it presents how individual coping styles can alleviate the negative results caused by stress. Also, employees' security-related role stress decrease will be determined by security policy goals established when planning and executing information security policy. This research applied the goal attributes (goal difficulty and goal specificity) of goal-setting theory and drew an influencing relationship. Because the results presented a theory that can be applied in the field of information security and correlation, we believe that this research will be the theoretical basis for further research to explain the factor for employees' security-related stress that can constantly occur due to the change in information security technology and stress reduction.

References

- Ackfeldt, A. L., and Malhotra, N. 2013. "Revisiting the Role Stress-commitment Relationship: Can Managerial Interventions Help?," *European Journal of Marketing* (47:3/4), pp. 353-374.
- AlHogail, A. 2015. "Design and Validation of Information Security Culture Framework," *Computers in Human Behavior* (49), pp. 567-575.
- Austin, J. T., and Vancouver, J. B. 1996. "Goal Constructs in Psychology: Structure, Process, and Content," *Psychological Bulletin* (120:3), pp. 338-375.
- Ayyagari, R., Grover, V., and Purvis, R. 2011. "Technostress: Technological Antecedents and Implications," *MIS Quarterly* (35:4), pp. 831-858.
- Behrman, D., and Perreault, W. D. 1984. "A Role Stress Model of the Performance and Satisfaction of Industrial Salespersons," *Journal of Marketing* (8:4), pp. 9-21.
- Bulgureu, B., Cavusoglu, H., and Benbasat, I. 2010. "Information Security Policy Compliance: An Empirical Study of Rationality-based Beliefs and Information Security Awareness," *MIS Quarterly* (34:3), pp. 523-548.
- Carte, T. A., and Russell, C. J. 2003. "In Pursuit of Moderation: Nine Common Errors and Their Solutions," *MIS Quarterly* (27:3), pp. 479-501.
- Chen, Y., Ramamurthy, K., and Wen, K. W. 2012. "Organizations' Information Security Policy Compliance: Stick or Carrot Approach?," *Journal of Management Information Systems* (29:3), pp. 157-188.
- D'Arcy, J., Herath, T., and Shoss, M. K. 2014. "Understanding Employee Responses to Stressful Information Security Requirements: A Coping Perspective," *Journal of Management Information Systems* (31:2), pp. 285-318.
- Endler, N. S., and Parker, J. D. 1994. "Assessment of Multidimensional Coping: Task, Emotion, and Avoidance Strategies," *Psychological Assessment* (6:1), pp. 50-60.
- Folkman, S., and Lazarus, R. S. 1980. "An Analysis of Coping in a Middle-aged Community Sample," *Journal of Health and Social Behavior* (21:3), pp. 219-239.

- Galluch, P. S., Grover, V., and Thatcher, J. B. 2015. "Interrupting the Workplace: Examining Stressors in an Information Technology Context," *Journal of the Association for Information Systems* (16:1), pp. 1-47.
- Higgins, J. E., and Endler, N. S. 1995. "Coping, Life Stress, and Psychological and Somatic Distress," *European Journal of Personality* (9:4), pp. 253-270.
- Hönc, K., and Eloff, J. H. P. 2002. "Information Security Policy: What Do International Information Security Standards Say?," *Computers & Security* (21:5), pp. 402-409.
- Hwang, I., and Cha, O. 2018. "Examining Technostress Creators and Role Stress as Potential Threats to Employees' Information Security Compliance," *Computers in Human Behavior* (81), pp. 282-293.
- Hwang, I., Kim, D., Kim, T., and Kim, S. 2017. "Why Not Comply with Information Security? An Empirical Approach for the Causes of Non-compliance," *Online Information Review* (41:1), pp. 1-17.
- Hwang, I., and Lee, H. 2016. "The Employee's Information Security Policy Compliance Intention: Theory of Planned Behavior, Goal Setting Theory, and Deterrence Theory Applied," *Journal of Digital Convergence* (14:7), pp. 155-166.
- Jung, H. S., and Yoon, H. H. 2015. "Understanding Regulatory Focuses: The Role of Employees' Regulatory Focus in Stress Coping Styles, and Turnover Intent to a Five-star Hotel," *International Journal of Contemporary Hospitality Management* (27:2), pp. 283-307.
- Kwok, L. F. and Longley, D. 1999. "Information Security Management and Modeling," *Information Management & Computer Security* (7:1), pp. 30-40.
- Lee, C., and Schuler, R. S. 1980. "Goal Specificity and Difficulty and Leader Initiating Structure as Strategies for Managing Role Stress," *Journal of Management* (6:2), pp. 177-187.
- Lewin, J. E., and Sager, J. K. 2009. "An Investigation of the Influence of Coping Resources in Salespersons' Emotional Exhaustion," *Industrial Marketing Management* (38:7), pp. 798-805.
- Loch, K. D., Carr, H. H., and Warkentin, M. E. 1992. "Threats to Information Systems: Today's Reality, Yesterday's Understanding," *MIS Quarterly* (16:2), pp. 173-186.
- Locke, E. A., and Latham, G. P. 2006. "New Directions in Goal Setting Theory," *Current Directions in Psychological Science* (15:5), pp. 265-268.
- Nicholls, A. R., Levy, A. R., Carson, F., Thompson, M. A., and Perry, J. L. 2016. "The Applicability of Self-regulation Theories in Sport: Goal Adjustment Capacities, Stress Appraisals, Coping, and Well-being among Athletes," *Psychology of Sport and Exercise* (27), pp. 47-55.
- Parker, D. F., and DeCotiis, T. A. 1983. "Organizational Determinants of Job Stress," *Organizational Behavior and Human Performance* (32:2), pp. 160-177.
- Pinder, C. C. 1998. *Work Motivation in Organizational Behavior*, Upper Saddle River, NJ: Prentice Hall.
- Quick, J. C. 1979. "Dyadic Goal Setting and Role Stress: A Field Study," *Academy of Management Journal* (22:2), pp. 241-252.
- Safa, N. S., and Von Solms, R. 2016. "An Information Security Knowledge Sharing Model in Organizations," *Computers in Human Behavior* (57), pp. 442-451.
- Salanova, M., Llorens, S., and Cifre, E. 2013. "The Dark Side of Technologies: Technostress among Users of Information and Communication Technologies," *International Journal of Psychology* (48:3), pp. 422-436.
- Tarafdar, M., Tu, Q., Ragu-Nathan, B. S., and Ragu-Nathan, T. S. 2007. "The Impact of Technostress on Role Stress and Productivity," *Journal of Management Information Systems* (24:1), pp. 301-328.
- Vance, A., Siponen, M., and Pahlila, S. 2012. "Motivating IS Security Compliance: Insights from Habit and Protection Motivation Theory," *Information & Management* (49:3), pp. 190-198.
- Vollmeyer, R., Burns, B. D., and Holyoak, K. J. 1996. "The Impact of Goal Specificity on Strategy Use and the Acquisition of Problem Structure," *Cognitive Science* (20:1), pp. 75-100.
- Wright, B. E. 2004. "The Role of Work Context in Work Motivation: A Public Sector Application of Goal and Social Cognitive Theories," *Journal of Public Administration Research and Theory* (14:1), pp. 59-78.

E4.3 The Impacts of Augmented Reality on Sports Events Spectators' Behavior Intention: A Stimulus-Organism-Response (S-O-R) Perspective

Wang, T.^a, Du, Z.^b, Liu, J.^c and Zhong, Q.^d

^a Business School of Sport, Beijing Sport University
E-mail: wtj0817@163.com

^b Business School of Sport, Beijing Sport University
E-mail: duzhao@bsu.edu.cn

^c Business School of Sport, Beijing Sport University
E-mail: 18701000308@163.com

^d Business School of Sport, Beijing Sport University
E-mail: 718025696@qq.com

Abstract

Nowadays, more and more people choose to watch sports events online. AR is the latest technology that improve consumers' perception and improves consumers' experience. There are many sports events use augmented reality (AR) to enrich the spectators' experience. However, the AR impact of online sports-watching satisfaction and continuous watching intention has not been studied. Based on the stimulus-organism-response framework, we aim to study how the AR characteristics in the sports events' videos affect spectators' satisfaction and examine the relationship between AR and continuous watching intention. We design an experimental study to recruit online spectators to watch the video with AR and then answer the questionnaire. Our study contributes to prompting scholars to focus more on the AR effects on sports events video and give them some suggestions about improving the online sports-watching experience.

Keywords: Augmented reality, sport events, online watching, S-O-R framework

E4.4 A Longitudinal Study of Extended Technology Usage Model in the Context of Student Response System

Kim, D. J.
University of North Texas
Dan.Kim@unt.edu

Abstract

Recently, interactive student response systems (SRS) are becoming a popular education tool in high education institutions. Despite the popularity, there is conflicting evidence as to the current level of perceptions and actual performances before and after the system's use. Thus, this study examines users' general perceptual differences in terms of usefulness, ease-to-use, enjoyment, satisfaction, and their intention to use the systems before and after they actually use the systems. We further test users' perceptions and provide a comparative result from a longitudinal perspective. We believe that the result of the study will provide a solid understanding of users' expectations and their performance related to the usage of SRS. Limitations and future directions will be discussed.

Keywords: Response systems, usefulness, ease-to-use, enjoyment, satisfaction, extended technology acceptance model, longitudinal study

Introduction

Technology Acceptance Model (TAM) has been researched by many scholars to explore the relationship between usefulness, ease to use and intent to use (Davis 1989, 1993; Liu, Chen, Sun, Wible, and Kuo 2010; Park and Kim 2013; Pituch and Lee 2004; Roca, Chiu, and Martinez 2006; Rocan and Cogne 2008; Shyu and Huang 2011). TAM explains that the usefulness and ease of use of technology induce users to utilize technology or computer systems. Many researchers extended TAM researchers to many fields such as e-learning (Pituch and Lee 2004; Roca, Chiu, and Martinez 2006; Rocan and Cogne 2008), online learning communities (Liu, Chen, Sun, Wible, and Kuo 2010), LTE acceptance (Park and Kim 2013), and e-government learning (Shyu and Huang 2011).

Also, Extensive studies have examined technology adoption using the TAM (Davis 1989), which is considered a robust model for explaining user attitudes towards the adoption of technology. TAM has been extended as TAM2 (Venkatesh and Davis 2000), TAM3 (Venkatesh and Bala 2008), Extended TAM (Agarwal and Karahanna 2000; Yi and Hwang 2003), and Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al. 2002) by adding additional constructs. For example, Burton-Jones and Hubona (2006) consider education level, age, and system experience as antecedent factors influencing usefulness and ease to use, which have impacts on intent to use. Shyu and Huang (2011) argue that value and enjoyment influence on usefulness and ease to use, respectively. Also, Chang, Yan, and Tseng (2012) explore the effect of convenience on usefulness and attitude.

However, although significant progress has been made over the last couple of decades in explaining and predicting the adoption and diffusion of emerging technologies in the individual and organizational level, they still remain a central issue of information systems research and practice (Venkatesh and Bala 2008). TAM and the extended models have several limitations. Foremost it examines users' technology adoption decisions at a single point in time (i.e., cross-sectional point) (Lee et al. 2003). The weakness of a cross-sectional model is that it cannot infer the causality of the research results reasonably (Agarwal and Karahanna 2000).

Student response system (SRS) is an emergent technology that allows students to help the learning process and enhance their educational performance (Matus, Summa, and Kuschke 2011). Because SRS is associated with the introduction of technology in the learning process, SRS could have been explored and explained by TAM and ETAM in order to analyze the factors influencing students' response to learning in the classroom. However, there are some researches that show inconsistent results on whether

the technology has a positive impact on students' responses or not. For example, Carnaghan and Webb (2007) found that student engagement declined when clickers were introduced into their courses. Although students reported enjoying the use of the clickers, this satisfaction did not translate into increased satisfaction with the course. More recently, Morling, McAuliffe, Cohen and DiLorenzo (2008) assessed the efficacy of clickers in four large sections of introductory psychology, with approximately 350 students per section. These researchers reported that clickers led to a small, positive effect on exam scores. However, students in the clicker classes in this study did not report feeling any more engaged during class than did students in the non-clicker classes.

This study tries to address the problem of efficient integration of SRS in the educational process. This study gives emphasis to defining keys to sustainable development to ensure academic quality. These keys are achieving certain objectives, such as determining whether using SRS is essential to support an organization's educational goals, defining what are students' attitudes to using clickers to enhance learning, and deciding how the organizational teaching plan is to be constructed.

This study is undertaken in a university classroom setting. This study seeks to ascertain students' perceptions of clickers as a learning tool and to identify the determinants of these perceptions. The following questions guided the direction of this study. *RQ1: How do students perceive clickers as a tool that supports learning before using them? RQ2: How do students perceive clickers as a tool that supports learning after using them?*

Literature Review and Theoretical Background

TAM is a dominant theoretical model used to explain technology adoption in the IS literature. According to TAM, the intention to adopt information technology is determined by the perceived usefulness and perceived ease of use. These two variables have also been used and validated as antecedents of technology adoption in various online trust studies (e.g., (Koufaris and Hampton-Sosa 2004)). Lin (2003) proposes a technology adoption model for studying the factors that influence adoption decisions of communication technologies. Her model consists of six types of factors related to the system, technology, social factors, use factors, audience, and adoption factors. Although the model is comprehensive, it examines users' intention to adopt technology at a certain time. Most studies on end-user beliefs and attitudes are conducted after systems have been adopted (Lu et al. 2005). Consequently, the beliefs and external motivations identified are only suitable for studying continued-usage behavior. Many other studies on technology adoption did not even mention on which technology usage stage was focused. This presents another problem - the factors that affect usage may not be the same in before- and after-usage experience or the degree of effect may vary (Lu et al. 2005). People could have different levels of experience with and perception of the technology being investigated at different usage stages. Therefore, the results could be biased, misleading, and inconclusive.

Previous studies on the effects of SRSs

The student response system (SRS) is considered a new technology introduced to students in the classroom to enhance student learning. As a new technology introduced into the classroom, many research groups studied and investigated the SRS system from various perspectives and examined various aspects of SRS, including effectiveness, ease of use, usefulness, and user acceptance

Research Model and Hypotheses

Focusing on users' perception of technology use from a longitudinal perspective, we test whether students' direct technology experience as an intervention affects changes in their perceptions. Especially in this study, we select four major constructs of the Extended Technology Acceptance Model (ETAM): Perceived usefulness, Ease-to-use, Enjoyment, and Intention to use. Figure 1 depicts the research model and hypotheses of the study. In this study, we are particularly interested in two components: longitudinal confirmation of the theoretical relationships among key Intervention effects across experiences.

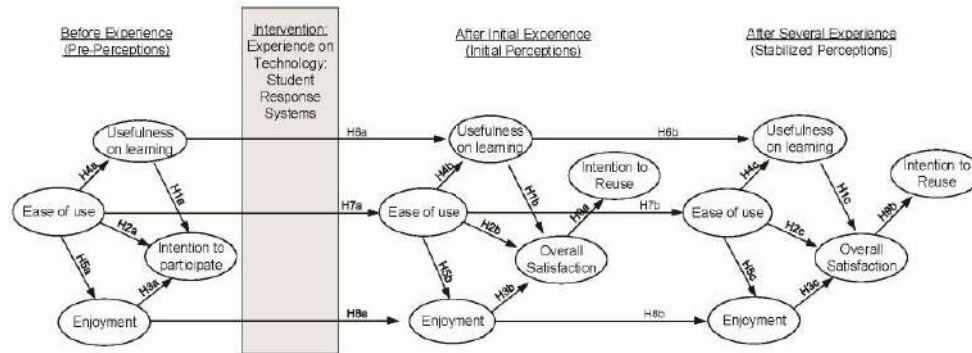


Figure 1: Research Model and Hypotheses

Research Methodology

To validate the research model, we will conduct three-round survey in a longitudinal design. Following the recommendation by Bentler and Chou (1987), we applied multiple measures for each construct to provide a more accurate representation of the concept of the construct. A series of measurement items for each construct are adapted from previous literature and revised to measure students' perceptions of SRSs before and after the intervention. A panel of experts classified and reviewed the instruments to ensure face validity.

Expected Result and Conclusion

Ease of use is found to be a determinant of intention to participate in the pre-perception model but not in the post-perception models. We theorize that before using the SRS, students might not have a good grasp of the degree of difficulties in using them. They thus considered ease of use as an important factor for their intention of participation as they need to budget less learning time for equipment that is easier to use. After they used the SRS, they might find out that these types of equipment were relatively easy to use, as compared to, for example, the complex maneuvers they need to master in many video games. This is especially true for IS students, who have even more opportunities to use digital equipment than the general population. The students might have completely figured out how to use the equipment after their first use. As a result, ease of use might no longer be an important consideration for the intention of participation. This may mean that students, in general, can learn to use SRS very quickly and do not consider the difficulty in using them as an obstacle to their participation.

Another interesting observation is the relatively strong results of enjoyment and satisfaction as determinants of the intention of perception in the models. In contrast, our analysis result does not support usefulness as a determinant in the post-perception model after using SRS a couple of times. This result is consistent with the upbringing of the younger and interactive generation. Some older and more traditional students, maybe more career-driven and do not mind going through dry studying so long as the materials are perceived to be useful. On the other hand, younger students accustomed to instant, rich and entertaining feedback cultivated by their video game experience consider the process to be at least as important as the end. This may have important implications for IS educators, who may not be as accustomed to interactivity. We are facing a generation of students who can master sophisticated equipment much quicker and value the enjoyment and satisfaction of the learning process much more. This points to the benefits of widespread adoption of SRS in IS courses.

References

- Agarwal, R., and Karahanna, E. 2000. "Time Flies When You're Having Fun: Cognitive Absorption and Beliefs About Information Technology Usage." *MIS Quarterly* (24:4), pp. 665-694.

- Bentler, P. M., and Chou, C. P. 1987. "Practical Issues in Structural Modeling," *Sociological Methods & Research* (16:1), pp. 78-117.
- Davis, F. D. 1989. "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly* (13:3), pp. 319-340.
- Koufaris, M., and Hampton-Sosa, W. 2004. "The Development of Initial Trust in an Online Company by New Customers," *Information & Management* (41), pp. 377-397.
- Lee, Y., Kozar, K. A., and Larsen, K. R. T. 2003. "The Technology Acceptance Model: Past, Present, and Future," *Communications of the AIS* (12:50), pp. 752-780.
- Lin, C. A. 2003. "An Interactive Communication Technology Adoption Model," *Communication Theory* (13:4), pp. 345 - 365.
- Lü, J., Yao, J. E., and Yu, C.-S. 2005. "Personal Innovativeness, Social Influences and Adoption of Wireless Internet Services Via Mobile Technology " *The Journal of Strategic Information Systems* (14:3), pp. 245-268
- Venkatesh, V., and Bala, H. 2008. "Technology Acceptance Model 3 and a Research Agenda on Interventions," *Decision Sciences* (39:2), pp. 273-315.
- Venkatesh, V., and Davis, F. D. 2000. "A Theoretical Extension of the Technology Acceptance Model: Four Longitudinal Field Studies," *Management Science* (46:2), pp. 186-204.
- Venkatesh, V., Speier, C., and Morris, M. G. 2002. "User Acceptance Enablers in Individual Decision Making About Technology: Toward an Integrated Model," *Decision Sciences* (33:2), pp. 297-316.
- Yi, M. Y., and Hwang, Y. 2003. "Predicting the Use of Web-Based Information Systems: Self-Efficacy, Enjoyment, Learning Goal Orientation, and the Technology Acceptance Model," *International Journal of Human-Computer Studies* (59:4), pp. 431-449.

E4.5 A study on the effecting factors on the performance of the semiconductor companies under covid-19 crisis: TSMC and Samsung case

Chang, T. Y.^a and Lim, G. G.^{b*}

^a Department of Business Informatics, Hanyang University
E-mail: jangtingyu@gmail.com

^{b*} Department of Business Informatics, Hanyang University
E-mail: gglim@hanyang.ac.kr

* Corresponding author

Abstract

Semiconductor is an industry that rather than diminish its sales value, the market has become more and more lucrative under COVID-19 pandemic era, it is suggested because of the implication of measures that aimed to restraint the spread of the disease. Taiwan and South Korea are two main countries that take over the worldwide semiconductor supply capability, and both of them have their own traits of R&D in semiconductor industry, and the corporation culture has caused different market performance of the companies in the same industry. By mainly analyzing the market capitalization from TSMC and Samsung with COVID-19's statistics, noticed that the pandemic has rare direct impact on company's market value in Taiwan, while Korean company was more susceptible to the number of death from COVID. Outcome would be further testified with the analysis result from other semiconductor manufacturers in both Taiwan and Korea, to see if the conclusion could be applied to national situation. Linear Regression is the core methodology used in this research, in order to find correlation between Taiwan and Korea's COVID-19's statistics and some variables, and then the relationship with institutions' market value. With the outcome, investors are supposed to have more authentic studies to refer to when making investments.

Keywords: Template, formats, instructions, length, conference publications

“오후 6시까지
영업합니다”

KB **9 TO 6** **뱅크**



영업시간 9am-6pm

코로나 확산 방지를 위한 순 은행 영업시간 조정으로
별도 안내시까지 아침/저녁 30분씩 단축 영업합니다

“공간정보로 연결하고,
공유하고, 볼 수 있는 세상”

올포랜드가 함께 만들어 가겠습니다.



사업분야



GIS솔루션 map prime CLOUD · OCEAN · 2D/3D GIS



SI 국토/해양 정보화, 환경·교통 서비스 등



DB 국토/해양 GIS, 정밀도로지도, 드론촬영 등

<http://www.all4land.com>

서울시 금천구 가산디지털1로 1460 에이스하이엔드타워 3차 1401호
T. 02-855-5724 F. 02-857-5746

글로벌 셀링의 **문**을 열다
Open the **Global Selling Gate**

(주)팜글로벌
FAEM GLOBAL Inc.



a 아마존코리아 공식 파트너사
Amazon Korea Service Provide Network

S 쇼피코리아 공식 파트너사
Shopee Korea Service Provider

컨설턴트가 만드는 IT 지식 채널

투이톡

투이톡에서는
디지털 혁신 사례, 디지털/IT 핫이슈, 컨설턴트 강의, IT인물 인터뷰 등
다양한 콘텐츠를 만나볼 수 있습니다.



YouTube 에서 투이톡을 검색하세요!!

2e 투이컨설팅
662





**클라우드전환
쌍용정보통신과 함께
Non - Stop으로
할 수 있습니다**

**클라우드 너머의 미래
쌍용정보통신과 함께 설계하세요!**

**No.1 Cloud Native IT Service Company
DX Innovator, 클라우드 · AI 전문가 그룹**



AVAIGA TAIPY

로우코드 AI 비즈니스 애플리케이션 빌더

Integrate Prescriptive-AI with Predictive-AI (Machine Learning)

GUI GENERATION

비즈니스 애플리케이션을 위한 직관적이면서도 강력한 GUI (ALL IN PYTHON)

DATA MODELING

시나리오 관리, 비즈니스 프로세스 모델링, 시계열 스마트 관리 등

BUSINESS PERFORMANCE

시간 경과에 따른 비즈니스 성과 맞춤형 KPI 등 강력한 모니터링

JOB/ PIPELINE MANAGEMENT

트레이닝에서 스코어링/ 실행으로 원활한 전환

SECURITY

강력한 보안 요구사항 기반 아키텍처
- 보안 API, 로그인/ 비밀번호 관리, 데이터 접근제어

AI PLATFORM SUPPORT

주요 모든 AI 플랫폼과 연결
- DATAIKU, GOOGLE GCP, AZURE, AMAZON, ETC.



최상의 전사적 AI 솔루션

Dataiku는 단순 분석도구에서 전사적 AI에 이르는 다양한 기업용 데이터 솔루션들을 제공하는 중앙집중식의 데이터 사이언스 플랫폼입니다. 많은 데이터 기반의 기업들이 Dataiku의 지능형 분석 도구들을 사용하고 있으며, 생산라인에도 Dataiku의 머신러닝 모델을 응용하고 있습니다.

450+
CUSTOMERS

45,000+
ACTIVE USERS

*data scientists, analysts, engineers, & more

1. Clean & Wrangle



2. Build + Apply Machine Learning



3. Mining & Visualization



5. Monitor & Adjust



4. Deploy to production



Santander



PREMERA



SEPHORA



마이데이터 기반 디지털 자산관리 서비스

내 자산이 **합**해지는

자산관리

JO 플레이스

나만을 위한 맞춤형
자산 매니지먼트

하나 합과
스마트한 자산관리
시작해보세요.



하나원큐 앱을
설치후 QR코드를
스캔해주세요.



흩어진 내 자산들을, **하나로 합!**

쉽고 편하게! 당신의 모든 자산관리
하나 합으로 모아주세요.



내 해외 베킹리스트 어휘보자!

**외화자산 적립을도와주는
환테크 챌린지**

해외여행, 직구, 해외 주식 투자 등
당신이 소망했던 해외 베킹리스트를 어휘 보세요.



나를 알아야 자산을 지킨다

**내 자산관리 스타일 분석부터
지출 진단 및 맞춤 혜택까지!**

내 자산&지출 스타일 진단 분석은 물론
최적의 혜택 추천으로 완벽한 자산관리



※ 본 홍보물은 법령 및 내부통제기준에 따른 절차를 거쳐 제공됩니다.
※ 하나 앱 서비스 관련 자세한 문의사항은 하나은행 고객센터 (1599-1111)0045로 문의하시기 바랍니다.
※ 본 홍보물은 2023년 4월 30일까지 유효합니다.
[문법(사)인 심의일 제2022-결고-43696(2022.05.20)/CCO(문)2206056-0038]