

ICSS 2026 Conference Program Book

Weaving the World with Digitalization and AI

May 30-June 1, 2026

Host: China Jiliang University

Website: <https://icss2026.servicescienceglobal.org/>

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Welcome Message

On behalf of the conference organizing and program committees, it is our great pleasure to invite you to participate in the 2026 International Conference on Service Science (2026 ICSS), which will be held in Hangzhou, China, during May 30-June 1, 2026.

The conference will serve as a platform for sharing visions, research findings, and practical experiences in Service Science research, education, and applications. Under the theme "Weaving the World with Digitalization and AI", 2026 ICSS seeks to foster global dialogue and collaboration across diverse application domains, particularly those influenced by rapid advancements in AI, Big Data, and Digital Transformation, while highlighting cutting-edge technologies and the latest developments in the field.

Hangzhou is one of the most beautiful cities in China, and also one of the six famous ancient capitals of China. With a profound cultural heritage and world-renowned natural scenery represented by West Lake, it perfectly blends traditional elegance with modern digital innovation. As a global hub of digital economy and the birthplace of e-commerce and AI-driven services in China, Hangzhou provides an inspiring and ideal setting for in-depth exchanges on service science, digitalization, and intelligent innovation.

We are looking forward to welcoming you in Hangzhou in the wonderful summer 2026!

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Conference Committee

Honorary Chair

- Daoxin Dai, China Jiliang University, China
- Richard Larson, Massachusetts Institute of Technology, USA
- Guillaume Roels, INSEAD, France

General Chairs

- Binrui Wang, China Jiliang University, China
- Haomiao Zhou, China Jiliang University, China
- Robin Qiu, The Pennsylvania State University, USA

Program Chairs

- Liang Shan, China Jiliang University, China
- Jianwei Zhao, China Jiliang University, China
- Youakim Badr, The Pennsylvania State University, USA

Program Track Chairs

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- Xu Dai, Tsinghua University, China

Publication Chair

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Best Student Paper Award Committee Chair

- Chair, Weiwei Chen, Rutgers University, USA)
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- Siyang Gao, City University of Hong Kong
- Jie Song, Peking University, China
- Xiaolei Xie, Tsinghua University, China
- Weihua Zhou, Zhejiang University, China
- Ben Niu, Shenzhen University, China

Best Conference Paper Award Committee

- Chair, Victor Chan, Tsinghua University, China
- Paul Messinger, University of Alberta, Canada
- Liang Shan, China Jiliang University, China
- Jie Song, Peking University, China
- Leifei Li (Tsinghua University, China)

Local Organization Committee Chairs

- Jianqi Wang, China Jiliang University
- Jinyun Lu, China Jiliang University
- Xuying Zhou, China Jiliang University

Invited Tracks

1. Intelligent Digital Health Systems and Healthcare Transformation
 - Prof. Ben Niu, Shenzhen University, China
 - Prof. Hongyan Dai, Central University of Finance and Economics, China
2. AI Readiness and Smart Infrastructure: Industrial and Urban Perspectives
 - Prof. Xue Pang, City University of Macau
3. Digital Transformation and Society
 - Prof. Robin Qiu, Pennsylvania State University, USA
 - Prof. Norita Ahmad, American University of Sharjah, United Arab Emirates
 - Prof. Peng Xiao, Sun Yat-sen University, China
4. Smart and Intelligent Port and Shipping Logistics Services
 - Prof. Bo Lu, Dalian University of Technology, China
 - Prof. Jian-Jun Wang, Dalian University of Technology, China
5. Strategic Decision-Making in the AI-Driven Service Economy
 - Prof. Yinlian Zeng, Shenzhen Technology University, China
6. Data-driven Optimizations for Smart City Operations
 - Prof. Zihao Jiao, Beijing Technology and Business University, China
7. Data-driven Applications in Healthcare Operations Management
 - Prof. Xiaolei Xie, Tsinghua University, China
8. Systemic Modeling and Optimization for AI-Driven Service Innovation
 - Prof. Lefei Li, Tsinghua University, China
 - Prof. Wei Qi, Tsinghua University, China
 - Prof. Feifan Wang, Tsinghua University, China
9. Rules-based vs. Data-driven: Decision-Making Strategies for Smart, Sustainable Service Systems
 - Prof. Jiajing Huang, Kennesaw State University, USA
 - Prof. Zhaojing Wang, Beijing Jiaotong University, China
 - Prof. Xinnan Liu, North China University of Technology, China
10. AI-Driven Service Innovation: From Personalization to Hyperautomation
 - Prof. Gang Du, Eastern China Normal University, China
 - Prof. Shan Wang, Sun Yat-sen University, China
 - Prof. Cheng Hua, Shanghai JiaoTong University, China
 - Prof. Jian-Jun Wang, Dalian University of Technology, China
 - Prof. Liping Zhou, Shanghai JiaoTong University, China

11. Sustainable AI Operations: Low-Carbon Design and Management of Compute Services
 - Prof. Jie Song, Peking University, China
 - Prof. Ziwei Wang, Peking University, China
 - Prof. Fan Zhang, Chinese Academy of Sciences, China
 - Prof. Wenting Wang, Peking University, China

12. Data-Driven Intelligence: Integrating Analytics, Artificial Intelligence, and Machine Learning for Smarter Decision-Making
 - Prof. Satish Mahadevan Srinivasan, Penn State (Great Valley), USA
 - Prof. Luna Yang, Penn State (Brandywine), USA
 - Prof. Yang Wang, La Salle University, USA
 - Prof. La Salle University, The College of New Jersey, USA

13. Data Based Operations Management in Service Industry
 - Prof. Qiang Su, Tongji University, China
 - Prof. Junxiang Li, University of Shanghai for Science & Technology, China
 - Prof. Ming Liu, Tongji University, China

14. Service Management in Healthcare
 - Prof. Zhongsheng Hua, Zhejiang University, China
 - Prof. Quan Yuan, Zhejiang University, China

15. Risk Management in Digital and AI-Driven Service Systems
 - Prof. Chuanmin Mi, Nanjing University of Aeronautics and Astronautics, China
 - Prof. Shan Li, Nanjing University of Aeronautics and Astronautics, China
 - Prof. Jian Liu, Missouri University of Science and Technology, China

16. Platform Supply Chain Operation Optimization
 - Prof. Qi Xu, Donghua University, China

17. Data-Driven Prediction and Optimization in Emergency Management & Resource Allocation and Scheduling in Service Systems
 - Prof. Wai Kin (Victor) Chan, Tsinghua University, China
 - Kexin Cao, Tsinghua University, China
 - Jiaqi Huang, Tsinghua University, China

18. Reliable Facility Location and Transportation Operations in the Digital-Intelligence Era
 - Prof. Yanzi Zhang, Beijing Institute of Technology, China

19. AI-driven complex service system modeling and decision-making
 - Prof. Feng Gao, Beijing University of Technology, China
 - Prof. Jingsi Huang, Beijing University of Chemical Technology, China

20. Data-Driven Service Operations Management under Uncertainty: Methods and Applications in Supply Chains and Energy Systems

- Prof. Lun Ran, Beijing Institute of Technology, China
- Prof. Yan Qiao, Zhengzhou University, China

21. Data Driven Decision Making in Service Systems under Uncertainty

- Prof. Caihua Chen, Nanjing University, China
- Prof. Houcai Shen, Nanjing University, China
- Prof. Qian Hu, Nanjing University, China

22. Intelligent Manufacturing and Logistics Operations Optimization

- Prof. Canrong Zhang, Tsinghua Shenzhen International Graduate School, China
- Prof. Zhi Pei, Zhejiang University of Technology, China

23. Vision and Intelligent based Metrology

- Prof. Liang Shan, China Jiliang University, China
- Prof. Jianwei Zhao, China Jiliang University, China
- Prof. Weiqi Yan, Auckland University of Technology, Australia

24. Human–AI Collaborative Decisions

- Prof. Weihua Zhou, Zhejiang University, China
- Prof. Hongyan Dai, Central University of Finance and Economics, China
- Prof. Yu Tong, Zhejiang University, China

25. Data Quality Management

- Prof. Haiyan Yu, Chongqing University of Posts and Telecommunications, China
- Prof. Dennis Lin, Purdue University, USA

26. AI driven Financial Service

- Prof. Sirong Luo, Shanghai University of Finance and Economics, China
- Prof. Xiangyu Cui, Shanghai University of Finance and Economics, China

27. Risk and Optimization for Service Systems Considering Digital Transformation

- Prof. Yichuan Ding, McGill University, Canada

28. AI for Finance

- Prof. Wei Zhang, Tianjin University, China
- Prof. Shen Lin, Tianjin University, China
- Prof. Ya Gao, Dalian University of Technology, China

Conference Quick Guide

Registration/Check In

The Registration/Information desk will be open at the following places:

- Lobby at Crowne Plaza Hangzhou Qiantang Hotel
Address: No.381 Shangsha Road, Qiantang District Hangzhou, ZJ 310018 Mainland China
Time: 3:00 PM-6:00 PM, Friday, May 29, 2026
- Wenting Building at the China Jiliang University Campus
Address: No. 258 Xueyuan St, Qiantang District, Hangzhou, Zhejiang, China
Time: 8:00 AM-12:00 PM, 2:00 PM-5:00 PM, May 30, 2026
8:00 AM-12:00 PM, 2:00 PM-5:00 PM, May 31, 2026
8:00 AM-12:00 PM, June 1, 2026

Meeting rooms

- The Conference Opening Ceremony, Keynotes, Panels, and Parallel Sessions will take place on the China Jiliang University campus.

Presentation

- Each meeting room will have a laptop, fully loaded with Microsoft PowerPoint and Acrobat Reader applications.

Lunch

- Lunches will be provided in the Tingsha Restaurant on the China Jiliang University Campus.

Social programme

- Banquet: The Conference Banquet will be held in the Crowne Plaza Hangzhou Qiantang Hotel at 6:30 PM on Sunday, May 31, 2026. The Dinner will start 7:00 PM.

Parking facilities on campus

- There are sufficient parking places on campus near the conference venue and these are free of charge.

Shuttle Bus

- We will arrange shuttle buses on the first floor at the Crowne Hotel and the Kaiyuan Hotel to take you to China Jiliang University. The bus will arrive 5 minutes earlier at the designated location and depart on time. The specific bus time schedules are as follows:

Date	Time	From	To
30 May	7:30	Crowne Plaza Hotel	China Jiliang University
		Kaiyuan Hotel	China Jiliang University
	13:00	Tingsha Restaurant	Crowne Plaza Hotel
		Tingsha Restaurant	Kaiyuan Hotel
	13:30	Crowne Plaza Hotel	China Jiliang University
		Kaiyuan Hotel	China Jiliang University
	18:00	China Jiliang University	Crowne Plaza Hotel
		China Jiliang University	Kaiyuan Hotel
31 May	7:30	Crowne Plaza Hotel	China Jiliang University
		Kaiyuan Hotel	China Jiliang University
	13:00	Tingsha Restaurant	Crowne Plaza Hotel
		Tingsha Restaurant	Kaiyuan Hotel
	13:30	Crowne Plaza Hotel	China Jiliang University
		Kaiyuan Hotel	China Jiliang University
	17:30	China Jiliang University	Crowne Plaza Hotel
	18:00	China Jiliang University	Crowne Plaza Hotel
1 June	7:30	Crowne Plaza Hotel	China Jiliang University
		Kaiyuan Hotel	China Jiliang University
	13:00	Tingsha Restaurant	Crowne Plaza Hotel
		Tingsha Restaurant	Kaiyuan Hotel
	13:30	Crowne Plaza Hotel	China Jiliang University
		Kaiyuan Hotel	China Jiliang University
	18:00	China Jiliang University	Crowne Plaza Hotel
		China Jiliang University	Kaiyuan Hotel

Conference Venue

- China Jiliang University Campus

Address: No. 258 Xueyuan St, Qiantang District, Hangzhou, Zhejiang, China

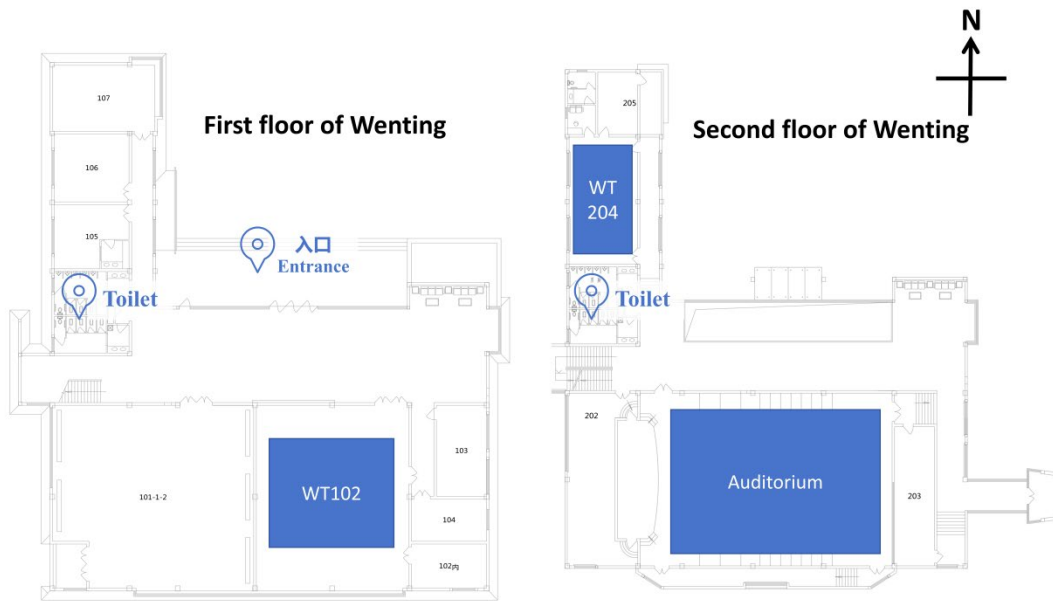


No.	Building Name	Use of the Venue
①	Wenting Building	Opening Ceremony, Keynote, Panel, Parallel Session
②	Mingde North Building	Parallel Session
③	Tingsha Restaurant	Lunch

- Conference Room

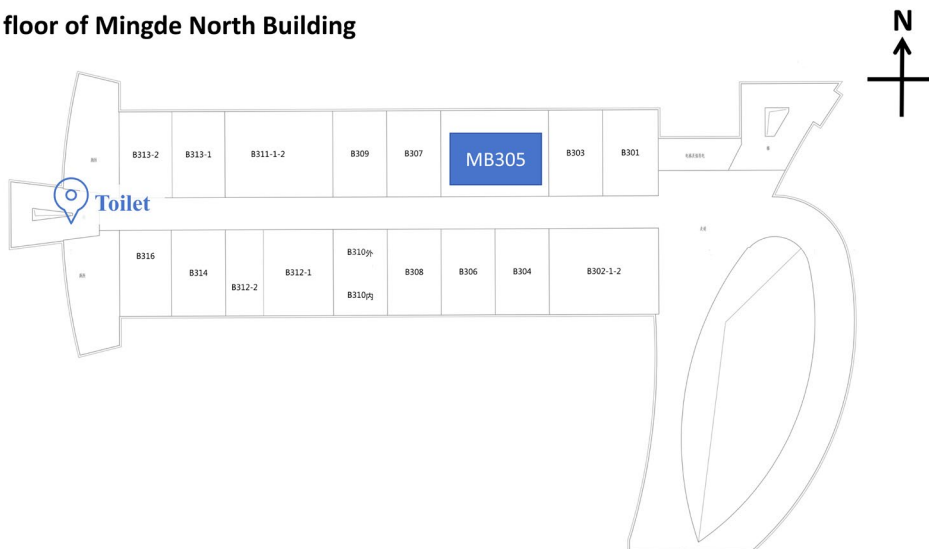
Meeting Room	Building Name	No.
Auditorium	Wenting Building	①
MB102	Mingde North Building	②
MB305	Mingde North Building	②
MB600	Mingde North Building	②
WT102	Wenting Building	①
WT204	Wenting Building	①

- Plan of Wenting Building

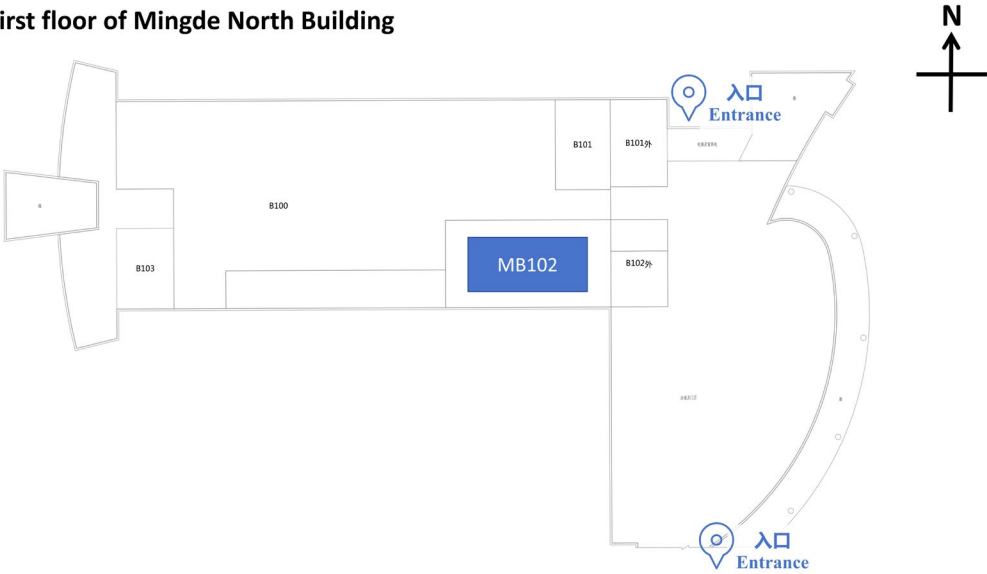


- Plan of Mingde North Building

Third floor of Mingde North Building



First floor of Mingde North Building



Sixth floor of Mingde North Building



Agenda Overview

Friday, May 29, 2026

3:00 PM – 6:00 PM	Registration/Check In	Lobby, Crowne Plaza
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Saturday, May 30, 2026

8:00 AM – 12:00 PM 2:00 PM – 5:00 PM	Registration/Check In				Wenting Building, CJLU	
8:00 AM – 8:30 AM General Meeting Chair: Robin Qiu	Opening Ceremony (Welcome Speeches) 1. President of CJLU, China 2. Prof. Haomiao Zhou, Dean of College of Information Engineering, CJLU, China 3. Prof. Liang Shan, Program Chair				Auditorium (2 nd Floor), Wenting Building	
8:30 AM – 8:50 AM	Photo Time					
8:50 AM – 9:30 AM Chair: Paul Messinger	Keynote Presentation: “Silicon Photonic Chips for Artificial Intelligence” Prof. Daoxin Dai , China Jiliang University, China				Auditorium (2 nd Floor), Wenting Building	
9:30 AM – 9:50 AM	Coffee/Tea/Refreshments				Lobby, Wenting and MB6, Mingde North	
9:50 AM – 10:30 AM Chair: Guiping Hu	Keynote Presentation: “Optimizing Service Encounters: A Co-Productive, Experiential, and People-Centric Approach”, Prof. Guillaume Roels , EIC of INFORMS Service Science, INSEAD, France				Auditorium (2 nd Floor), Wenting Building	
10:30 AM – 11:15 AM Chair: Robin Qiu	Panel: “Services in the AI Era” Prof. Paul Maglio, University of California Merced, USA Prof. Kwang-Jae Kim, Former Vice President of Pohang University of Science and Technology, Korea Prof. Zhongsheng Hua, Zhejiang University, China Prof. Wei Le, China Jiliang University, China				Auditorium (2 nd Floor), Wenting Building	
11:15 AM – 12:00 PM Chair: Guillaume Roels	Panel: “AI & Digital Transformation in Industry” Zhenyu Xue, China Jiliang University, China Kai Cai, Uniview, China Shi Wang, Huimei Technology, China Miya Li, Ballsnow, China				Auditorium (2 nd Floor), Wenting Building	
Lunch (Tingsha Restaurant) (12:00 PM – 2:00PM))						
2:00 PM – 3:40 PM	Parallel Session				Wenting and Mingde North	
SA01	SA02	SA03	SA04	SA05	SA06	

(Best Conference Paper Competition) Auditorium (2 nd Floor), Wenting Building	(Best Student Paper Competition (I)) WT 204, Wenting Building	(Track 21) WT 102, Wenting Building	(Track 6) MB 600, Mingde North	(Track 18) MB 305, Mingde North	(Track 26) MB 102, Mingde North
Chair: Victor Chan Paper IDs: 164, 388, 372, 311, 328	Chair: Hongyan Dai Paper IDs: 230, 279, 277, 155	Chair: Caihua Chen Paper IDs: 390, 392, 397, 396, 394	Chair: Zihao Jiao Paper IDs: 343, 342, 323, 320, 326	Chair: Yanzi Zhang Paper IDs: 90, 180, 363, 321, 316	Chair: Sirong Luo Paper IDs: 413, 414, 102, 132, 122
3:40 PM – 4:00 PM	Coffee/Tea/Refreshments			Lobby, Wenting and MB6, Mingde North	
4:00 PM – 5:40 PM	Parallel Session			Wenting and Mingde North	
SA07 (Track 5) Auditorium (2 nd Floor), Wenting Building	SA08 (Best Student Paper Competition (II)) WT 204, Wenting Building	SA09 (Track 8) WT 102, Wenting Building	SA10 (Track 14) MB 600, Mingde North	SA11 (Track 15 & 20 & 5) MB 305, Mingde North	SA12 (Track 3) MB 102, Mingde North
Chair: Yinlian Zeng Paper IDs: 411, 141, 266, 117, 24	Chair: Xiaolei Xie Paper IDs: 253, 371, 352, 228	Chair: Lefei Li Paper IDs: 243, 85, 37, 340, 217	Chairs: Heng Zhao and Quan Yuan Paper IDs: 330, 332, 366, 331, 319	Chair: Shan Li Paper IDs: 81, 351, 185, 362, 103	Chair: Norita Ahmad Paper IDs: 272, 73, 373, 302, 349

Sunday, May 31, 2026

8:00 AM – 12:00 PM 2:00 PM – 5:00 PM	Registration/Check In				Wenting Building, CJLU
8:00 AM – 8:40 AM Chair: Xiaoyang Yao	Keynote Presentation: "How to BRIDGE the Digital Divide: A Framework and Research Agenda", Paul Messinger, University of Alberta, Canada				Auditorium (2 nd Floor), Wenting Building
8:40 AM – 9:20 AM Chair: Zhenyu Xue	Keynote Presentation: "System thinking to address trans-disciplinary service challenges", Prof. Guiping Hu , Department Chair of Systems Engineering and Operations Research, George Mason University, USA				Auditorium (2 nd Floor), Wenting Building
9:20 AM – 10:00 AM Chair: Robin Qiu	Panel: "Meet Journal Editors" Prof. Guillaume Roels, INSEAD, France Prof. Norita Ahmad, American University of Sharjah, United Arab Emirates Prof. Wei Zhang, Tianjin University, China Prof. Gang Du, East China Normal University, China Prof. Robin Qiu, Pennsylvania State University, USA				Auditorium (2 nd Floor), Wenting Building
10:00 AM – 10:20 AM	Coffee/Tea/Refreshments				Lobby, Wenting and MB6, Mingde North
10:20 AM – 12:00 AM	Parallel Session				Wenting and Mingde North
SU01 (Track 27) Auditorium (2 nd Floor), Wenting Building	SU02 (Track 28) WT 204, Wenting Building	SU03 (Track 10) WT 102, Wenting Building	SU04 (Track 4) MB 600, Mingde North	SU05 (Track 11) MB 305, Mingde North	SU06 (Track 1) MB 102, Mingde North
Chair: Yichuan Ding Paper IDs: 188, 43, 265, 110, 127	Chair: Shen Lin Paper IDs: 404, 383, 410, 385, 384	Chair: Shan Wang Paper IDs: 72, 163, 30, 168, 158	Chair: Jian-Jun Wang Paper IDs: 46, 40, 201, 174, 60	Chair: Ziwei Wang Paper IDs: 285, 183, 150, 282, 236	Chair: Ben Niu Paper IDs: 18, 210, 262, 420, 295
Lunch (Tingsha Restaurant) (12:00 PM – 2:00PM)					
2:00 PM – 3:40 PM	Parallel Session				Wenting and Mingde North

SU07 (Track 12) Auditorium (2 nd Floor), Wenting Building	SU08 (Track 28) WT 204, Wenting Building	SU09 (Track 10) WT 102, Wenting Building	SU10 (Track 4 & 2) MB 600, Mingde North	SU11 (Track 11 & 19) MB 305, Mingde North	SU12 (Track 0) MB 102, Mingde North
Chair: Luna Yang Paper IDs: 151, 290, 17, 83,146	Chair: Ya Gao Paper IDs: 387, 407, 405, 403, 401	Chairs: Gang Du, Cheng Hua Paper IDs: 66, 79, 32, 104, 165	Chair: Bo Lu Paper IDs: 55, 172, 40, 57, 21	Chair: Fan Zhang Paper IDs: 237, 171, 107, 287, 22	Chair: Peng Xiao Paper IDs: 15, 49, 74, 133, 248
3:40 PM – 4:00 PM	Coffee/Tea/Refreshments			Lobby, Wenting and MB6, Mingde North	
4:00 PM – 5:40 PM	Parallel Session			Wenting and Mingde North	
SU13 (Track 12) Auditorium (2 nd Floor), Wenting Building	SU14 (Track 23) WT 204, Wenting Building	SU15 (Track 24) WT 102, Wenting Building	SU16 (Track 16) MB 600, Mingde North	SU17 (Track 25) MB 305, Mingde North	SU18 (Track 26 & 28 & 10) MB 102, Mingde North
Chair: Satish Srinivasan Paper IDs: 190, 415, 97, 300, 187	Chair: Jianwei Zhao Paper IDs: 71, 87, 377, 75, 345	Chair: Weihua Zhou Paper IDs: 378, 308, 367, 48, 421	Chair: Baoli Shi Paper IDs: 227, 20, 19, 52	Chair: Haiyan Yu Paper IDs: 196, 118, 276, 422, 423	Chairs: Jian- Jun Wang, Liping Zhou Paper IDs: 220, 123, 279, 31, 209
7:00 PM – 9:30 PM	Banquet 1. General Chair, CLJU 2. Awards Presentation, Award Committee			Banquet Hall, Crowne Plaza	

Monday, June 1, 2026

8:00 AM – 12:00 PM		Registration/Check In			Wenting Building, CJLU
8:20 AM – 10:00 AM		Parallel Session			Wenting and Mingde North
MO01 (Track 17)	MO02 (Track 21 & 18)	MO03 (Track 10)	MO04 (Track 16 & 12)	MO05 (Track 7 & 9)	
Auditorium (2 nd Floor), Wenting Building	WT 204, Wenting Building	WT 102, Wenting Building	MB 600, Mingde North	MB 305, Mingde North	
Chair: Victor Chan Paper IDs: 162, 166, 203, 222, 408	Chair: Houcai Shen Paper IDs: 393, 391, 398, 324, 327	Chairs: Gang Du, Jian-Jun Wang Paper IDs: 339, 139, 333, 34, 32	Chair: Satish Srinivasan Paper IDs: 161, 240, 251, 245, 416	Chair: Jiaying Huang Paper IDs: 42, 374, 13, 418, 354	
10:00 AM – 10:20 AM		Coffee/Tea/Refreshments			Lobby, Wenting and MB6, Mingde North
10:20 AM – 12:00 AM		Parallel Session			Wenting and Mingde North
MO06 (Track 17 & 13)	MO07 (Track 22)	MO08 (Track 7)	MO09 (Track 23)	MO10 (Track 25)	
Auditorium (2 nd Floor), Wenting Building	WT 204, Wenting Building	WT 102, Wenting Building	MB 600, Mingde North	MB 305, Mingde North	
Chairs: Qiang Su & Victor Chan Paper IDs: 208, 116, 229, 238, 182	Chair: Zhi Pei Paper IDs: 292, 273, 128, 223, 219	Chair: Xiaolei Xie Paper IDs: 3, 289, 283, 284, 286	Chair: Liang Shan Paper IDs: 358, 348, 254, 84, 258	Chair: Haiyan Yu Paper IDs: 41, 275, 409, 313	
Lunch (12:10 PM – 2:00PM)					

Tuesday, June 2, 2026

Industry tour: Alibaba Center


Departure Time: 8:00 AM

Departure Location: Crowne Plaza

Keynote Speeches

Time: 8:50 AM-9:30 AM, May 30

Venue: Auditorium (2nd Floor), Wenting Building

	Speech Topic: Silicon Photonic Chips for Artificial Intelligence
	Speech Summary: The exponential growth of Artificial Intelligence (AI) is pushing the limits of conventional electronic computing, creating a critical need for more efficient hardware solutions. In this plenary talk, we discuss the potential of Silicon Photonic Chips as a promising platform for accelerating AI workloads. In particular, this talk includes three parts. The first part is related with silicon photonic transceivers with unprecedented data bandwidth and reduced energy consumption to effectively address the interconnect bottlenecks. The second part is focused on silicon photonic switches for reconfigurable data routing in optical interconnects. The third one is about silicon photonic computing and processing, such as matrix multiplications. Finally, we will further talk about the challenges and prospective of silicon photonics for AI.
	Short Bio: Daoxin Dai received the B.Eng. degree from Zhejiang University (ZJU), China, and the Ph.D. degree from the Royal Institute of Technology, Stockholm, Sweden, in 2000 and 2005, respectively. He joined Zhejiang University as an assistant professor in 2005, and became an associate professor in 2007 and a full professor in 2011. He worked at the University of California at Santa Barbara (UCSB) as a visiting scholar during the years of 2008-2011. Currently Prof. Daoxin Dai is the executive president of China Jiliang University and the Chair of Optical Society of Zhejiang Province. He is the Qiushi Distinguished Professor of ZJU and is leading the silicon integrated nanophotonics group at ZJU. He is the pioneer in the fields of asymmetric silicon photonics, multimode silicon photonics, and silicon-plus photonics. He is the Winner of National Science Fund for Distinguished Young Scholars (2017), Wang-Daheng Award of Optics (2020), the first-class Zhejiang Provincial Award for Natural Science (2020), the first-class Award of Chinese Optical Society (2020), the first-class Award of Chinese Society of Optical Engineering (2025). Prof. Daoxin Dai has published more than 400 refereed international journals papers in Science, Nature, Nature Photonics, etc., and has been invited to give >100 plenary/tutorial/keynote/invited talks on silicon photonics at prestigious national/international conferences including OFC, ECOC and CLEO. Prof. Daoxin Dai is one of Most Cited Chinese Researchers in 2014-2025 (from Elsevier's report). He is a Fellow of Optica (formerly OSA).

Daoxin Dai
Professor and Executive
president of China Jiliang
University

Keynote Speeches

Time: 9:50 AM -10:30 AM, May 30

Venue: Auditorium (2nd Floor), Wenting Building


	Speech Topic: Optimizing Service Encounters: A Co-Productive, Experiential, and People-Centric Approach
	Speech Summary: Most value creation in services takes place in service encounters — at the interfaces between customers, employees, and service organizations. However, managers are often unable to effectively optimize them, because their tools either fail to fully comprehend these interfaces, lying therefore on the fringes of the value creation process, or predate digital technologies. This monograph reviews the recent development of three levers for optimizing service encounters, which lie at the core of the service value creation process and are relevant in a digital world. These levers are: leveraging co-production to innovate in service design; delighting customers through experience design; and fostering employee engagement by putting people first. Given today’s abundant datasets and short feedback loops enabling scientific experimentation, we argue that the time is ripe for effectively optimizing service encounters.
	Short Bio: Guillaume Roels is the Timken Chaired Professor of Global Technology and Innovation at INSEAD. His research lies on the interface of operational excellence, people-centric operations, and the management of services. Some of his recent work has focused on collaborative dynamics in organizations, design of service experiences, and customer ownership in queuing systems. He is currently serving as the Editor-in-Chief of Service Science and was previously a Department Editor at M&SOM and an Associate Editor at Management Science. He has received numerous research awards, including Finalist in the 2024 International Service Science Best Student Paper Competition, Second Place in the 2023 International Service Science Cluster Best Paper Competition, an Honorable mention in the 2016 International Service Science Best Published Paper Competition, and the First prize in the 2013 International Service Science Cluster Best Paper Award Competition.

Guillaume Roels
Timken Chaired Professor
of Global
Technology and
Innovation, INSEAD

Keynote Speeches

Time: 8:00 AM-8:40 AM, May 31


Venue: Auditorium (2nd Floor), Wenting Building

 <p>Paul R. Messinger Professor of Marketing and Chair of the Department of Marketing, Business Economics, and Law at the University of Alberta School of Business</p>	Speech Topic: How to BRIDGE the Digital Divide: A Framework and Research Agenda
	Speech Summary: This presentation explores communication gaps between different generations, specifically between digital natives (people raised with full access to digital technologies) and digital laggards (people raised earlier who retain earlier practices). The speaker introduces the BRIDGE framework, which identifies five key dimensions of differences: (1) Boundaries Perceptions, (2) Relationship Focus, (3) Information Processing Style, (4) Digital Literacy, and (5) Generational Language. The talk also examines the emergent consequences of these gaps, including over-communication and perceived irrelevance. The presentation summarizes past literature and suggests future research avenues to better understand miscommunication between digital natives and digital laggards.
	Short Bio: Paul R. Messinger is Professor of Marketing and Chair of the Department of Marketing, Business Economics, and Law at the University of Alberta School of Business and Past-Chair of the International Service Science Section. He has served on the Boards of International and the International Marketing Science Society, and on Editorial Boards of Marketing Science, Service Science, and as Guest Area Editor of Information Technology and Management. He has numerous peer-reviewed articles, book chapters, and five books about service science, emerging retail formats, the Metaverse, cities of the future, consumer behavior, e-commerce, and recommendation systems. Ten of his papers have more than 100 Google citations, including four with more than 300 citations. He holds a PhD (Economics) and MA (Statistics) from UC Berkeley, an MBA from Harvard Business School, and a BA from Carleton College.

Keynote Speeches

Time: 8:40 AM-9:20 AM, May 31

Venue: Auditorium (2nd Floor), Wenting Building

 <p>Dr . Guiping Hu Professor and Department Chair of Systems Engineering and Operations Research at George Mason University</p>	<p>Speech Topic: System thinking to address trans-disciplinary service challenges</p>
	<p>Speech Summary: The landscape in research for service sectors continues to evolve rapidly, driven by emerging opportunities and challenges with significant societal implications. As a pivotal approach to embracing these challenges and opportunities, trans-disciplinary research plays an increasingly important role, especially as systems become borderless and dynamic. During this process, it is critical to embrace and adopt system thinking to address trans-disciplinary service challenges. Dr. Hu will share an overview of service systems and digitalization in the era of artificial intelligence and digital twin adoption. Application domains will include supply chain design, manufacturing production, renewable energy production, sustainable agriculture, and healthcare.</p>
	<p>Short Bio: Dr . Guiping Hu is a Professor and Department Chair of Systems Engineering and Operations Research at George Mason University. During 2023 – 2025, she served as the School Head of Industrial Engineering and Management at Oklahoma State University. During 2022-2023, she served as the Associate Chair of the Department of Industrial and Manufacturing Systems Engineering at Iowa State University where she was a faculty from 2009-2023. Dr. Hu’s research has been supported by NSF, USDA, DOE, and DOD with over \$12M funding. She has published over 100 journal articles and 50 conference proceedings. She is an Institute of Industrial and Systems Engineers (IISE) Fellow, ELATES fellow, and an NSF IAspire Leadership Academy Fellow.</p>

Panel

Topic: Services in the AI Era	
Time: 10:30AM-11:15AM, May 30	Venue: Auditorium (2nd Floor), Wenting Building
	<p>Kwang-Jae Kim is a Professor in the Department of Industrial and Management Engineering and the Director of the Graduate Program in Industrial Data Science at Pohang University of Science and Technology (POSTECH), Korea. His research focuses on quality assurance in product and service design, as well as analytics-driven new service development. His work has been applied across various fields, including semiconductor manufacturing, steel manufacturing, automobile design and manufacturing, healthcare and wellness, smart energy, smart transportation, telematics, and ICT services. His research has been supported by numerous government agencies—including the National Research Foundation, the Ministry of Science and ICT, the Ministry of Education, the Ministry of Health and Welfare, and the Ministry of Trade, Industry and Energy of Korea—as well as by leading companies such as Samsung, LG, POSCO, Hyundai, SK Hynix, KT, IBM, and Microsoft. He has received several prestigious awards, including the Proud POSTECHian Award, the Literati Award for Excellence, the KIIIE Jung-Hun Academic Excellence Award, and the KSQM Academic Excellence Award. He is a member of the National Academy of Engineering of Korea and served as President of the Korean Institute of Industrial Engineers (2023–2024). More details can be found at http://quality.postech.ac.kr.</p>
	<p>Paul P. Maglio is a Professor of Management and Cognitive Science at the University of California, Merced. He holds a bachelor's degree in computer science and engineering from MIT and a Ph.D. in cognitive science from the University of California, San Diego. One of the founders of the field of service science, Dr Maglio was the Editor-in-Chief of International Service Science (2013-2018), and is lead editor of the Handbook of Service Science, Volumes I and II. He has published more than 125 papers in computer science, cognitive science, and service science.</p>
	<p>Zhongsheng Hua is a Qiushi Distinguished Professor of Zhejiang University (ZJU), HengYi Chair Professor of ZJU, and a Changjiang Scholar Distinguished Professor of the Chinese Ministry of Education (MOE). He is the founding director of Research Center of Service Sciences, ZJU. He takes the positions as a vice President of the Society of Management Science and Engineering of China, and services as an associate director of the Faculty of Social Sciences (FSS), Zhejiang University. Prof. Hua is engaged in the research of service services and operations management. His research has been supported by the project for Distinguished Young Scholars, Major Program and Innovative Research Group Project of NSFC. He has been awarded the 1 st prize of the Natural Science of MOE, and has published more than 100 papers, and he was selected by Elsevier's list of Most Cited Chinese Researchers from 2014 to 2025.</p>
	<p>Le Wei is a professor of China Jiliang University, and he is an expert in the ISO/TC 289 WG 4. He has been engaged in research in areas such as service quality management and brand management for a long time. He has authored four monographs, including “Research on Extraction of Service Quality Characteristics and Measurement of Perceived Quality”, and has published over 70 papers, including “Research on Influencing Factors of Hotel Visual Comfort – Based on the Emotional Perspective”, “Construction and Research of Service Quality Evaluation Model Based on Three-Dimensional Subdivision of Contact Units – Based on the Comparative Perspective of B2C and B2B”, and “Research on Extraction of Service Characteristics Based on the View of Service Contact Units”. He has also led industry standards such as “Guidelines for Laboratory Capability of Service Quality Assessment in Conformity Assessment”.</p>
Kwang-Jae Kim	
Paul P. Maglio	
Zhongsheng Hua	
Wei Le	

Topic: “AI & Digital Transformation” in Industry

Time: 11:15AM-12:00AM May 30

Venue: Auditorium (2nd Floor), Wenting Building



Zhenyu Xue

Zhenyu Xue is a highly accomplished engineer and scientist with a Ph.D. in Mechanical Engineering from UIUC (2001) and a B.S. from Tsinghua University. He began his career as a Research Associate at Harvard University, then moved into industry as a Lead Engineer at Schlumberger and Principal Scientist at Halliburton, where he led supercomputing labs, developed shaped charge technologies, and contributed to multi-million-dollar product lines. He later co-founded ZSFab Inc. as CTO, focusing on 3D-printed orthopedic implants. Returning to China in 2018, he became R&D Director and Scientist at the Global Research Center for Flexible Electronics & Intelligent Technology, leading teams to develop smart monitoring systems for high-speed rail and power grids. Dr. Xue has published over 40 papers (4,000+ citations), holds multiple patents, and has been recognized under the Zhejiang provincial and national “Thousand Talents” programs. He serves as Vice President of the Digital Economy Committee of the Zhejiang Tsinghua Alumni Association. His expertise spans computational mechanics, ductile fracture, additive manufacturing, oilfield services, and flexible electronics.



Shi Wang

Wang Shi is the Chief Technology Officer of HuiMei Technology. Shi joined HuiMei Technology in 2015 and oversees the R&D of medical AI systems powered by large language models and medical knowledge graphs. He leads the R&D team in continuously advancing the reasoning capabilities and model performance of medical AI algorithms. His work has established a solid technical foundation for key AI applications, including CDSS and other medical quality control systems.



Miya Li

Miya Li is the founder of Ballsnow in China and the co-founder of KnowFab in Germany. With 20+ years of working experience in the Chinese and German manufacturing sectors, she has long been engaged in aerospace and automotive industries. She founded Ballsnow which focuses on industrial AI and knowledge graph technology, specializing in automotive manufacturing process optimization and intelligent prediction. Serving both Chinese and European markets, it owns mature automotive customer channels and numerous core patents, committed to empowering the upgrade of industrial super-intelligence through AI technology.



Kai Cai

Kai Cai, Deputy Dean of Research Institute, Uniview Technology Responsible for the overall R&D of the company's AI large models, he led the development of the Wutong AIoT industrial large model and promoted the deployment of enterprise-level AI agents based on it. Deeply customized for security and enterprise scenarios, the model integrates visual perception, language understanding and multimodal interaction capabilities to efficiently support fragmented application demands across various niche industries.

Topic: Meet Journal Editors

Time: 9:20AM-10:00AM, May 31

Venue: Auditorium (2nd Floor), Wenting Building



Wei Zhang

Wei Zhang is the University Chair Professor at College of Management and Economics, Tianjin University (TJU). He currently serves as Director of the Key Lab of Complex Management Systems at TJU, supported by Ministry of Education. At present, he is the president of CSAMSE. His research interests include financial computing and analytics, FinTech, asset pricing and risk management. He has served as Executive Editor-in-chief for Journal of Management Science and Engineering, Journal of Management Sciences in China (in Chinese). He also sits on several editorial/advisory boards of international & domestic academic journals, such as SS, JEIC. He is active in business consulting for big financial players like SSE & CFFEX, and national/regional government agencies, as well as corporations such as Tianjin Port, North Trust Group.



Dr. Norita Ahmad

Dr. Norita Ahmad is a Professor of Information Systems and Business Analytics at the American University of Sharjah (AUS), United Arab Emirates (UAE), and serves as the Director of the Center for Innovation in Teaching and Learning at AUS. Prior to her tenure in the UAE, she taught at Pennsylvania State University, USA. Dr. Ahmad earned her Ph.D. in Decision Sciences Engineering Systems from Rensselaer Polytechnic Institute (RPI) and holds both an MSc. in Telecommunications and Network Management and a BSc. in Computer Sciences from Syracuse University, NY. She currently holds positions as the editor of Data Column for IEEE Computer Magazine and an Associate Editor for the Digital Transformation and Society journal. She is a Member of IEEE.



Dr. Robin Qiu

Dr. Robin Qiu is a Professor of Information Science at The Pennsylvania State University, where he earned both a Ph.D. in Industrial Engineering and a Ph.D. (minor) in Computer Science in 1996. A prolific scholar, he has published over 180 peer-reviewed articles and 5 books (including Value Co-Creation in Web 3.0: Blockchain, Metaverse, and Privacy Preservation, Responsible AI: Principles, Governance, and Global Practice, and Service science: The Foundations of Service Engineering and Management). He currently serves as Editor-in-Chief for SpringerBriefs in Service Science, the Springer Series in AI, Data Analytics, and Smart Systems, and the Journal of Digital Transformation and Society. His professional leadership is marked by founding and chairing several major academic forums, including the INFORMS Conference on Service Science (General Co-Chair since 2009), and the IEEE International Conference on Service Operations and Logistics, and Informatics (SOLI) (General Co-Chair, 2005–2008). He was also the founding chair of the Logistics and Services Technical Committee, IEEE Intelligent Transportation Systems Society, and the Service Science Section of INFORMS. His research expertise lies in Big Data, Data Analytics, AI, Smart Service Systems, Service Science, Service Operations and Management, and Information Systems and Modelling.



Gang Du

Gang Du is currently a Professor with the School of Economics and Management, Associate Dean of the Academy of Statistics and Interdisciplinary Sciences, East China Normal University. He was a Research Fellow with the National University of Singapore from 2011 to 2013. His research interests include consumer decision-making and service operation management, human-artificial intelligence collaboration, and artificial intelligence algorithm. He has published three academic monographs, and more than 100 academic papers in important domestic and international journals and international conferences. He is a member of POMS, INFORMS, and Operations Research Society of China, and serves on the peer Reviewer of 《Production and Operations Management》、《MIS Quarterly》、《Information Systems Research》、《European Journal of Operational Research》.

Parallel Sessions

Date	Time	Venue	Stream	Titles		Authors
May 30th	2:00 PM– 3:40 PM	Parallel Session SA01 Auditorium (2nd Floor), Wenting Building, CJLU	Best Conference Paper Competition <i>Chair:</i> <i>Victor Chan</i>	164	Intelligent Joint Fee Optimization for Port Logistics Services	Bing Han, Tianze Chi, Ying Zhang
				388	How Different Modes of Doctor Recommendation Affect Patients' Adoption Intentions: a task-technology Fit Perspective	Gang Du
				372	Congestion-Aware Static LLM Cascades: Analysis of a Steady-State Framework	Yuan Guo, Stefanus Jasin, Chen-An Lin
				311	Navigation-Aware Energy Consumption Modeling and Charging Infrastructure Planning for Low-Altitude UAV Networks Using Graph Attention Networks	Zi-Xuan ZHOU, Jiawei Feng, Wenjun Mei
				328	Signaling Value in the Age of AI: How Generative AI Adoption Reshapes Pricing Strategies in Online Labor Markets	Fei Wang, Yingpeng Zhu, Liy Yang, Zike Cao
		Parallel Session SA02 WT 204, Wenting	Best Student Paper Competition (I)	230	An LLM-Driven Bayesian–Stackelberg Game for Expert Recommendation Platforms: Equilibrium, Mechanism Design and Empirical Evaluation	Mr. Yonghao Zhang, Shaoru Ye, Jing Luo, Dingyu Zhou, Runqing Miao, Prof. Wai Kin (Victor) Chan

Date	Time	Venue	Stream	Titles		Authors
		Building, CJLU	Chair: Hongyan Dai	279	Two-Stage Robust Optimization for Rural Mobile Medical Fleet Routing with Endogenous Service Time Trade-off	Hengjia Zhang, Prof. Canrong Zhang
				277	AI-Enabled Effort in Competitive Service Markets with Stochastic User Equilibrium	Chuyue Chen, Zichen Mei, Hongzhi Lin
				155	Collaborative Drone and Human Courier Delivery in the Gig Economy	Mr. Zhiwei Ren, Prof. Li Xiao, Prof. Canrong Zhang, Prof. Xin Weng
		Parallel Session SA03 WT 102, Wenting Building, CJLU	Track 21 Data Driven Decision Making in Service Systems under Uncertainty Chair: Caihua Chen	390	Joint Planning and Operations of Wind Power under Decision-Dependent Uncertainty	Zhiqiang Chen, Prof. Caihua Chen, Jingshi Cui, Prof. Qian Hu, Wei Xu
				392	A Learning and Rectification Algorithm for Nonstationary Online Linear Programming	Jiawen Yang, Xingyu Lu, Prof. Caihua Chen, Wei Lu, Baozhuang Niu, Jun Zhou
				397	Collaborative Production Scheduling Problem under Uncertainty	Tianqi Cai, Prof. Qian Hu
				396	Competition between Service Platform: Myopic vs. Farsighted Stability	Hongqiao Chen, Pengfei Guo, Qingying Li, Yulan Wang
				394	Dynamic Competition in Online Retailing: Implications of Customer-to-Customer Interactions	Zheyu Jiang, Xin Geng, Nan Yang, Renyu Zhang
		Parallel Session SA04 MB 600, Mingde North, CJLU	Track 6 Data- driven Optimizations for Smart City Operations Chair: Zihao Jiao	343	How Third-Party Quality Certification Shapes Consumer Experience: Evidence from Forbes Hotel Rating Changes	Chengxing Li, Sai Liang, Wenkang Wang
				342	Scheduling Policies of Flexible Capacity in Supply Chains	Jingchuan Chen, Shaochong Lin, Zuo-Jun Max Shen
				323	Subsidizing Smart Tourism: Optimal Subsidy Policy for Attraction Digitalization under Competition	Xiaoxin Xie, Shigui Ma, Sai Liang
				320	GAN-enhanced Heuristic Algorithms for Solving Complex Urban Traffic Problems: GAN-enhanced Heuristic Algorithms	Liwei Liu
				326	Analytics of Influencing Factors of Community Governance based on Spatial Search Method	Mengyi Sha
		Parallel Session SA05 MB 305,	Track 18 Reliable Facility Location and	90	Integrated scheduling of battery electric buses and decentralized energy storage systems under capacity-dependent costs	Dr. Runfeng Cao, Feifeng Zheng, Ming Liu

Date	Time	Venue	Stream	Titles		Authors	
		Mingde North, CJLU	Transportation Operations in the Digital-Intelligence Era <i>Chair: Yanzi Zhang</i>	180	Continuous Takeoff and Landing of Bus-Aided UAVs for Last-Mile Delivery: A Bi-Objective Optimization Approach	Xu Huai, Zixuan Li, Qiang Du	
				363	Integrated scheduling optimization of AGV and double yard cranes in automated container terminals	Xiaoju Zhang	
				321	Operational Stress on On-Demand Delivery Platforms: Measurement, Consequences, and Scheduling Implications	Prof. Hongyan Dai, Prof. Zihao Jiao, Qin Xiao, Xianyi Xie, Yuqian Xu	
				316	MDKLR: A Task-oriented Dialogue Generator Augmented with Multi-domain Knowledge and LLM-refinement	Yuanyuan Cai, Yiyao Zhang, Qingchuan Zhang, Zhouzhou Fan	
		Parallel Session SA06 MB 102, Mingde North, CJLU	Track 26 AI driven Financial Service <i>Chair: Sirong Luo</i>	413	Explainable Financial Distress Prediction via Rule Distillation	Tianhao Yi, Jiaxuan Zhang, Prof. Zhiyong Li	
				414	Integrate Mean-Variance Estimation with Portfolio Optimization	Dr. Ziyang Wang, Prof. Sirong Luo	
				102	Managing Quality Risk in a Decentralized Supply Chain: Contractual Incentives and Product Recall Insurance	Jing Chen, Hang Wei, Lei Xie, Chaonan Zheng	
				132	From Serving Human Analysts to Empowering Agents	Lei Chai	
				122	Dynamic Mean-Variance Policies under Gaussian Mixture Models: An Integrated Estimation-Optimization Approach	Prof. Xiangyu Cui, Prof. Yun Shi, Zhao Si	
		4:00 PM – 5:40 PM	Parallel Session SA07 Auditorium (2nd Floor), Wenting Building, CJLU	Track 5 Strategic Decision-Making in the AI-Driven Service Economy <i>Chair: Yinlian Zeng</i>	411	Learning-by-Doing in Digital Services: A Sino-Western Comparison of User-Driven AI Iteration and Institutional Friction	Dr. Liufang Yao, Dr. Andrew Carrothers
					141	On-time Delivery Service with Compensation: A Queueing Game Approach	Xiaoli Cai, Hailun Zhang, Dr. Yinlian Zeng
					266	True Service Utility in Digital Ecosystems	Miss Yingrui Ruan
					117	Incentive Mechanism Design for Federated Learning under Rényi Differential Privacy	Lijun Gao, Prof. Yinlian Zeng
					24	Navigating the AI Frontier: China's Enterprises Expedition into Generative AI Implementation	Xianning Wang, Prof. Yinlian Zeng, Jun Li, Lina Wang

Date	Time	Venue	Stream	Titles		Authors
		Parallel Session SA08 WT 204, Wenting Building, CJLU	Best Student Paper Competition (II) <i>Chair: Xiaolei Xie</i>	253	Drone Deployment in Hybrid Air-Ground Response Systems for Out-of-Hospital Cardiac Arrests	Jiani Miao, Kexin Cao, Dr. Xinglu Liu, Mingchuan Yang, Prof. Wai Kin (Victor) Chan
				371	SHAP-Guided Data Augmentation for Small-Data Prediction in Emergency Service Systems	Linchao Li, Jiani Miao, Chih-Yuan Yang, Kexin Cao, Prof. Wai Kin (Victor) Chan
				352	AI-Enabled Decision Support as a Service for Continuous Pharmaceutical Manufacturing	Haoyang Pan, Miaoxuan Zhou, Qiaochu He
				228	Carbon-Budget Service Level Agreements for AI Compute Services: Dynamic Scheduling and Pricing under Renewable Uncertainty	Zi-Xuan Zhou, Junkai Cheng, Jiawei Feng, Wenjun Mei
		Parallel Session SA09 WT 102, Wenting Building, CJLU	Track 8 Systemic Modeling and Optimization for AI-Driven Service Innovation <i>Chair: Lefei Li</i>	243	Generative AI and Allocation Bias in Service Systems	Rowena Gan
				85	A Cognitive Digital Twin for Private Aviation Markets: LLM-Enabled Coordination and Optimization in Two-Sided Floating Charter Networks	Xinkai Xu, Professor Chun Wang, Saeed Golzar, Anojh Thayaparan
				37	Dynamic Scheduling of Hospital Examination Capacity between Outpatient and Inpatient Services	Mirui Zhang, Fangyu Zong, Prof. Feifan Wang
				340	UAF-Guided Systemic Design of AI-Enabled Service Architectures	Lefei Li
				217	Supply Chain Management Empowered by Large Model Technologies	Wei Qi
		Parallel Session SA10 MB 600, Mingde North, CJLU	Track 14 Service Management in Healthcare <i>Chair: Heng Zhao and Quan Yuan</i>	330	Appointment Scheduling with Waiting Time Limits	Zhang min, Han Zhu, Chen Rachel R, Zhenzhen Zhang
				332	Engineering Endurance	Ming Hu, Prof. Quan Yuan
				366	Price Cuts Without Savings: The Unintended Consequences of Centralized Drug Procurement	Prof. Nan Li, Xu Li, Prof. Yuanchen Li, Xiuguo Song, Dr. Heng Zhao
				331	Overprescription under Patients' Private Information: An Information Design Perspective	Xinyue Fei, Wei Zhang
				319	How AI May Impact Customer Intensive Services	Ming Hu, Xiaofei Li, Prof. Quan Yuan, Han Zhu
		Parallel Session SA11	Track 15 Risk Management in Digital and	81	A Study on Systemic Risk Contagion Paths in Multilayer Bank-Real Estate Networks	Prof. Shan Li, Hongyang Xu, Yumeng Zhu

Date	Time	Venue	Stream	Titles		Authors
		MB 305, Mingde North, CJLU	AI-Driven Service Systems & 20 Data-Driven Service Operations Management under Uncertainty: Methods and Applications in Supply Chains and Energy Systems & 5 Strategic Decision-Making in the AI-Driven Service Economy <i>Chair: Shan Li</i>	351	Beyond Productivity: Behavioral Embedding, Trade-offs, and Organizational Value in GenAI-Enabled Human-AI Collaboration	Ruifeng Sun, Qi Zhu, Jian Liu
	185			Optimization of physician scheduling under dual channel mode of online and offline	Mengbo Zhai, Cun Yu, Prof. Yan Qiao, Yunkai Zhai	
	362			Research on Construction of Online Medical Triage Model Integrating Statistical Prior and Semantic Understanding	Jule Guo, Yunkai Zhai, Prof. Yan Qiao	
	103			Proprietary or Open-source? Strategic Competition in Enterprise Generative AI Markets	Ji Lin, Prof. Yinlian Zeng, Jun Li	
		Parallel Session SA12 MB 102, Mingde North, CJLU	Track 3 Digital Transformation and Society <i>Chair: Norita Ahmad</i>	272	Balancing Moore's Strategic Triangle in an Agentic Public Service Stack: An Empirical Study of Public Value in AI-Driven Hyper-Personalized Service Delivery	Stany Nzobonimpa
	73			Bridging Digital Learning and Sustainability: Experiential Pathways to SDG 12 in Higher Education	Prof. Norita Ahmad, Professor Mai Zaki	
	373			Mapping Digital Responsibility	Shahban Shah, Hongying Foscht	
	302			A Framework for Evaluating the Effectiveness of Key Technology Applications in Libraries: Measurement from Technological, User, and Institutional Perspectives	Cui Qinglin, Heng Hou, Prof. Peng Xiao	
	349			Application Privacy Policy Compliance Detection and Market Current Situation Analysis Based on Text Classification and FactCC	Hou Zhu, Jianing Yu	

Date	Time	Venue	Stream	Titles		Authors
May 31	10:20 AM – 12:00 PM	Parallel Session SU01 Auditorium (2nd Floor), Wenting Building, CJLU	Track 27 Risk and Optimization for Service Systems Considering Digital Transformation <i>Chair:</i> <i>Yichuan Ding</i>	188	ORPR: An OR-Guided Pretrain-then-Reinforce Learning Model for Inventory Management	Lingjie Zhao, Xue Yu, Yongzhi Qi, Hao Hu, Jianshen Zhang, Yingzheng Ma, Shuyu Han, Prof. Wei Qi, Zuo-Jun Max Shen
				43	You, Me, or We? Co-Productive Principal-Agent Dynamics	Professor Guillaume Roels, Vladimir Smirnov, Ilia Tsetlin, Andrew Wait
				265	How Digital Triage Quality Influences Patient Behavior: Evidence from Hospital Data	Kuo Liang, Prof. Yichuan Ding, Dongdong Ge, Xian Wang
				110	Online Demand Fulfillment in Highly Asymmetric Markets	Hailun Zhang, Zhen Xu, Jiheng Zhang, Jiheng Zhang
				127	Model Explanation, Accuracy Feedback, and Use of Algorithmic Advice: A Field Experiment	Yang Zhan, Zike Cao, Zheng Zhang, Liping Xiong
		Parallel Session SU02 WT 204, Wenting Building, CJLU	Track 28 AI for Finance <i>Chair:</i> <i>Shen Lin</i>	404	Beyond Public Disclosure: Identifying Private Corporate Visits via Mobile GPS Traces	Xianfeng Hao, Qingsong Ruan, Shujing Wang, Prof. Yudong Wang
				383	Incentivizing Digital Workforce: Digitalization, Compensation Design, and Productivity	Cunyi Yang, Yan Zeng, Shuchi Zhang
				410	When Competition Backfires: Broker Learning and Commission Fees- Abstract ONLY	Xindan Li, Baolian Wang, Wei Xiong, Xuewei Yang, Yinhong Zhao
				385	Talk to AI-Equipped Investors: A Field Experiment	Yupeng Lin, Zhenghui Ni, Yichen Su, Nianhang Xu
				384	Identity Disclosure and Social Transmission Bias: A Natural Experiment from WeChat	Xianfeng Hao, Prof. Yudong Wang, Liangyu Wu, Prof. Wenfeng Wu

Date	Time	Venue	Stream	Titles		Authors
		Parallel Session SU03 WT 102, Wenting Building, CJLU	Track 10 AI-Driven Service Innovation: From Personalization to Hyperautomation Chair: Shan Wang	72	Algorithm-Augmented Gatekeeping: Combining Human and Machine Intelligence in Screening Programs	Jiatao Ding, Michael Freeman, Prof. Tinglong Dai
	163			Efficient Budget Allocation for Large-Scale LLM-Enabled Virtual Screening	Weiwei Fan	
	30			Robust surgery scheduling with patient feature and downstream resource constraints	Yu Wang, Shuzheng Zhang, Gang Qu	
	168			Cloud-Enabled Transformation of Outpatient Service Line Design: Strategic Quality-Speed Tradeoffs and Regulatory Implications	Weixiang Huang, Qingyuan Sang, Wenhui Zhou	
	158			A Two-Stage Stochastic Programming Approach for Physician Scheduling with Multi-Disciplinary Teams Demands	Guowei Hu, Liping Zhou, Yihui Wang	
		Parallel Session SU04 MB 600, Mingde North, CJLU	Track 4 Smart and Intelligent Port and Shipping Logistics Services Chair: Jian-Jun Wang	46	Transitioning to electrification: Optimal strategies for ship fleet replacement	Ziyu Cui, Xiaowen Fu, Huan Jin, Anthony Chen, Prof. Kun Wang
	40			Integrated Optimization of Berth and Quay Crane Allocation under Dynamic Double-Line Multi Ship Mooring Mode	Chun Gan, Prof. Caimao Tan, Prof. Junliang He	
	201			Deep Reinforcement Learning for Container Stacking	Dr. Mingzhong Huang, Prof. Hang Yu, Prof. Junliang He, Prof. Gangyan Xu	
	174			Tracing the Morphology of Maritime Clusters: A Dynamic Quantitative Analysis of Spatial Boundaries and Industry Structure in China	Borui Gao, Benedict Jun Ma, Dr. Louise Lu Li	

Date	Time	Venue	Stream	Titles		Authors
				60	Routing and scheduling problem for mothership and drones in shore-to-ship delivery	Prof. Yadong Wang, Mengyan Yang, Qiaolin Hu
		Parallel Session SU05 MB 305, Mingde North, CJLU	Track 11 Sustainable AI Operations: Low-Carbon Design and Management of Compute Services <i>Chair: Ziwei Wang</i>	285	T-ILS: A Transition-based Iterated Local Search Heuristic for the Computational Resource Leveling Problem	Jiaqi Huang, Boxiao Chen, Yining Sun, Yijui Chang, Xingyu Lu, Prof. Wai Kin (Victor) Chan
				183	Zero-Order Feedback-Based Optimization for Distributed Energy Management	Ruiyang Jin, Yujie Tang, Prof. Jie Song
				150	Achieving Efficient and Sustainable Allocation in Decentralized Computing via Nash Equilibrium	Dongwei Xie, Xiupeng Chen
				282	Simulation-Based Calibration of Time-Varying Queuing Models	Gongbo Zhang, Prof. Fan Zhang
				236	The Impact of Computing Task Flexibility on the Coordinated Optimization of Power and Computing Power Systems	Qin Guo, Ronggang Cong
				Parallel Session SU06 MB 102, Mingde North, CJLU	Track 1 Intelligent Digital Health Systems and Healthcare Transformation <i>Chair: Ben Niu</i>	18
		210	Designing Proactive Healthcare Networks with Mobile Clinics for Co-morbidities			Yafei Shi, Shandong Mou
		262	An Interpretable DRG Subdivision Method Using Tree-Structured Multi-Objective Optimization			Prof. Ben Niu, Shuowen Zang, Gaocheng Cai

Date	Time	Venue	Stream	Titles		Authors
				420	CMFH-Net: A Cross-Modal Frequency Enhancement and Hierarchical Distance-Aware Fusion Network for Multimodal Semi-Supervised 3D Medical Image Segmentation	Prof. Xinqiang Wang, Wenhuan Lu
				295	Bridging the Implementation Gap: Engineering Trust in the Era of Agentic AI	Prof. Robin Qiu
	2:00 PM – 3:40 PM	Parallel Session SU07 Auditorium (2nd Floor), Wenting Building, CJLU	Track 12 Data-Driven Intelligence: Integrating Analytics, Artificial Intelligence, and Machine Learning for Smarter Decision-Making Chair: Luna Yang	151	Modeling Heterogeneity in the Commitment-Engagement Link	Toshikuni Sato, Takumi Kato
				290	Mapping Marketing Skills for Career Mobility and Curriculum Design: A Network Analytic Framework	Prof. Luna Yang, Prof. Satish Mahadevan Srinivasan, Dr. Xianfang Tan
				17	“Cure Sometimes, Relieve Often, Comfort Always”	Qiusi Yan, Yachen Guo, Siyin Chen
				83	Decision Trajectory Metrology for Vision Models: Measuring Stability, Explaining Dynamics, and Guiding Adaptive Inference	Dr. Zhenyu Xue
				146	Unlocking Latent Crowd Wisdom via Dual-Path Expectancy Violation Modeling for Fake News Detection	Yiping Chen, Xuelong Chen
	Parallel Session SU08 WT 204, Wenting Building, CJLU	Track 28 AI for Finance Chair: Ya Gao	387	Uncertainty about "Uncertainty"	Xiangyu Wang, Ying Chen, Kotaro Inoue, Yosuke Kimura, Jin Xu	
			407	How does the development of next-generation artificial intelligence impact energy stability?	Tingqiang Chen, Chengping Wang, Jiaqi Wang	
			405	Nature Transition Risk	Prof. Haoyu Gao, Dr. Fukang Chen, Dr. Minhao Chen, Prof. Hao Liang	

Date	Time	Venue	Stream	Titles		Authors
				403	Text features and fundraising performance of medical crowdfunding	Prof. Zhi-Qiang Jiang
				401	Know Thyself? Managerial Self-Assessment Accuracy and Fund Performance	Yi Li, Prof. Wei Zhang
		Parallel Session SU09 WT 102, Wenting Building, CJLU	Track 10 AI-Driven Service Innovation: From Personalization to Hyperautomation <i>Chair: Gang Du, Chen Hua</i>	66	Warehouse Assortment Selection with Constant-Factor Guarantees via Birkhoff--von Neumann Decomposition	Xiaobo Li, Hongyuan Lin, Fang Liu
				79	Managing Public Health Surveillance Operations with Endogenous Population Growth	Hui Lin, Nan Liu, Guohua Wan, Prof. Shan Wang, Schnall Rebecca
				32	Real-time scheduling of multi-test outpatient services: integrating appointment plans with operational uncertainties	Junpeng Wang, Yanan Zhu, Yang Wang, Erik Demeulemeester, Abraham Punnen
				104	When Ratings Compete: Revisiting the Role of Product Reviews in Differentiated Markets	Wenjuan Yang, Jinxiang Wei, Xiaodong Wang
				165	Measuring empathy with large language models reveals its consequences for patient behavior in online healthcare	Li Zhang, Hong Wu
		Parallel Session SU10 MB 600, Mingde North, CJLU	Track 4 Smart and Intelligent Port and Shipping Logistics Services & 2 AI Readiness and Smart Infrastructure : Industrial and Urban	55	Resilience of Inland Waterway Networks: A Bayesian Analysis of Vessel Trajectory Data	Dr. Louise Lu Li, Dr. Shiguan Liao Prof. Samuel Shuai Liu
				172	Strategic Information Acquisition for Shore Power Adoption in Smart Ports	Prof. Bo Lu, Dr. Yuxin Liu, Dr. Yonggang Li, Prof. Jian-Jun Wang
				40	Integrated Optimization of Berth and Quay Crane Allocation under Dynamic Double-Line Multi Ship Mooring Mode	Chun Gan, Prof. Caimao Tan, Prof. Junliang He

Date	Time	Venue	Stream	Titles		Authors	
			Perspectives <i>Chair: Bo Lu</i>	57	AI deployment for heterogeneous ports: Strategic choices between independent R&D and outsourcing	Prof. Bo Lu, Guixian Zhang	
				21	Using Association Logic for Smart Construction: How Macau's 369 Co-op Town Bridges Fragmented AI Readiness	Dr. Limeng Yu, Prof. Xue Pang, Dr. Jingwei Guo	
		Parallel Session SU11 MB 305, Mingde North, CJLU	Track 11 Sustainable AI Operations: Low-Carbon Design and Management of Compute Services & 19 AI-driven complex service system modeling and decision-making <i>Chair: Fan Zhang</i>	237	Platform Merger, Resource Refill, and Welfare Effects in Computing Markets	Pro. Ronggang Cong, Han Pu	
				171	Distributed Gradient Tracking Algorithm with Gradient Noises	Xiaozheng Fu	
				107	An LLM-Driven Agent-based Model for Monopoly Dynamics in Academic Data Market	Kangzheng Ge, Zhou He	
				287	Reinforcement Learning Hyper-Heuristic Workflow Scheduling for Distributed Cloud Systems	Dingyu Zhou, Jiaqi Huang, Yijui Chang, Mr. Yonghao Zhang, Runqing Miao, Prof. Wai Kin (Victor) Chan	
				22	Flexibility Value of Reshoring Capacity Under Policy Uncertainty and Domestic Competition	Xiao Tan, Panos Kouvelis, Sammi Tang	
		Parallel Session SU12 MB 102, Mingde North, CJLU	Track 0 Default Track <i>Chair: Peng Xiao</i>	15	Data-driven Simulation Optimization and Learning for Digital Twins	Enlu Zhou	
				49	Making a Cloud: The Role of R&D in Software-as-a-Service	Bo Li	
				74	Manufacturer Encroachment with Economies of Scale: Centralized vs. Decentralized Structures	Professor Jing Chen, Prof. Wei Li, Prof. Hubert Pun	
				133	A Randomized Fair Solution to Algorithmic Discrimination Problem for Digital Logistics Platforms	Yimiao Wang, Minghui Lai	
				248	Research on Airline Pricing Strategies Considering Passengers' Green Behavior Preferences	Ya Li, Qing Zhang, Junjie Hu, Guo Lv	
		4:00 PM – 5:40 PM	Parallel Session SU13 Auditorium (2nd Floor), Wenting	Track 12 Data-Driven Intelligence: Integrating Analytics, Artificial Intelligence,	190	Solving Contextual Stochastic Optimization Problems through Contextual Distribution Estimation	Xuecheng Tian, Bo Jiang, King-Wah Pang, Yu Guo, Yong Jin, Shuaian Wang
					415	Beyond Visibility and Agility: A Configurational Approach to Supply Chain Resilience	Hao Zheng, Qiuyu Chen, Bao Xie, Xin Jin, Wenjun Zeng

Date	Time	Venue	Stream	Titles		Authors
		Building, CJLU	and Machine Learning for Smarter Decision-Making <i>Chair: Satish Srinivasan</i>	97	Dynamic Multi-Product Inventory Control with Joint and Individual Setup Costs Using Proximal Policy Optimization	Guo Feng
	300			Fairness-Constrained Optimal Model Averaging with High-Dimensional Sparsity Learning	Zeyu Chen, Dr. Wei Qian, Dr. Bintong Chen	
	187			Price Elasticity in Service Systems under Spatial Confounding: A Debiased Learning Approach	Han-Yuan Yeh, Prof. Yen-Chun Chou, Prof. Howard Hao-Chun Chung	
		Parallel Session SU14 WT 204, Wenting Building, CJLU	Track 23 Vision and Intelligent based Metrology <i>Chair: Jianwei Zhao</i>	71	A Lightweight 3D Distillation Volumetric Transformer for 3D MRI Super-Resolution	Prof. Jianwei Zhao, Tao Hong, Hao Qi, Zhenghua Zhou, Hai Wang
	87			LLM-Guided Dynamic Proxy-Based Adapter Learning for Visual Clustering	Wenjie Zhu	
	377			An Integrated Rapid Path-Planning Model for Lunar Rovers Incorporating Novel Performance Evaluation Methodologies	Hang Zhou, Li Yang, Sha Lin	
	75			DSAN: a dual-scale spatial-temporal aggregation network for robust gait recognition	Mr. Liang Ren, Prof. Xiuhui Wang	
	345			HC-TS-LDVMNet: Robust Micro-Expression Recognition via Optical Flow, Landmarks, and Landmark Distance Variation Maps	Yecheng Han, Xianghu Yue, Wenhuan Lu, Minghao Guo, Jianguo Wei	
		Parallel Session SU15 WT 102, Wenting	Track 24 Human-AI Collaborative Decisions	378	Insuring AI Systems: Human Oversight and the Limits of Autonomous Deployment	Dr. Mina Iravani, Dr. Agni Orfanoudaki, Dr. Mihalis Markakis
	308			Effects of AI Based Triage Systems on Patient Behavior	Meichen Liu, Dr. Haifeng Xu	

Date	Time	Venue	Stream	Titles		Authors
		Building, CJLU	Chair: Weihua Zhou	367	Is Involving Human Always Good? Use EEG to Understand Users' Emotional and Cognitive Experiences with Hybrid Service Chatbots	Lingyi Zhou, Xixian Peng, Chee Wee Tan
	48			Complementarity in Human–AI Collaboration: A Three-Component Theory, Conversion Mechanisms, and Empirical Validation	An Li, Chuanyin Guo, Qihong Zhao	
	421			Too Close for Comfort? Human-AI Relationship Framing and Customer Decision: Empirical Insights from Experiments	Yuguang Xie, Peiyu Zhou, Changyong Liang, Dongxiao Gu	
		Parallel Session SU16 MB 600, Mingde North, CJLU	Track 16 Platform Supply Chain Operation Optimization & 4 Smart and Intelligent Port and Shipping Logistics Services Chair: Baoli Shi	227	Dynamic Government Subsidy Mechanisms for Green Transformation and Dual-Channel Coordination: An Evolutionary Game and System Dynamics Approach	Jing Wang, Qing Zhang
	20			Inventory Policies for Cash-Constrained Retail Service Providers	Youssef Boulaksil	
	19			An evolution analysis of living streaming governance: Deceptive advertising and non-compliant operation	Dr. Baoli Shi	
	52			Two-Period Pricing and Platform Sales Model Selection Under Informed Privacy Consent	Zhongmiao Sun, Yijie Fu, Dr. Baoli Shi	
		Parallel Session SU17 MB 305, Mingde North, CJLU	Track 25 Data Quality Management Chair: Haiyan Yu	196	Algorithmic equity in emergency care: Uncovering the social determinants of spatiotemporal EMS demand for responsive dispatch	Yuchen Lei, Cc Yan, Fangqi Liu, Chenlu Li, Ying Zhang, Haiyan Yu
	118			The Impacts of EHR on Heart Transplants: The Role of Meaningful Use Program	Yulin Nie, Chao Zhang, Qiaochu He	

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				276	More Human-like, More Risky? The Trust-Anthropomorphism Paradox in Digital Human Live Streaming: An Explainable AI Approach	Mr. Keyan Chen, Dr. Haiyan Yu, Ms. Siqi Duan, Mr. Fangbo Fu		
				422	How Quality 4.0 Shapes Innovation Performance: A Nonlinear Explanation from Dynamic Capabilities	Yujia Deng, Tong Lv, Can Cai, Hongtao Wang		
				423	Enhancing Public Data Supply Quality and Efficiency: A Revenue-Feedback and Trust-Building Perspective	Jing Shen, Yanrui Jing, Yang Zhang		
		Parallel Session SU18 MB 102, Mingde North, CJLU	Track 26 AI driven Financial Service & 28 AI for Finance & 10 AI-Driven Service Innovation: From Personalization to Hyperautomation <i>Chair: Jian-Jun Wang, Liping Zhou</i>	220	Research on the Impact of Banking Network Structural Characteristics on Systemic Risk	Zhang Yicong		
				123	Risk-Sensitive Reinforcement Learning with Costly Signals and Information Choices	Dr. Tingjin Yan, Prof. Yun Shi		
				279	Two-Stage Robust Optimization for Rural Mobile Medical Fleet Routing with Endogenous Service Time Trade-off	Hengjia Zhang, Prof. Canrong Zhang		
				31	Data-Driven Operating Room Planning and Scheduling: A Comprehensive Review and Future Directions	Yu Wang, Shuzheng Zhang, Jiafu Tang, Yu Zhang		
					209	Data-Driven Facility Layout for Enhancing Walk Appeal in Walkable Neighborhoods	Haoran Guo, Sentao Miao, Wei Qi, Jian Cui, Zhenning Dong	
		June 1	8:20 AM – 10:00 AM	Parallel Session MO01 Auditorium	Track 17 Data-Driven Prediction and Optimization	162	Interpretable Metric System for Academic Potential Prediction: Integrating Network Topology and Decision Support	Dr. Keqin Guan, Prof. Wai Kin (Victor) Chan

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		(2nd Floor), Wenting Building, CJLU	in Emergency Management & Resource Allocation and Scheduling in Service Systems <i>Chair: Victor Chan</i>	166	Context-Aware Scholar Recommendation via Conditional Diffusion on OpenAlex	Runqing Miao, Sihong Zhang, Dingyu Zhou, Mr. Yonghao Zhang, Jiadong Liu, Wei Chen, Prof. Wai Kin (Victor) Chan
	203			MAOCG: Multi-Agent Reinforcement Learning for Opinion Consensus Guidance in Online- Offline Social Networks	Meixi Song, Ningyu Liao, Guilherme Almeida Ferreira, Prof. Wai Kin (Victor) Chan	
	222			Cross-City Transfer for Spatial OHCA Risk Prediction without Local OHCA Records	Chih-Yuan Yang, Mingchuan Yang, Dr. Xinglu Liu, Li Li, Bin Zhang, Prof. Wai Kin (Victor) Chan, Kexin Cao	
	408			A DQN-based Approach for Real- Time Scheduling in 5G-V2X Edge Computing Networks	Wenbo Zhang, Zhaosheng Yao, Yu Yang, Kun Song, Jining Liu, Prof. Wai Kin (Victor) Chan	
		Parallel Session MO02 WT 204, Wenting Building, CJLU	Track 21 Data Driven Decision Making in Service Systems under Uncertainty & 18 Reliable Facility Location and Transportatio n Operations in the Digital- Intelligence Era <i>Chair: Houcai Shen</i>	393	Internalizing Behavioral Queue Aversion in EV Charging: A Decision-Dependent DRO Approach	Xuedong Wang, Hongli Xu, Prof. Caihua Chen
	391			Incentives through Case Assignment	Dr. Xiaohan Zhu	
	398			Managing Cooperative Advertising in the Presence of Cross-Channel Spillover	Jixin Zhao, Zheyu Jiang, Prof. Houcai Shen	
	324			End-to-End Learning for Constrained Inventory Reconfiguration	Prof. Hongyan Dai, Ruiqi Zhang, Prof. Zihao Jiao	
	327			How Can Government Automobile Trade-In Subsidy Policies Boost Domestic Demand and Enhance Environmental Sustainability?	Dr. Hang Zhang	
		Parallel Session MO03	Track 10 AI- Driven Service	339	Dynamically Reactive and Predictive Surgery Scheduling	Lixiang Zhao, Han Zhu

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		WT 102, Wenting Building, CJLU	Innovation: From Personalization to Hyperautomation <i>Chair: Gang Du, Jian-Jun Wang</i>	139	When AI Empathy Backfires: The Mismatch Effect of Emotional Support in Human-AI Service Handoffs in Online Healthcare	Anfei Xia, Prof. Jian-Jun Wang, Jierui Zhang
				333	The Impact of Hashtag Challenges on User Engagement in Sports Mobile Applications	YiLin Lv
				34	Optimizing Server Locations in Spatial Service Systems: Parametric and Nonparametric Bayesian Optimization Approaches	Prof. Cheng Hua, Prof. Arthur Swersey, Wenqian Xing, Yi Zhang
				32	Real-time scheduling of multi-test outpatient services: integrating appointment plans with operational uncertainties	Junpeng Wang, Yanan Zhu, Yang Wang, Erik Demeulemeester, Abraham Punnen
		Parallel Session MO04 MB 600, Mingde North, CJLU	Track 16 Platform Supply Chain Operation Optimization & 12 Data- Driven Intelligence: Integrating Analytics, Artificial Intelligence, and Machine Learning for Smarter Decision- Making <i>Chair: Satish Srinivasan</i>	161	Strategic inventory and supplier development investment under downstream competition	Shuangyu Xu, Junfeng Tian, Prof. Wei Li
				240	AI identity disclosure and platform regulation in digital human live streaming commerce: An evolutionary game analysis	Yanfen Zhang
				251	Strategic Governance: Analysis of Instant Refund Service Considering Fraud Risks and Repurchase Incentives	Xiaoyong Wu, Jing Chen, Weili Xue, Peixuan Li
				245	Supply Chain Emission Reduction Strategies Based on Blockchain Technology under Different Carbon Policies	Qianyao Zhang, Qing Zhang
				416	Configuring Supply Chain Resilience: An Integrated Fuzzy-set Qualitative Comparative Analysis and Machine Learning Approach	Hao Zheng, Qiuyu Chen, Bao Xie, Xin Jin, Wenjun Zeng

Date	Time	Venue	Stream	Titles		Authors
		Parallel Session MO05 MB 305, Mingde North, CJLU	Track 7 Data-driven Applications in Healthcare Operations Management & 9 Rules-based vs. Data-driven: Decision-Making Strategies for Smart, Sustainable Service Systems <i>Chair: Jiajing Huang</i>	42	Data-Driven Prediction of Biologic Treatment Response in Pediatric Crohn's Disease Using Longitudinal Single-Cell Transcriptomics	Peng Qiu
				374	A Machine Learning Framework for Optimizing Travel Restriction Interventions in Response to Infectious Disease Outbreaks	Elias Mohellebi, Prof. Satish Mahadevan Srinivasan
				13	An Entropy-Based Causality Framework for Cross-Level Faults Diagnosis and Isolation in Building HVAC Systems	Prof. Jiajing Huang
				418	A Novel Early Warning Method of Deep Foundation Pit Collapse Risks Based on Temporal Knowledge Graph	Tianyu Xiang, Wenteng Fan, Yueyang Zhao, Yingbo Ji, Assoc. Prof. Xinnan Liu
				354	Pixel-level Crack Segmentation and Quantification of Building Facades Using Deep Learning	Yanyao Li
		Parallel Session MO06 Auditorium (2nd Floor), Wenting Building, CJLU	Track 17 Data-Driven Prediction and Optimization in Emergency Management & Resource Allocation and Scheduling in Service Systems & 13 Data Based Operations Management in Service Industry <i>Chair: Qiang Su & Victor Chan</i>	208	Prediction-Driven AI Deployment for UAV-Assisted Emergency Communication Service Systems	Ningyu Liao, Meixi Song, Prof. Wai Kin (Victor) Chan
				116	Outpatient Appointment Scheduling with Stochastic Re-entry and Patient Unpunctuality	Prof. Qiang Su, Yichen Wang, Zian Zhuang
				229	V2G Pricing for Enhancing Service System Resilience under Constrained Real-Time Coordination	Yuanrui Li, Professor Junxiang Li, Ziyi Yang
				238	CVaR-Oriented Bayesian Network with Side Information for Medical Supply Chain Risk Assessment Under Disruption Propagation	Ming Liu, Xiangye Yao, Chengbin Chu, Feng Chu, Feifeng Zheng
				182	A Branching Dueling Q-Network-Based Multi-Objective Hyper-Heuristic for Multi-Stage Outpatient Scheduling Problem	Zian Zhuang, Prof. Qiang Su, Yichen Wang
	10:20 AM – 12:00 PM					

Date	Time	Venue	Stream	Titles		Authors
		Parallel Session MO07 WT 204, Wenting Building, CJLU	Track 22 Intelligent Manufacturing and Logistics Operations Optimization <i>Chair: Zhi Pei</i>	292	Vehicle Routing for Sustainable Urban Logistics under Urban Access Regulations	Sejeong Kang, Ilkyeong Moon
	273			Who Bears the Cost of Railway Network Resilience in a Warming World?	Haoyu Wang, Dongjunn Li, Jingxin Dong	
	128			Planning Human–Robot Collaborative Reconfigurable Manufacturing Systems under Workforce Absenteeism Uncertainty	Feifeng Zheng, Dr. Chenchao Zhu, Prof. Huaxin Qiu, Ming Liu	
	223			Digital Empowerment or Traditional Channel? A Tripartite Evolutionary Game Analysis of Export-to-Domestic Sales Transition under Tariff Shocks	Fuying Chen, Shanwu Luo, Tingting Tian	
	219			Supply Chain Network Design with Hybrid Fixed and Mobile Factories: A Bi-Objective Location-Routing Optimization	Zixuan Li, Xu Huai, Qiang Du	
		Parallel Session MO08 WT 102, Wenting Building, CJLU	Track 7 Data-driven Applications in Healthcare Operations Management <i>Chair: Xiaolei Xie</i>	3	Revolutionizing Prime Time Efficiency: Data-Driven Robust Operating Room Planning and Scheduling with Uncertain Durations and Emergencies	Ze Cao, Xiaolei Xie, Mingda Liu
	289			A Novel Hybrid Ordinal Learning Model with Health Care Application	Jing Li	
	283			Empowering Attended Home Healthcare Service: A Robust Strategy to Pre-schedule On-Demand Newcomers	Mingda Liu, Chun Peng, Xiaolei Xie	
	284			Pooling vs. Dedication: Analytical Staffing for Multi-class Multi-Stage Emergency Department Queueing Networks	Mr. Xu Dai, Zhenghao Fan, Xiaolei Xie	
	286			The Impact of Workload and Shift Patterns on AI Reliance in Medical Imaging: A Multi-Factor Statistical Analysis	Dr. Jia Li, Dr. Han Lv	

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		Parallel Session MO09 MB 600, Mingde North, CJLU	Track 23 Vision and Intelligent based Metrology <i>Chair:</i> Liang Shan	358	HC-TSNet: Dual-Branch Micro-Expression Recognition Network Based on Multi-Scale Feature Fusion and Temporal Sensitivity	Yecheng Han, Xianghu Yue, Wenhuan Lu, Minghao Guo, Jianguo Wei
	348			Feature Disentanglement Model with Multi-level Alignments for Cross-Domain Hyperspectral Image Classification	Yunfei Xu, Minchao Ye, Prof. Weiqi Yan	
	254			Confidence Penalty-Based Multi-Model Collaborative Continual Learning Framework	Yuzhen Wu, Chen Pan	
	84			Precision Medical Image Generation Based on Large-Scale Diffusion Models	Wanli Huo, Jingyu liu	
	258			Deep Learning-Based Code Identification and Authenticity Verification for Luxury Handbag	Zhigang Gao, Jian Li, Zesen Wang, Jianxiang Sun, Qichao Fei	
		Parallel Session MO10 MB 305, Mingde North, CJLU	Track 25 Data Quality Management & 14 Service Management in Healthcare <i>Chair:</i> Haiyan Yu	41	Digital Transformation of Traditional Chinese Medicine	Prof. Haiyan Yu, Xu Zhang, Zhenyu Shi, Tao Huang, Jinxiang Tang, Ling Qiao, Wei Wang, Qingcai He
	275			A Reliable Pipeline for Kinematic Analysis and Multi-regional Quantification of Mouse Facial Features	Shiconghui Yuan, Siqi Duan, Yifeng Liang, Linghan Ouyang, Haiyan Yu	
	409			A Semi-Supervised Learning Approach to Predicting Pavement Conditions with Laser Crack Measure System (LCMS)	Dr. Lihui Bai, Xiaoyu Chen, Bijan Bibak	
	313			Promote radiation dose management based on medical imaging cloud platforms	Yantao Niu	

Abstracts of Paper

Session SA01 (Best Conference Paper Competition)

Paper ID: 164

Paper Title: Intelligent Joint Fee Optimization for Port Logistics Services

Authors: Bing Han, Tianze Chi, Ying Zhang

Abstract: Port logistics network predominantly relies on road transport, and road congestion will have a negative impact on port operations. This study examines the logistics issues within the port hinterland by implementing a combined fee scheme consisting of road tolls and rail subsidies. The proposed approach encourages shippers to opt for multimodal transport, alleviating road saturation. A bi-level programming model is developed to minimize road congestion waiting times and port losses, along with corresponding solution methods. The real-world case of Tianjin Port demonstrates that the fee scheme can mitigate 35% of road saturation while increasing rail freight volume by nearly 10%. Additionally, the analysis of case data reveals the interrelationships among optimal fee schemes, shipper characteristics, cargo types, and rail freight stations. The study can assist port enterprises or local governments in better formulating toll policies, improving the current state of highway transportation congestion, and correspondingly reducing the resulting carbon emissions.

Paper ID: 388

Paper Title: How Different Modes of Doctor Recommendation Affect Patients' Adoption Intentions: a task-technology Fit Perspective

Authors: Gang Du

Abstract: As online consultation services expand, understanding how different human-AI collaboration modes influence patients' adoption intentions becomes crucial. This study examines the impact of different doctor recommendation modes (AI algorithm-only, AI algorithm-dominated, human-dominated, human-only) on patients' intention to adopt doctor recommendations through a scenario experiment. The results showed that patient adoption intentions were higher for human-dominated and human-only modes compared to AI algorithm-only. There were no significant differences in the effects of AI algorithm-dominated versus AI algorithm-only and human-dominated versus human-only modes on patient adoption intentions. Patients' perceived fit mediated the effects of different recommendation modalities on adoption intentions, while patients' expertise moderated the effects of different healthcare recommendation modes on patients' adoption intention. The findings enrich human-AI collaboration

research in healthcare and guide online medical platforms in selecting appropriate recommendation modes.

Paper ID: 372

Paper Title: Congestion-Aware Static LLM Cascades: Analysis of a Steady-State Framework

Authors: Yuan Guo, Stefanus Jasin, Chen-An Lin

Abstract: We study congestion-aware static routing across heterogeneous large language models (LLMs). Unlike model-cascading methods that treat inference costs as exogenous, we model LLM serving as a multiclass queueing network in which routing decisions endogenously determine latency. Jobs may query up to L distinct models, and total cost combines query fees, Bayesian misclassification loss, and steady-state waiting cost. We show that the routing problem is convex, the optimal load vector is unique, and the optimal policy admits a congestion-pricing interpretation. We quantify the penalty of ignoring congestion, and show that the value of additional depth decays exponentially. We further consider a family of adaptive policies and establish high-penalty near-optimality of static routing relative to adaptive policies. Finally, we extend the framework to general service times through a many-replica $M/G/1$ -FCFS limit.

Paper ID: 311

Paper Title: Navigation-Aware Energy Consumption Modeling and Charging Infrastructure Planning for Low-Altitude UAV Networks Using Graph Attention Networks

Authors: Zi-Xuan Zhou, Jiawei Feng, Wenjun Mei

Abstract: Accurate energy consumption prediction is critical for reliable unmanned aerial vehicle (UAV) operations in dense urban environments, yet conventional models neglect the impact of navigation signal degradation on flight energy efficiency. In urban canyons, Global Navigation Satellite System (GNSS) signals are severely occluded by high-rise buildings, forcing UAVs to reduce speed, take detours, and activate auxiliary sensors, all of which substantially increase energy consumption.

This paper proposes a navigation-aware energy consumption model that couples GNSS-based navigation quality with UAV power consumption through three mechanisms: speed constraint under positioning uncertainty, detour cost for obstacle avoidance, and adaptive sensor power switching. We construct a three-dimensional navigation quality map over a synthetic urban area using ray-tracing satellite visibility analysis and Dilution of Precision computation. A Graph Attention Network (GAT) is then trained to predict the navigation-induced energy ratio on an airway graph, achieving $R^2 = 0.994$ and $MAPE = 0.41\%$ at 50m altitude. The analytical power model

is validated against 196 real flights from the DJI Matrice 100 dataset ($R^2 = 0.958$). Cross-validation experiments demonstrate that charging stations planned with the traditional energy model exhibit a 100% route failure rate under realistic navigation conditions, underscoring the necessity of navigation-aware infrastructure planning.

Paper ID: 328

Paper Title: Signaling Value in the Age of AI: How Generative AI Adoption Reshapes Pricing Strategies in Online Labor Markets

Authors: Fei Wang, Yingpeng Zhu, Liy Yang, Zike Cao

Session SA02 (Best Student Paper Competition (I))

Paper ID: 230

Paper Title: An LLM-Driven Bayesian–Stackelberg Game for Expert Recommendation Platforms: Equilibrium, Mechanism Design and Empirical Evaluation

Authors: Mr. Yonghao Zhang, Shaoru Ye, Jing Luo, Dingyu Zhou, Runqing Miao, Prof. Wai Kin (Victor) Chan

Abstract: Online expert recommendation platforms increasingly rely on large language models (LLMs) to score the semantic match between projects and experts. Existing market-design analyses, however, treat the platform as a deterministic Stackelberg leader, treat raw social welfare as the only performance metric, and ignore both the stochasticity of LLM outputs and the strategic responses of project owners and experts. We formulate a three-party Bayesian–Stackelberg game in which the platform commits to a stochastic mechanism that combines an LLM scoring policy with a deterministic capacity-aware allocation rule and an internally optimised commission rate. We define a new equilibrium concept, the **LLM-BSE** equilibrium, characterise it via an iterative best-response algorithm, prove existence in mixed strategies via Reny’s better-reply security, and bound the welfare gap between the stochastic mechanism and a deterministic oracle, which we call the *Price of Stochasticity*. We complement raw welfare with a Sustainable Welfare indicator that excludes project owners whose individual rationality is violated. On 100 independent markets, seven baselines, four ablations, three sensitivity axes, five LLM backbones and a Price-of-Stochasticity validation experiment, the proposed mechanism delivers a sustainable welfare of 23.1 ± 4.6 . It more than doubles the strongest non-game ranking baseline (Greedy-LLM, 10.9 ± 4.6 , $p < 10^{-15}$), improves on a traditional deterministic Stackelberg mechanism (22.6 ± 4.4 , $p = 0.015$), reaches 99.9% owner participation, and lies within 8.9% of the deterministic oracle. A decomposition shows that more than 95% of the price of stochasticity is paid for the mechanism itself, while LLM randomness contributes less than 2%.

Paper ID: 279

Paper Title: Two-Stage Robust Optimization for Rural Mobile Medical Fleet Routing with Endogenous Service Time Trade-off

Authors: Hengjia Zhang, Prof. Canrong Zhang

Abstract: The deployment of mobile medical facilities is vital for rural healthcare accessibility, where traveling directly consumes severely limited service-time resources. Compounded by uncertain patient demand, this creates significant challenges for fleet sizing and vehicle routing. This paper proposes a two-stage robust optimization model for the Robust Mobile Medical Fleet Problem (RMMFP) to address these challenges. To solve the resulting formulation, we develop a dual-method framework: an exact Column-and-Constraint Generation (C&CG) algorithm for certified robust optimization, and a tailored Simulated Annealing-based Matheuristic (SA-MATH) for scalable scenario-wise stress evaluation. The C&CG algorithm solves the two-stage robust model on small-to-medium networks, while SA-MATH exploits the extreme-point structure of the budgeted uncertainty set to rapidly identify high-stress demand scenarios and evaluate their deterministic counterparts on large networks. Numerical experiments on instances calibrated from real rural-healthcare records validate the proposed model and solution framework. The results further reveal a saturation effect in the price of robustness, providing actionable managerial insights for cost-effective rural mobile healthcare deployment.

Paper ID: 277

Paper Title: AI-Enabled Effort in Competitive Service Markets with Stochastic User Equilibrium

Authors: Chuyue Chen, Zichen Mei, Hongzhi Lin

Abstract: Although AI is increasingly becoming a strategic instrument in service competition, how AI-enabled service effort reshapes market equilibrium through consumer choice remains insufficiently understood. This paper studies this problem in a competitive service market with multiple providers and heterogeneous consumer segments. Providers choose prices and AI-enabled service effort, while consumers make probabilistic choices among providers and an outside option under service access frictions. The resulting stochastic consumer-choice equilibrium and providers' effort decisions are formulated as a computable variational inequality system. Numerical experiments generate three findings. First, unilateral AI adoption increases the adopter's demand, price, and profit, with an interior optimal effort level. Second, when competitive positions differ, weaker providers benefit mainly by attracting consumers from the outside option, whereas stronger providers benefit mainly by capturing rivals' demand. Third, simultaneous AI adoption reduces the share of the outside option and expands total market demand, but the profit gains are uneven and may intensify investment rivalry. These results provide a behavioural and computable framework for

service management decisions on AI investment, competitive positioning, and market governance.

Paper ID: 155

Paper Title: Collaborative Drone and Human Courier Delivery in the Gig Economy

Authors: Mr. Zhiwei Ren, Prof. Li Xiao, Prof. Canrong Zhang, Prof. Xin Weng

Abstract: The low-altitude economy, such as drone food delivery, still cannot work without human support. This paper studies a delivery system where human couriers and drones work together in two stages. First, a courier moves the order from the restaurant to a launch site. Then, a drone carries it to a locker for the customer to pick up. In many cases, companies use new technology to replace workers and cut costs, which can hurt labour welfare. However, our research shows that in the gig economy, using drones to improve efficiency does not always harm couriers. In fact, it can sometimes improve their welfare. We also found that having more patient customers is not always a good thing.

Because the number of couriers affects the system in complex ways, more patience can even lead to zero profits for the platform. We use a single-server model to see how the environment affects decisions and a multi-server model to check if these results are consistent.

Session SA03 (Track 21 Data Driven Decision Making in Service Systems under Uncertainty)

Paper ID: 390

Paper Title: Joint Planning and Operations of Wind Power under Decision-Dependent Uncertainty

Authors: Zhiqiang Chen, Prof. Caihua Chen, Jingshi Cui, Prof. Qian Hu, Wei Xu

Abstract: We study a joint wind farm planning and operational scheduling problem under decision-dependent uncertainty. Geographic heterogeneity in wind power resources induces stochastic fluctuations that can partially offset one another—a phenomenon known as the smoothing effect. Capturing this effect requires strategic capacity allocation, which introduces decision-dependent uncertainty. At the same time, joint planning and operations must address long-term complexity, where traditional stochastic optimization faces a trade-off between statistical robustness and computational burden. To address these challenges, we propose a two-stage distributionally robust optimization model with a decision-dependent Wasserstein ambiguity set, where both the distribution and the radius adapt to planning decisions. The resulting decision-dependent radius contracts at the $O(N^{-1/2})$ rate and avoids

the dimensionality dependence. The model is reformulated as a mixed-integer second-order cone programming, incorporating an empirical approximation and a regularization term that includes variance-covariance estimates for the wind power resource of each farm. We further establish finite-sample guarantees for both cost and power stability. These theoretical insights motivate an asymmetric sampling strategy that leverages large datasets for variance-covariance estimation while using smaller datasets for optimization. To improve computational efficiency, we develop a constraint generation based solution framework that accelerates the solution procedure by hundreds of times. Numerical experiments using different datasets validate the effectiveness of the solution framework and demonstrate the superior performance of the proposed model. Our results offer clear managerial implications for renewable energy planning under uncertainty: (i) information quality outweighs quantity—covariance information should be incorporated only when it is sufficiently reliable; otherwise, it may compromise power stability; and (ii) effective data utilization is more valuable than simply increasing data quantity—the asymmetric sampling strategy can achieve comparable performance with substantially lower computational effort.

Paper ID: 392

Paper Title: A Learning and Rectification Algorithm for Nonstationary Online Linear Programming

Authors: Jiawen Yang, Xingyu Lu, Prof. Caihua Chen, Wei Lu, Baozhuang Niu, Jun Zhou

Abstract: This paper investigates online linear programming (OLP) under resource capacity constraints, aiming to maximize total reward over a finite horizon. To address the limitations of stochastic models in nonstationary settings and the conservatism of adversarial models, we introduce a globally nonstationary and locally stationary arrival model to the OLP context. This framework partitions the horizon into known periods where requests are independent and identically distributed within each period, while the underlying distribution varies across periods, balancing environmental evolution with local stability.

Assuming the true distribution is unknown, but an inaccurate prior is available, we propose the Gradient Descent with Learning and Rectification (GDLR) framework. This dual-based method optimizes budget consumption for each request through two complementary components: a learning component that leverages local stationarity to refine estimates by combining prior knowledge with real-time observations, and a rectification component that counters global nonstationarity by adaptively adjusting estimates based on cumulative resource imbalance.

Theoretically, we demonstrate that rectification serves as robust optimization against estimation errors in dual and ensures primal feasibility. The regret bound of GDLR decomposes into intrinsic stochasticity, estimation error, and allocation suboptimality, with the latter two significantly reduced via learning and rectification. Empirically, our

approach consistently outperforms baselines on synthetic and real-world datasets. To our knowledge, this work presents the first enterprise OLP deployment at Alipay, achieving a 2.2\% average revenue gain in online A/B tests.

Paper ID: 397

Paper Title: Collaborative Production Scheduling Problem under Uncertainty

Authors: Tianqi Cai, Prof. Qian Hu

Abstract: This study addresses the Collaborative Production Scheduling Problem in Supply Chains (CPSP-SC), a highly coupled optimization problem integrating multi-factory production, inter-factory flows, and distribution decisions. We develop a unified spatio-temporal network-flow model that systematically captures production, inventory, and transportation interactions across multiple nodes and stages.

To overcome the computational challenges of long-horizon coordinated scheduling, we propose a Rolling-Horizon Nested Benders Decomposition (RH-NBD) algorithm. By embedding nested Benders cuts into a rolling-horizon structure, the method simultaneously achieves dynamic decision revision and global cost-to-go approximation, effectively mitigating myopia while preserving adaptability. This integration constitutes a methodological innovation beyond existing supply chain coordination approaches.

Considering pervasive processing-time uncertainty, we further introduce a Robust RH-NBD framework. By combining polyhedral uncertainty sets with a master-subproblem architecture, the approach transforms the multi-stage robust model into a sequence of tractable deterministic subproblems, ensuring both feasibility and solution stability under worst-case scenarios.

Computational experiments demonstrate that the proposed models and algorithms significantly improve solution quality, robustness, and scalability compared with deterministic and traditional decomposition baselines. The results offer a practical and generalizable pathway for real-time, uncertainty-aware collaborative scheduling in intelligent manufacturing.

Paper ID: 396

Paper Title: Competition between Service Platform: Myopic vs. Farsighted Stability

Authors: Hongqiao Chen, Pengfei Guo, Qingying Li, Yulan Wang

Abstract: In the platform economy, platforms often engage in both demand and supply competition. We consider two platforms competing through service prices and wages. Instead of exploring myopic stability, i.e., Nash equilibrium, which focuses on the immediate payoff change from a one-step deviation, the two competing platforms are farsighted and can anticipate their rivals' reactions. They consider the chains of

reactions following their initial deviation as well as the long-term consequences of their actions. We model the competing platforms by a queueing system where customers and workers strategically decide whether to join and which platform to join. We first determine the equilibrium of the worker-customer subgame and then analyze the platforms' service pricing decisions. To derive farsighted stability, we apply the concept of the von Neumann-Morgenstern farsightedly stable set (vNM FSS), which requires both internal and external stabilities. To find the vNM FSS, we first prove that any vNM FSS for the service platform competition is a singleton, and then show that a strategy profile being Pareto efficient is a sufficient and necessary condition to form a singleton vNM FSS. In this way, we identify all the vNM FSSs by determining the Pareto-efficient strategy profiles. We show that while myopically stable outcomes leave both platforms zero profit, platforms can coexist in the market and earn positive profits at the farsightedly stable outcomes. Farsightedness enhances the profitability of the platforms by fully extracting surplus from both the demand and supply sides. However, it cannot achieve the efficiency of a merged system where two platforms are operated by a single entity. We further show that the advantage of farsightedness over myopia is independent of the platform's structure (whether one-sided or two-sided), whereas the efficiency of farsightedness does depend on the platform's structure.

Paper ID: 394

Paper Title: Dynamic Competition in Online Retailing: Implications of Customer-to-Customer Interactions

Authors: Zheyu Jiang, Xin Geng, Nan Yang, Renyu Zhang

Abstract: Online retailing has increasingly become socially embedded, with customers frequently engaging in customer-to-customer (C2C) interactions such as reviews, social media posts, and recommendations, which significantly shape their purchase decisions. In a competitive context, we distinguish two types of C2C interactions: Within-brand interactions expand the future market specifically for the originating retailer, whereas cross-brand interactions generate a shared market benefiting competing retailers. This paper aims to investigate how these different types of C2C interactions influence dynamic competition among online retailers. We formulate a two-period duopoly game between newsvendor-type online retailers with asymmetric costs. Stock-out based substitution occurs within periods, and C2C interactions regulate market evolution across periods. We derive equilibrium outcomes under various scenarios and obtain three major findings. First, under cross-brand C2C interactions, the higher-cost retailer tends to stock less initially compared to the within-brand scenario, strategically leveraging the lower-cost retailer's larger stockpile and benefiting from market expansion at reduced inventory cost, a form of free-riding behavior. Second, equilibrium profit comparisons across scenarios can yield non-intuitive results. Specifically, the lower-cost (advantaged) retailer might achieve higher profits under cross-brand interactions, where competition is softened by shared market growth. Conversely, the higher-cost (disadvantaged) retailer can benefit more under within-

brand interactions, which intensify competition but allow it to retain control over its customer base. Third, when retailers have pricing flexibility, equilibrium prices exhibit contrasting trends. Under within-brand interactions, prices increase over time as firms leverage their exclusive market growth. In contrast, under cross-brand interactions, prices decline across periods as retailers aggressively compete to secure larger shares of the jointly expanded market.

Session SA04 (Track 6 Data-driven Optimizations for Smart City Operations)

Paper ID: 343

Paper Title: How Third-Party Quality Certification Shapes Consumer Experience: Evidence from Forbes Hotel Rating Changes

Authors: Chengxing Li, Sai Liang, Wenkang Wang

Abstract: This paper examines how third-party quality certification shapes consumer experience. Using star-rating changes in Forbes Travel Guide-listed hotels in the United States from 2018 to 2025 as a quasi-natural experiment, and drawing on hotel-month review data, we employ a synthetic difference-in-differences design to identify the causal effects of certification downgrades. We find that when a hotel is downgraded from a higher star tier to a lower one but remains on the list, consumer ratings increase significantly, while review volume does not change significantly. By contrast, when a hotel drops out of the list entirely, average ratings do not change significantly, but review volume declines substantially. Topic analysis of review texts further shows that, following within-list downgrades, reviews become less focused on fault-finding and shift more toward overall experience and value judgments; after complete delisting, however, reviews exhibit lower narrative effort and weaker expressive engagement. We propose a theory of evaluative-focus shift: third-party certification not only provides a quality signal, but also shapes how consumers use reviews. Within-list downgrades primarily alter how consumers evaluate, whereas delistings primarily alter whether they choose to express. Our findings reveal the heterogeneous effects of expert certification on consumer experience and online word of mouth.

Paper ID: 342

Paper Title: Scheduling Policies of Flexible Capacity in Supply Chains

Authors: Jingchuan Chen, Shaochong Lin, Zuo-Jun Max Shen

Abstract: This work is motivated by practical observations in supply chains, where some productive resources are arranged to serve two stages by switching regularly due to the unbalanced throughput of stages. In fact, the introduction of such flexible capacity can improve the performance of the supply chain. Therefore, we study

scheduling policies for a two-stage system with dedicated capacity in each stage and a flexible resource that can serve both stages. We find that a dedicated allocation policy, i.e., assigning the flexible resource to the stage of lower throughput rate, is optimal when switches are costly. Besides, our analysis shows that a dynamic scheduling policy is optimal when switch costs are medium, and we provide some instructions for scheduling the flexible resource dynamically. For the system with low-cost switches, we identify the optimal conditions for switching the flexible resource. Finally, we tentatively extend our results from single-cycle scheduling to policies for multiple cycles.

Paper ID: 323

Paper Title: Subsidizing Smart Tourism: Optimal Subsidy Policy for Attraction Digitalization under Competition

Authors: Xiaoxin Xie, Shigui Ma, Sai Liang

Abstract: Smart tourism has evolved from a technology-led agenda into a destination governance challenge. At the attraction level, digitalization can improve visitor experience and destination competitiveness, yet it is often underprovided because individual attractions do not fully internalize destination-wide spillovers. This paper develops a game-theoretic framework to study how destination governments should use start-up subsidies, performance-based subsidies, and hybrid schemes to promote attraction digitalization under competition. The model distinguishes between two margins of digitalization: adoption, which requires overcoming fixed costs, and post-adoption effort, which determines the intensity of digital investment. We show that start-up subsidies support participation but do not increase effort in response to stronger spillovers, whereas performance-based subsidies are necessary to transmit external benefits into attraction-level effort. Hybrid schemes provide the greatest policy flexibility because they separately address adoption and effort incentives. We further show that the optimal subsidy structure varies systematically with spillover strength, market size, tourist composition, and competition intensity, and that competition can induce opposite policy responses across regimes. The findings provide a theoretical foundation for destination governments to tailor digitalization policy to heterogeneous competitive environments.

Paper ID: 320

Paper Title: GAN-enhanced Heuristic Algorithms for Solving Complex Urban Traffic Problems: GAN-enhanced Heuristic Algorithms

Authors: Liwei Liu

Abstract: Complex urban traffic and routing problems are typically formulated as large-scale combinatorial optimization tasks. While exact algorithms struggle with

computational scalability and traditional heuristics often suffer from premature convergence, this paper proposes a GAN-enhanced heuristic framework that bridges offline structural learning with online evolutionary search. The approach leverages a Conditional Generative Adversarial Network (GAN) to extract transferable structural patterns from high-quality, small-scale instances. Specifically, the generator produces an edge-level structure-guidance matrix that is integrated into the initialization, crossover, and mutation phases of a Genetic Algorithm (GA). Unlike one-time initialization methods, this framework provides a persistent guidance signal throughout the evolutionary process. Benchmarked on the Traveling Salesman Problem (TSP) and Vehicle Routing Problem (VRP), the results demonstrate that the proposed framework consistently outperforms baseline GAs. Performance gains scale positively with problem complexity and size, highlighting the framework's robustness and scalability for complex urban logistics and traffic optimization.

Paper ID: 326

Paper Title: Analytics of Influencing Factors of Community Governance based on Spatial Search Method

Authors: Mengyi Sha

Abstract: Community governance is a key component of grassroot administration management system in our country, and also serves as the “last mile” for social governance. It also plays a crucial role in maintaining social stability and promoting the harmonious development of communities. With the rapid development of society and the continuous advancement of urbanization, the complexity and diversity of grass-roots communities are increasingly prominent, putting forward higher requirements for community inspection work. Effective community inspection can timely discover and solve problems in grass-roots governance and lay a solid foundation for the stable development of communities. However, previous research related to community governance is basically limited to case studies or qualitative analytics, and rarely adopts quantitative methodologies to analyze the problem. The inspection team and the inspected community are important components in the process of community inspection. To provide managers with more objective and interpretable decision support, in this paper, we analyze how the attributes of inspection teams and communities influence the effectiveness of community inspections. The historical inspection records can be regarded as the points in the multi-dimensional space, and identifying the range of attribute values where inspection issues frequently occur can be abstracted as a frequent subset search problem in a two-dimensional attribute space. We first employ logistic regression on the historical inspection records to identify critical two-dimensional attribute combinations. Based on the results, we propose a mixed-integer quadratic programming model to search a space where the inspection issues frequently happen, and transforms it into a mixed-integer quadratic programming model. To enhance computational efficiency and tractability, we also use McCormick inequalities to convert the model into a linear programming, and identify the smallest frequent

subset in space prone to inspection issues. Thus, the rectangle regions in the two-dimensional space, which do not overlap and are identified through the search process, represent the frequent subsets of inspection issues. To identify the attribute value ranges corresponding to a certain proportion of inspection issues, the proposed optimization model aims to minimize the sum of the areas of all frequent subsets, thereby ensuring that the distribution of inspection records with inspection issues within these subsets is more dense.

Based on the practical data of community inspection records, we conduct case studies on the problems of community personnel management and community assistance, and the results demonstrate the effectiveness of the proposed method. The method can be extended to other risk analysis and influencing factor analysis problems, overcoming difficulties such as insignificant regression analysis, the inability of association rules for continuous values, and the complexity of nonlinear programming. The proposed methodology and models also offer an alternative and effective decision support framework for improving the effectiveness of community inspections.

This model identifies the minimal infrequent subsets where inspection issues are likely to occur.

This research assists grassroots governance departments in focusing on critical issues and provides a scientific basis for decision-making in personnel allocation and resource management. It contributes to enhancing inspection efficiency and improving overall community governance.

Additionally, the study offers significant theoretical support for the improvement and development of future grassroots governance systems. The proposed framework provides valuable insights and methods for exploring more scientific and efficient grassroots governance models and facilitates the construction of a more refined and efficient inspection system.

Session SA05 (Track 18 Reliable Facility Location and Transportation Operations in the Digital-Intelligence Era)

Paper ID: 90

Paper Title: Integrated scheduling of battery electric buses and decentralized energy storage systems under capacity-dependent costs

Authors: Dr. Runfeng Cao, Feifeng Zheng, Ming Liu

Paper ID: 180

Paper Title: Continuous Takeoff and Landing of Bus-Aided UAVs for Last-Mile Delivery: A Bi-Objective Optimization Approach

Authors: Xu Huai, Zixuan Li, Qiang Du

Abstract: Efficient last-mile delivery is becoming increasingly critical in urban transportation, especially under rising passenger demand, traffic congestion, and low-carbon objectives. Traditional fixed-route bus systems often face challenges in meeting dynamic delivery requirements and optimizing resource utilization, particularly when urban areas are densely populated or when delivery tasks are time-sensitive. Bus-Aided Unmanned Aerial Vehicles (UAVs) have emerged as a promising approach, combining the mobility of buses with the flexibility of UAV operations to improve delivery efficiency, responsiveness, and system adaptability. Existing studies, however, predominantly rely on discrete UAV takeoff and landing points, which limits operational flexibility and underutilizes the dynamic distribution of bus routes, thereby restricting the full potential of bus-UAV collaborative systems.

This study addresses the problem of continuous takeoff and landing for bus-aided UAVs in last-mile delivery. A bi-objective optimization model is proposed to simultaneously maximize UAV delivery efficiency and minimize operational cost, while explicitly considering bus schedules, passenger transport demands, UAV energy and payload constraints, and the ability for UAVs to take off and land at any point along bus trajectories. By enabling continuous takeoff and landing, the model significantly enhances operational flexibility, task completion rates, and resource utilization, providing a more realistic and adaptive framework for integrated bus-UAV delivery systems.

To solve this complex problem, a hybrid optimization framework is developed. It combines candidate takeoff interval generation with a heuristic-exact algorithm to identify feasible UAV deployment options, while an improved genetic algorithm enhanced with local search is designed to efficiently handle large-scale, nonlinear combinatorial constraints. Additionally, the framework incorporates dynamic cost evaluation and time-window considerations to better account for traffic congestion, varying bus speeds, and UAV energy consumption over urban routes.

Simulation experiments are conducted using real-world urban bus routes and delivery demand data to validate the effectiveness of the proposed approach. Results indicate that continuous UAV takeoff and landing along bus trajectories increases task completion rates by 15-25%, reduces total system energy consumption by 10-18%, and maintains high-quality service for bus passengers. Sensitivity analyses further examine the effects of UAV endurance, traffic congestion levels, varying takeoff strategies, and different delivery task distributions on system performance, providing critical insights for practical deployment and operational planning.

Overall, this study introduces a novel paradigm for continuous UAV deployment in bus-assisted delivery systems. The findings demonstrate substantial improvements in

operational efficiency, flexibility, and sustainability, highlighting the potential of dynamic UAV-bus integration for future urban transportation and low-carbon last-mile delivery systems. The proposed framework offers a versatile tool for city planners and logistics operators seeking to optimize hybrid human-vehicle-drone delivery networks while addressing urban mobility challenges.

Paper ID: 363

Paper Title: Integrated scheduling optimization of AGV and double yard cranes in automated container terminals

Authors: Xiaoju Zhang

Abstract: Double yard cranes in one yard block refer to two yard cranes that run in different rails and can pass each other. They can both reach to the seaside and landside of the yard blocks. But interference between the double yard cranes occurs during picking up or putting down containers, which has to be solved when assigning tasks to the double yard cranes. AGVs assignment have also to be considered when scheduling yard cranes. This paper focuses on the integrated optimization of AGV and double yard cranes in automated container terminals, aiming to increase terminal efficiency through the coordination of multiple sub-operations. A mixed integer programming model is developed, which considers the interference of the double yard cranes. The objective is to minimize the completion time of all the tasks. To solve the problem, a branch and bound (B&B) based method is designed. Specifically, a heuristic algorithm is used to assign container tasks to AGVs, and B&B method is utilized to assign container tasks to double yard cranes. This paper derives pruning strategies and acceleration strategies based on model analysis to improve the efficiency of the algorithm. The effectiveness and validity of the proposed model and algorithm is verified through small-scale and large-scale experiments. Results are compared with that of commercial solver Gurobi.

Paper ID: 321

Paper Title: Operational Stress on On-Demand Delivery Platforms: Measurement, Consequences, and Scheduling Implications

Authors: Prof. Hongyan Dai, Prof. Zihao Jiao, Qin Xiao, Xianyi Xie, Yuqian Xu

Abstract: The explosive growth of on-demand delivery platforms has created unprecedented logistical efficiency but also transferred intense time pressure and workload risk to millions of independent riders. This paper develops a stress-aware operations framework that quantifies, predicts, and mitigates riders' operational stress within algorithmic dispatch systems. We first introduce a real-time, data-driven stress metric that extends classical workload measures to heterogeneous and interdependent delivery tasks by integrating time urgency and within-trip pacing. Using over 780,000 delivery records from a major Chinese platform, we empirically

validate that this metric captures both behavioral stress responses and their operational consequences-accelerated driving, income inequality, and reduced future labor supply. Building on these insights, we formulate a mixed-integer optimization model that embeds pre-trained random-forest predictors of delay and stress directly into dispatch decisions, thereby unifying behavioral prediction and prescriptive scheduling. To ensure scalability, we design a cluster-specific random-forest embedding and a Top-w truncation scheme based on a general magnitude measure, offering provable bounds on optimality loss. The proposed stress-aware scheduling reduces riders' workload stress and equalizes stress exposure across groups with minimal impact on delivery efficiency. The study advances the integration of behavioral sustainability into algorithmic operations, demonstrating how human-centered optimization can enhance both welfare and performance in gig-economy service systems.

Paper ID: 316

Paper Title: MDKLR: A Task-oriented Dialogue Generator Augmented with Multi-domain Knowledge and LLM-refinement

Authors: Yuanyuan Cai, Yiyao Zhang, Qingchuan Zhang, Zhouzhou Fan

Abstract: Task-oriented dialogue systems (TODS) confront pronounced challenges in low-resource domains, primarily due to scarce training data. Although large language models (LLMs) possess remarkable general language capabilities, they frequently exhibit limitations in precise knowledge retrieval and task-specific dialogue coherence. To bridge this gap, we propose MDKLR, a task-oriented dialogue generator augmented with multi-domain knowledge and LLM-refinement. The Domain-specific Knowledge Attention (DKA) module extracts linguistically salient context from knowledge triples via a dependency-aware attention mechanism. A talking-heads attention network then adaptively fuses cross-domain features to improve representational transfer. The LLM-refinement (LR) module subsequently refines the initial response, enhancing linguistic fluency while preserving factual accuracy. We evaluate MDKLR on the standard SMD and MultiWOZ2.1 benchmarks. Experimental results demonstrate that our model achieves substantial improvements in BLEU scores, with 22.1 on SMD and 11.45 on MultiWOZ2.1, while maintaining competitive entity F1 scores of 62.8% and 40.02%, respectively. Validated on task-oriented dialogue benchmarks, the proposed architecture balances factual accuracy with response naturalness for practical applications.

Session SA06 (Track 26 AI driven Financial Service)

Paper ID: 413

Paper Title: Explainable Financial Distress Prediction via Rule Distillation

Authors: Tianhao Yi, Jiaxuan Zhang, Prof. Zhiyong Li

Abstract: Financial distress prediction is critical for risk management. This study proposes an explainable framework balancing predictive performance and explainability via Rule Distillation. We extract explainable decision rules from an ensemble tree model, convert to rule features, and train them using transparent approaches based on Lasso. Empirical results indicate that Rule Distillation improves explainability while maintaining the high predictive performance of the ensemble tree model. Further trade-off can be made between predictive performance and explainability by adjusting the penalty parameters of Lasso. This method provides regulators and investors with a transparent decision-support tool for risk assessment.

Paper ID: 414

Paper Title: Integrate Mean-Variance Estimation with Portfolio Optimization

Authors: Dr. Ziyang Wang, Prof. Sirong Luo

Abstract: In finance and related fields, the predict-then-optimize paradigm first estimates model parameters from data and then solves an optimization problem using these point estimates. Although this approach can achieve low prediction error, it may lead to poor out-of-sample decisions because the predictive objective is generally misaligned with the downstream decision loss. We develop a decision-driven framework for mean–variance portfolio optimization that directly combines estimation with the downstream quadratic utility. We construct a convex surrogate that upper-bounds the nonconvex SPO loss, extending the original SPO/SPO+ framework from linear objectives to a fully quadratic setting. A key technical contribution is an explicit, efficiently computable subgradient with respect to both expected returns and the covariance matrix, enabling scalable end-to-end training via stochastic (sub)gradient methods. Building on this surrogate, we propose a unified factor-based approach that jointly models returns and covariance with shrinkage to improve robustness and interpretability. We further design an efficient learning algorithm with second-order updates and polynomial-time per-iteration complexity. Empirical evidence across multiple stock cases shows that the utility-based SPO+ approach delivers better risk-adjusted portfolio performance, with lower volatility and drawdowns and higher Sharpe ratios than competing methods. This supports our main claim that jointly estimating the mean and covariance under a decision focused loss leads to more stable and better out-of-sample portfolio allocations.

Paper ID: 102

Paper Title: Managing Quality Risk in a Decentralized Supply Chain: Contractual Incentives and Product Recall Insurance

Authors: Jing Chen, Hang Wei, Lei Xie, Chaonan Zheng

Abstract: We consider a two-echelon decentralized supply chain where the probability of selling nondefective products depends on the supplier's quality improvement and the buyer's inspection efforts. Products assembled from defective components cause a recall that leads to external failure costs for the buyer. Both players' efforts are not contractible and it is a challenge to align inspection and quality-improvement efforts in a decentralized supply chain. We find that a procurement contract can provide preventive incentives that induce high inspection efforts and enhancing incentives that enable the supplier to credibly commit to high-quality components. However, these contractual incentives only align two players' efforts under certain conditions. Interestingly, our findings suggest that introducing a product recall (PR) insurance requirement into a standard procurement contract provided by the buyer can complement enhancing incentives and lead to quality improvement in components. More importantly, as PR insurance can improve the flexibility of risk-sharing arrangements between the supplier and the buyer, we show that it can also serve as a coordinating role in improving the performance of a decentralized supply chain.

Paper ID: 132

Paper Title: From Serving Human Analysts to Empowering Agents

Authors: Lei Chai

Abstract: As financial digital transformation enters its critical stage, the application boundaries of AI are expanding from an "augmented mode" assisting human analysts towards an "autonomous mode" empowering intelligent agents, driving a fundamental paradigm shift in financial services. This paper addresses the core challenges in the practical implementation of financial AI. Grounded in the integration of engineering-oriented and business-oriented AI, and combined with the practical experience of the Magic Engine (ME) Platform, it systematically elucidates this evolutionary logic and technical pathway. First, a business-oriented AI system incorporating explainability is constructed. Through capabilities like rapid modeling, AI rule generation, and a "dual-brain system" integrating large language models (LLMs) with machine learning (ML) models, it overcomes hurdles such as high modeling thresholds and difficult implementation, thereby upgrading AI capabilities for serving human analysts. Building on this foundation, the Model Context Protocol (MCP) standardizes communication, breaking down barriers between LLMs and financial data platforms.

Core capabilities are then encapsulated into atomic, deterministic, functional units

(Tools), forming a collaborative model of "orchestration by LLMs + precise execution by Tools." This enables the critical transition from "human-machine collaborative assistance" to "autonomous decision-making by intelligent agents." This evolution reshapes the fundamental logic of financial services. By standardizing and tooling AI capabilities through atomic Tools, it propels financial services into a new phase characterized by "precise prediction + deep cognition + autonomous execution," providing core support and forward-looking reference for financial institutions to build a new generation of intelligent decision-making systems.

Paper ID: 122

Paper Title: Dynamic Mean-Variance Policies under Gaussian Mixture Models: An Integrated Estimation-Optimization Approach

Authors: Prof. Xiangyu Cui, Prof. Yun Shi, Zhao Si

Abstract: This paper studies a multi-period mean-variance portfolio problem when asset returns follow a Gaussian mixture distribution. We develop a data-driven framework that combines return modeling with portfolio optimization and compare two estimation approaches: the conventional estimate-then-optimize (ETO) method and an integrated estimation-optimization (IEO) method. Unlike ETO, which estimates model parameters solely from statistical fit, IEO directly selects parameters according to portfolio performance. We first derive the optimal dynamic portfolio strategy in a market with one risk-free asset and multiple risky assets under Gaussian mixture returns. We then extend the model to incorporate transaction costs and obtain the corresponding optimal policy. These results provide a tractable framework for dynamic portfolio choice under more flexible return distributions. We further analyze the performance of ETO and IEO under model misspecification. The theoretical results show that IEO is more robust because it aligns parameter estimation with the investment objective, while ETO may converge to parameters that fit the data well but perform poorly in portfolio decisions. Simulation results confirm that both methods work well under correct specification, but IEO performs better when the model is misspecified. An empirical study based on U.S. industry portfolio data also shows that IEO delivers returns closer to the target and achieves better risk-adjusted performance than ETO. Overall, the paper highlights the value of integrating estimation and optimization in dynamic portfolio selection.

Session SA07 (Track 5 Strategic Decision-Making in the AI-Driven Service Economy)

Paper ID: 411

Paper Title: Learning-by-Doing in Digital Services: A Sino-Western Comparison of User-Driven AI Iteration and Institutional Friction

Authors: Dr. Liufang Yao, Dr. Andrew Carrothers

Abstract: The "scale-first, iterate-later" pathway—characterized by rapid, large-scale user adoption preceding technological perfection—has emerged as a defining feature of digital service innovation in China, contrasting with the Western paradigm of frontier-technology development prior to market diffusion. Despite its practical prominence, the micro-mechanisms by which massive user participation accelerates technological iteration remain theoretically underexplored in the service science literature. This study addresses the following research question: Does largescale user engagement generate a quantifiable "service learning-by-doing" effect that accelerates AI-driven technological improvement, and how is this effect moderated by differing Sino-Western institutional environments?

Extending Arrow's (1962) theory of learning-by-doing to the context of service operations and digital platforms, this research proposes a novel service learning framework. We posit that within AI-centric digital services (e.g., LLMs, intelligent driving systems), each user interaction functions as a discrete "learning event." This process generates experiential data, exposes latent failure modes, and reveals heterogeneous usage scenarios, thereby compressing the cycle from problem identification to algorithmic solution. Crucially, we introduce the concept of institutional friction as a key moderating variable. We hypothesize that the efficiency of learning derived from user participation is amplified in China's integrated digital ecosystem—characterized by lower data fragmentation and policy-driven scaling incentives—whereas it is attenuated in Western contexts marked by stringent privacy regulations and higher costs of early-stage market education.

Empirically, this study employs a longitudinal panel design comparing major AI-driven services across Chinese and U.S. markets. Leveraging version iteration logs, user engagement metrics, and textual analysis of user feedback, we will quantify the relationship between cumulative service interactions and the velocity of technological upgrades. Instrumental variable approaches will be deployed to address endogeneity concerns between user scale and iteration speed.

This study offers three primary contributions to service science. First, it extends learning-by-doing theory from traditional manufacturing to digital service ecosystems, specifying the unique mechanisms through which user co-production fuels AI and data-driven innovation. Second, it bridges the service operations management literature with institutional theory by identifying friction as a determinant of cross-national variation

in service learning efficiency. Third, it provides the first systematic empirical comparison of the "scale-first" innovation model in digital platforms, offering both theoretical grounding for a widely observed phenomenon and actionable insights for multinational service firms navigating divergent institutional logics in the era of digitalization and AI.

Paper ID: 141

Paper Title: On-time Delivery Service with Compensation: A Queueing Game Approach

Authors: Xiaoli Cai, Hailun Zhang, Dr. Yinlian Zeng

Abstract: Online food delivery platforms increasingly offer on-time delivery (OTD) services with compensation to mitigate customer dissatisfaction from delays. Using a tripartite Stackelberg game framework in a queueing model, we analyze the strategic interactions between a platform, a restaurant, and delay-sensitive customers. For customers, due to compensation, they may prefer congestion, inducing Follow-the-Crowd (FTC) behavior, and they show interest in the OTD service when the service value is not high. For the platform, it tends to introduce the OTD service when the service value is moderate, and forgo it when this value is low owing to the potential high compensation. Counterintuitively, although the compensation is an expense for the platform, setting higher compensation rates can make the service more attractive, thereby increasing customers' willingness to pay and, in turn, enhancing the platform's profitability. For the restaurant, purchasing the OTD service for customers can boost profit in some cases. Importantly, even though platforms act in self-interest, OTD service can improve social welfare under certain conditions. These findings provide practical insights for designing the OTD service with compensation to improve customer satisfaction, platform profitability, and overall market efficiency.

Paper ID: 266

Paper Title: True Service Utility in Digital Ecosystems

Authors: Miss Yingrui Ruan

Abstract: In the hyper-competitive digital economy, platforms frequently deploy personalized service interventions—such as targeted incentives and premium positioning—to drive user growth. However, evaluating the true causal efficacy of these interventions is increasingly confounded by "algorithmic endogeneity": recommendation systems often "feed" interventions to users who already possess high organic purchase intent. This leads to a systematic overestimation of service utility in observational data.

This study develops a robust causal attribution framework utilizing Neyman-orthogonal Double Machine Learning (DML) to isolate the pure incremental uplift of platform

interventions from high-dimensional system-driven biases. Leveraging a unique, multi-source dataset from 2024 comprising transaction records from six diverse platforms (Tmall, JD, Taobao, Pinduoduo, Suning, and 1688), we construct a comprehensive "commerce spectrum" ranging from factory-direct sourcing to premium retail.

Our empirical results reveal a striking "Performance Illusion": while raw observational data suggests a substantial spending gap of 10.83 units between high-intervention and baseline platforms, our Neyman-orthogonal estimation reveals a true causal ATE (Average Treatment Effect) of only 0.87 units. This indicates that approximately 92% of the observed performance variance is attributed to algorithmic selection bias and user self-selection rather than actual service utility. Furthermore, heterogeneous treatment effect (HTE) analysis via Causal Forests identifies that mature user cohorts exhibit significantly higher causal responsiveness compared to younger cohorts, who are more deeply entrenched in "algorithmic cocoons."

Methodologically, this research advances the literature on Causal AI in Service Science by providing a scalable de-biasing toolkit for complex digital environments. Managerially, our findings challenge the conventional reliance on volume-based metrics, advocating for a shift toward incremental-value-based decision-making to optimize resource allocation and prevent strategic missteps in the digital platform economy.

Paper ID: 117

Paper Title: Incentive Mechanism Design for Federated Learning under Rényi Differential Privacy

Authors: Lijun Gao, Prof. Yinlian Zeng

Abstract: The practical deployment of federated learning is often constrained by insufficient participation of data owners, limited privacy budget supply, and difficulty in configuring the number of training rounds. Existing studies on incentive mechanisms mainly focus on payment design or data quality heterogeneity, while paying limited attention to the intrinsic relationship between privacy-constrained training loss and mechanism design. To address this issue, this paper investigates the federated learning incentive problem involving a single model requester (MR) and multiple data owners (DOs), proposing an incentive mechanism design framework that incorporates training convergence under the Rényi Differential Privacy (RDP) constraint. Based on the RDP-FedAvg protocol, we first establish a training performance analysis framework for general non-convex settings and derive an analytical proxy loss function with respect to the number of training rounds, the total privacy budget, and the participation structure. Furthermore, by embedding this proxy loss function into the MR's utility, a two-stage Stackelberg game model is formulated. The MR jointly determines the training rounds and incentive rules, while the DOs respond to the mechanism under privacy constraints by deciding their data sharing levels and privacy budget provisions. Analytical results demonstrate that the platform's optimization problem regarding

training rounds admits a unique optimal solution. This optimal number of rounds increases with the total privacy budget and decreases as the concentration of data contribution rises. Appropriate two-dimensional incentives can effectively screen data owners with heterogeneous data capabilities and privacy preferences, inducing differentiated data sharing and privacy budget allocations. Meanwhile, the training loss exhibits significant sensitivity to the concentration of data distribution; a more concentrated participation leads to a stronger amplification effect of privacy noise, thereby reducing the final achievable utility of the platform.

Paper ID: 24

Paper Title: Navigating the AI Frontier: China's Enterprises Expedition into Generative AI Implementation

Authors: Xianning Wang, Prof. Yinlian Zeng, Jun Li, Lina Wang

Abstract: The emergence of generative artificial intelligence (GenAI) presents potential for enhancing enterprise innovation and operational efficiency. This study develops a comprehensive conceptual framework by integrating the Technology-Organisation-Environment (TOE) model, the Technology Acceptance Model (TAM), and the Diffusion of Innovations (DOI) theory to investigate the factors influencing GenAI adoption. Utilizing a mixed-methods approach, we collected data through surveys and semi-structured interviews from a sample of enterprises in China. Key findings reveal that technology level, organisation capabilities, environmental conditions, and the innovation diffusion characteristics significantly influence the adoption of GenAI. Notably, while factors across all three TOE domains drive adoption, environmental elements-specifically emerging ethical concerns and legal risks- act as significant inhibiting forces. These results underscore the critical role of technology, organisation, and environmental factors, indicating the effects of ethical issues and legal risks for GenAI adoption in Chinese enterprises.

Session SA08 (Best Student Paper Competition (II))

Paper ID: 253

Paper Title: Drone Deployment in Hybrid Air-Ground Response Systems for Out-of-Hospital Cardiac Arrests

Authors: Jiani Miao, Kexin Cao, Dr. Xinglu Liu, Mingchuan Yang, Prof. Wai Kin (Victor) Chan

Abstract: Out-of-hospital cardiac arrest (OHCA) survival critically depends on rapid cardiopulmonary resuscitation and early defibrillation. However, conventional responder-only emergency systems often struggle to deliver automated external

defibrillators (AEDs) in time due to traffic congestion, geographic constraints, and uneven resource distribution. Recent advances in unmanned aerial vehicles (UAVs) offer new opportunities for rapid AED delivery, yet most studies consider UAV deployment in isolation without integrating ground resources, such as volunteer responders and publicly accessible AEDs. This study develops a hybrid air-ground emergency response model that jointly coordinates UAVs and ground resources to maximize expected survival rates.

The survival rate is characterized using a clinically derived logistic function that captures the relationship between response time and patient survival. To improve computational tractability, a precomputation-based linearization method is proposed, which significantly accelerates the solution process, achieving an average speed up of 242.93 and up to 893.30 in the best case. Experimental results show that the proposed hybrid system improves the average survival rate by 13.40% compared with the conventional responder-only system, highlighting the substantial benefit of UAV-assisted AED deployment and providing insights for the design of integrated emergency response systems.

Paper ID: 371

Paper Title: SHAP-Guided Data Augmentation for Small-Data Prediction in Emergency Service Systems

Authors: Linchao Li, Jiani Miao, Chih-Yuan Yang, Kexin Cao, Prof. Wai Kin (Victor) Chan

Abstract: Small-data prediction remains a persistent challenge in emergency service systems, where limited observations often weaken model stability and predictive usefulness. To address this issue, this paper proposes a SHAP-guided data augmentation method for small-data regression. The method first trains a predictive model on the original dataset and then uses Kernel SHAP to estimate sample-specific feature attributions. Guided by these local contributions, augmented samples are generated through perturbations of the original observations, so that the augmented data remain aligned with the learned predictive structure. The proposed method is first validated on benchmark regression tasks to examine its robustness and predictive effectiveness under controlled settings, and is then applied to a real emergency-related prediction problem using weekly NYC 911 EMS incident data. Experimental results show that the method provides stable and competitive improvements over nonaugmented and interpolation-based settings, leading to better predictive accuracy and generalization. The findings suggest that attribution-guided augmentation is a promising approach for data-driven demand prediction in emergency management and may support subsequent service planning and resource allocation.

Paper ID: 352

Paper Title: AI-Enabled Decision Support as a Service for Continuous Pharmaceutical Manufacturing

Authors: Haoyang Pan, Miaoxuan Zhou, Qiaochu He

Abstract: Continuous pharmaceutical manufacturing generates rich process telemetry but produces sparse, delayed quality measurements, creating a fundamental mismatch between data abundance and decision-relevant information.

We study this mismatch as an AI-enabled service design problem: how should a learned multistage surrogate be constructed and evaluated so that it reliably ranks corrective actions for operators across heterogeneous production batches? Using the MSD/Merck continuous tablet-manufacturing dataset, we formulate a control-ready surrogate that maps multistage process state and candidate actions to signed deviations from target hardness. We compare a sequential baseline adapted from MMP Net with a structured multistage surrogate derived from Multistage Net, and evaluate four decision layers—greedy action selection, deterministic model predictive control, adaptive conformal MPC, and latent-aware local search—under strict grouped cross-batch validation. The results distinguish prediction fit, action-ranking quality, and projected control quality. The advantage of the structured surrogate becomes clear once interventions are multivariate. Global residual-based uncertainty correction does not materially improve beyond the nominal controller under grouped cross-batch evaluation, whereas batch-aware candidate-set localization via latent clustering yields the clearest improvement. These findings reframe quality-prediction surrogates as decision-support services whose value must be judged by cross-batch action-ranking reliability rather than within-batch regression accuracy.

Paper ID: 228

Paper Title: Carbon-Budget Service Level Agreements for AI Compute Services: Dynamic Scheduling and Pricing under Renewable Uncertainty

Authors: Zi-Xuan Zhou, Junkai Cheng, Jiawei Feng, Wenjun Mei

Abstract: The rapid growth of AI computing has led to significant carbon emissions from data centers, yet existing mechanisms, particularly carbon taxation, prove ineffective for computing power scheduling. We propose a carbon-budget service level agreement (SLA) framework that integrates hard emission caps into AI task scheduling across geographically distributed data centers. We develop a Lyapunov-based drift-plus-penalty algorithm jointly optimizing task routing, dynamic pricing, and flexible task deferral, with $O(1/V)$ optimality gap and $O(\sqrt{\{V/T\}})$ constraint violation bound.

In computing infrastructures, data-intensive demand concentrates in urban regions while clean energy abounds in remote areas; the framework exploits this spatial asymmetry by migrating workloads toward low-carbon sites under enforceable SLA

constraints. Calibrated with real-world electricity tariffs, grid emission factors, satellite-derived renewable profiles, and production-scale AI workload traces, the proposed method reduces daily carbon emissions by 26.0% with zero SLA violations and 16.9% cost savings, while carbon taxation achieves merely 1.8%.

Session SA09 (Track 8 Systemic Modeling and Optimization for AI-Driven Service Innovation)

Paper ID: 243

Paper Title: Generative AI and Allocation Bias in Service Systems

Authors: Rowena Gan

Abstract: Many service systems rely on human managers to allocate scarce resources across incoming requests, such as emergency department triage, police dispatching, compliance review, or customer service routing. In these settings, requesters typically provide unstructured descriptions of their needs, which managers must interpret quickly under operational pressure. Organizations are increasingly introducing generative AI tools that convert these free-form inputs into standardized summaries that are easier to scan. While these summaries may improve efficiency and clarity, they may also omit or reshape relevant details even when requesters confirm that the summary appears accurate. This raises an important question: how does the introduction of generative AI decision support affect fairness and accuracy in resource allocation?

This project provides a framework for analyzing the fairness and operational implications of AI assisted decision support in service systems. We develop a theoretical model of a human manager who must prioritize cases that differ in their underlying level of urgency or need. Each case arrives with a requester-generated description that contains information about urgency but may vary in clarity across groups due to differences in communication styles, language proficiency, or familiarity with institutional norms. A generative AI system processes the description and produces a standardized summary. The original description remains available to the manager, but reviewing it requires additional cognitive effort.

The model has two key features. First, we conceptualize the generative AI system as a lossy information compressor. The AI-generated summary reduces noise and improves readability, enabling managers to process many cases quickly, but the compression process may also omit or shift important details. Second, the model incorporates endogenous attention. Managers can rely solely on the AI-generated summary or invest effort to inspect the original description for more accurate information, and this inspection decision depends on workload and the expected value of additional information.

Paper ID: 85

Paper Title: A Cognitive Digital Twin for Private Aviation Markets: LLM-Enabled Coordination and Optimization in Two-Sided Floating Charter Networks

Authors: Xinkai Xu, Professor Chun Wang, Saeed Golzar, Anojh Thayaparan

Abstract: Private charter aviation is a high-value yet underutilized transportation sector where aircraft frequently operate empty repositioning flights before passenger pickup and empty returning flights after trip completion, leading to significant inefficiencies in fleet utilization. These empty flights, commonly referred to as “empty legs”, are often associated with the fixed-base fleet model, which requires aircraft to return to their base after serving customers. Maximizing the utilization of these empty legs can significantly improve an operator’s bottom line. In contrast, floating fleet models allow aircraft to operate without returning to a fixed base. However, they introduce complex coordination challenges involving continuous routing, repositioning, and passenger–aircraft matching decisions across geographically distributed fleets. This paper introduces a Cognitive Digital Twin for Private Aviation Markets, a digital twin platform designed to connect charter aircraft operators and passengers within a real-time virtual private aviation network. The system integrates operational fleet data provided by operators with passenger demand signals collected through an interactive booking interface, including origin, destination, travel dates, passenger count, aircraft type, luggage requirements, and budget constraints. A key innovation of the framework is the integration of large language model (LLM) agents that serve as cognitive interfaces for both operators and passengers. These agents interpret travel intent, gather missing operational constraints, explain available flight options, and support dynamic negotiation of routing and pricing decisions within the marketplace. The platform further incorporates metaheuristic optimization algorithms for aircraft repositioning, routing, and passenger–aircraft matching, while a microservice-enabled multi-agent architecture models key entities including operators, aircraft, passengers, airports, and intermediaries. The main contributions are threefold: (1) a novel LLM-enabled cognitive digital twin architecture for private aviation markets, (2) an AI-driven interaction layer that automates coordination in two-sided charter markets, and (3) optimization methods that improve fleet utilization and market efficiency. A case study based on the Canadian private charter aviation market demonstrates the feasibility and potential benefits of the proposed approach.

Paper ID: 37

Paper Title: Dynamic Scheduling of Hospital Examination Capacity between Outpatient and Inpatient Services

Authors: Mirui Zhang, Fangyu Zong, Prof. Feifan Wang

Abstract: Appointment systems are commonly used in healthcare. Dynamical reallocation of future healthcare capacity remains underexplored. We study the

allocation of examination resources between outpatient and inpatient services in large general hospitals, where imbalanced capacity often causes long appointment lead times and operational inefficiencies. Considering varying patient preferences and the evolving appointment state, we model the problem as a Markov Decision Process and learn control policies via Proximal Policy Optimization. The resulting control policy adjusts the split of examination resources dynamically according to current booking conditions, with the objective of minimizing appointment lead time. Numerical experiments show that this proposed method outperforms both static and random allocation benchmarks across diverse scenarios. The gains are most pronounced under heavy demand and in complex decision spaces.

Paper ID: 340

Paper Title: UAF-Guided Systemic Design of AI-Enabled Service Architectures

Authors: Lefei Li

Abstract: In complex, multi-stakeholder environments, operational processes are often described in direct relation to the systems, personnel, and other resources that realize them, while the intermediate service structure remains implicit. Making this mediating structure explicit—determining what services are needed, what capabilities they encapsulate, and how they relate to both operational tasks and underlying resources—is a core challenge in service design and one that structured architectural methods can help address systematically. The Unified Architecture Framework (UAF), a widely adopted enterprise and system-of-systems architecture framework, provides such a structure through its Services Viewpoint, a formal intermediary between the Operational Viewpoint, which specifies tasks and process flows, and the Resource and Personnel Viewpoints, which represent the systems, platforms, and human roles available within an organization. Despite the structural importance of this layer, UAF primarily provides metamodel definitions and viewpoint semantics, while offering limited procedural guidance on how services may be systematically identified and organized from operational and resource descriptions.

To address this gap, this study proposes a large language model (LLM)-driven framework for the systematic modeling of the UAF Services Viewpoint. The framework proceeds in three stages: (1) extracting operational task structures and their implicit capability dependencies from enterprise documentation in a form aligned with UAF's Operational Viewpoint metamodel; (2) clustering these dependencies into candidate service definitions, guided by UAF service taxonomy constraints and service granularity heuristics encoded as prompt-level rules; and (3) mapping the identified services to relevant resources and personnel through entity- and role-level extraction, thereby producing a traceable, UAF-compliant three-layer architecture. An illustrative example is used to demonstrate the overall pipeline and to provide an initial comparison of the resulting architecture against direct task-to resource mappings in terms of service reusability and coupling. By providing a replicable, AI-assisted methodology for

constructing the service abstraction layer, this work contributes to the operationalization of service design principles through formal architectural modeling.

Paper ID: 217

Paper Title: Supply Chain Management Empowered by Large Model Technologies

Authors: Wei Qi

Abstract: With the rapid development of artificial intelligence, supply chain management is undergoing profound transformation. This talk introduces collaborative innovative research and applications between Tsinghua University's Department of Industrial Engineering and JD.com in supply chains. The talk covers intelligent solutions for core scenarios like intelligent replenishment (via the "Pretrain then Reinforce" deep learning framework), distribution network planning (using a Simulation-Optimization framework for large-scale problems), and supply chain planning management (with a large language model-based multi-agent system). These practices provide efficient, scalable solutions for supply chain management.

Session SA10 (Track 14 Service Management in Healthcare)

Paper ID: 330

Paper Title: Appointment Scheduling with Waiting Time Limits

Authors: Zhang Min, Han Zhu, Chen Rachel R, Zhenzhen Zhang

Abstract: This paper studies outpatient appointment scheduling with waiting time limits, in the presence of uncertain service times, patient no-shows and unpunctual arrivals. To tackle the problem of excessively long waiting times, policymakers may impose a waiting time limit. The introduction of waiting time limits increases the complexity of model formulation by significantly increasing the number of problem scenarios. To address this challenge, we introduce the concept of virtual waiting time, representing the additional waiting time that a patient would have to incur to see the doctor beyond the imposed waiting time limit. Using this construct, we are able to unify the modeling of system dynamics of all different scenarios into one stochastic program.

We develop a tailored integer L-shaped method to solve this model and test its effectiveness against two benchmarks. Specifically, the subproblem is a mixed integer nonlinear program with good properties, which allow us to deduce its optimal value without using optimization solver. We find that the presence of waiting time limits increases the job allowance between two adjacent patients, and the optimal schedule does not necessarily exhibit the well-known dome-shaped pattern. We also find that waiting time limits help reduce variation in patient waiting times across different positions in the schedule, thereby enhancing fairness in the schedule. Furthermore, our

results indicate that in the presence of waiting time limits, the total cost of the system is minimized when patients tend to arrive slightly late on average. Finally, we find that when a social planner sets the limit, the clinic has incentives to misreport its true cost of serving each diverted patient, and an additional fine on top of the time limits helps improve social welfare.

Paper ID: 332

Paper Title: Engineering Endurance

Authors: Ming Hu, Prof. Quan Yuan

Abstract: A widely adopted approach to designing incentive schemes is to decompose long-term objectives into recurring small tasks that encourage habit formation and continued engagement. We develop a finite-horizon dynamic decision model to analyze user behavior under different incentive schemes. We examine three prominent schemes, including Fixed Target, All-or-Nothing (AoN) Streaks, and Streak Freezes. Our findings reveal distinct effort-exerting behaviors across mechanisms. Under Fixed Target, the optimal per-period effort is time-invariant and increasing in rewards for both user types. Under AoN, per-period effort rises over time as the perceived reward becomes increasingly salient. Streak Freezes generate an inverted U-shaped pattern of per-period effort: scarce freezes weaken incentives due to high failure risk, whereas abundant freezes induce effort conservation. In terms of total expected effort, AoN performs only marginally better than no incentives, due to its fragility: a single failure results in the loss of the entire reward. Streak Freezes buffer temporary failures and sustain engagement, thus generating more total expected effort than AoN, especially when the target is sufficiently high. Fixed Target decouples current rewards from past performance, allowing users to recover from failure, thus outperforming AoN by sustaining consistent effort, especially when the time horizon is long. Overall, our study shows that rigid incentive schemes, such as the Close-the-Ring streak by Apple Watch, can undermine engagement, whereas mechanisms with both rigid and flexible components, such as Streak Freezes and Fixed Target, may generate greater total expected effort.

Paper ID: 366

Paper Title: Price Cuts Without Savings: The Unintended Consequences of Centralized Drug Procurement

Authors: Prof. Nan Li, Xu Li, Prof. Yuanchen Li, Xiuguo Song, Dr. Heng Zhao

Abstract: Governments worldwide have adopted centralized drug procurement to curb rising medication costs. While this policy successfully lowers prices for the procured drugs, its effects on total patient medical expenditures remain unclear. Using a unique panel dataset of patient visits across multiple hospitals in a Chinese province, we

employ a difference-in-differences approach to demonstrate that centralized procurement reduces costs on core drugs of the category included in the procurement by 14.0%, but paradoxically does not significantly reduce patients' total medical expenditures. This stems from two key channels. First, patients spent more on non-procured drugs—particularly non-prescription medications—consistent with hospitals' revenue-preservation incentives. Second, patients visited hospitals more frequently, likely due to the procurement's heavy reliance on less-effective generic drugs. We also conduct heterogeneity analyses and find that the effect of the centralized procurement policy on patients' medical expenditure differs across patient groups. Our findings highlight unintended consequences of centralized procurement and underscore the need for complementary policies that align the incentives of patients, policymakers, hospitals, and pharmaceutical firms to achieve sustainable cost containment.

Paper ID: 331

Paper Title: Overprescription under Patients' Private Information: An Information Design Perspective

Authors: Xinyue Fei, Wei Zhang

Abstract: Overprescription has been identified as a critical driver of high spending and waste in healthcare systems. The AI era, equipping patients with diverse information sources, is fundamentally reshaping the physician-patient communication and influencing physicians' prescription strategies. This study employs the Bayesian persuasion framework to model this interaction, examining a healthcare provider's optimal persuasion strategy when faced with a patient who holds private perceptions of their health status and may exhibit disobedience. Our analysis yields two key findings. First, improving the accuracy of patients' perceptions does not invariably curb overprescription, as physicians strategically adapt their persuasion tactics in response. Second, risk-aversion does not necessarily lead to less overprescription, as the effect hinges on the relative degree of risk aversion toward side effects versus the underlying sickness.

Paper ID: 319

Paper Title: How AI May Impact Customer Intensive Services

Authors: Ming Hu, Xiaofei Li, Prof. Quan Yuan, Han Zhu

Abstract: Artificial intelligence (AI) technologies are increasingly employed in customer-intensive services to automate auxiliary tasks and augment quality productivity. We investigate a service system in which the overall service rate depends on both auxiliary and professional service times. AI automation reduces the time allocated to auxiliary tasks, while AI augmentation enhances the effectiveness of professional tasks in improving service quality. The revenue-maximizing service

provider decides the service price and the professional service time spent on customers. Our findings reveal that marginal improvements in the automation capability always enhance market coverage and the service provider's optimal revenue, but somewhat surprisingly, tend to reduce the optimal service quality. In contrast, we find that higher levels of the augmentation capability always reduce the provider's optimal professional service time while still improving the optimal service quality. Moreover, we uncover an inverted U-shaped pattern in the optimal system utilization as both the automation and augmentation capabilities grow. This implies that although AI tends to improve the efficiency of auxiliary tasks and augment quality productivity, it can actually increase the provider's workload. Overall, our study shows that with AI adoption, the service provider likely reduces the optimal service quality, but with more customers served and revenue boosted on the demand side, while tending to create more hiring needs for labor on the supply side.

Session SA11 (Track 15 Risk Management in Digital and AI-Driven Service Systems & 20 Data-Driven Service Operations Management under Uncertainty: Methods and Applications in Supply Chains and Energy Systems & 5 Strategic Decision-Making in the AI-Driven Service Economy)

Paper ID: 81

Paper Title: A Study on Systemic Risk Contagion Paths in Multilayer Bank–Real Estate Networks

Authors: Prof. Shan Li, Hongyang Xu, Yumeng Zhu

Abstract: This study proposes a novel systemic risk contagion path prediction framework for multilayer bank–real estate networks by integrating adversarial learning with graph structural representation learning. Using lending data and news sentiment data, we construct a four-layer bank–real estate association network that captures both financial relationships and market sentiment interactions. Based on the Deep Multiplex Graph Infomax (DMGI) model, unified node embeddings are generated through cross-layer representation learning, while the SIR model is used to identify systemically important nodes in the network. Building upon these representations, we develop a GAE–GAN-based contagion path prediction model that jointly optimizes graph reconstruction and adversarial learning to detect hidden high-risk contagion channels. Empirical experiments conducted on real financial datasets demonstrate that the proposed model significantly outperforms traditional graph autoencoder-based approaches in terms of AUC and precision. The results reveal several critical contagion paths and key nodes within the multilayer network that align closely with observed financial market conditions. The proposed framework provides a data-driven approach for identifying systemic risk transmission channels and offers valuable insights for financial risk monitoring and regulatory decision-making in complex financial systems.

Paper ID: 351

Paper Title: Beyond Productivity: Behavioral Embedding, Trade-offs, and Organizational Value in GenAI-Enabled Human-AI Collaboration

Authors: Ruifeng Sun, Qi Zhu, Jian Liu

Abstract: Generative AI has turned human-AI collaboration into a service-system design problem rather than a narrow model-performance issue. Recent evidence shows that GenAI can improve writing, customer support, coding, and other knowledge-intensive service tasks, but it also shows that local productivity gains do not automatically create durable organizational value. This review-based conference paper synthesizes the emerging literature through three linked claims. First, augmentation should be distinguished from synergy. Second, GenAI-enabled collaboration can be understood as a process of behavioral embedding in which prompts, feedback, memory, and organizational routines progressively reshape collaboration configurations. Third, collaboration outcomes should be evaluated through multidimensional trade-offs rather than productivity alone. Building on these claims, the paper proposes a future research agenda for service science focused on workflow redesign, review architecture, hidden checking burden, and scalable value realization.

Paper ID: 185

Paper Title: Optimization of physician scheduling under dual channel mode of online and offline

Authors: Mengbo Zhai, Cun Yu, Prof. Yan Qiao, Yunkai Zhai

Abstract: The integration of online and offline healthcare services has provided hospitals with more flexible operational options with the advancement of information technology. Balancing the workload between online and offline consultations and optimizing physician scheduling have become a key factor in improving hospital operations management. Hence, this paper aims to explore the optimization of physician scheduling under a dual channel model of online and offline services. Firstly, two benchmark quadratic programming models are proposed: the online scheduling model and the online without scheduling model. Secondly, based on actual hospital operational data, the required parameters for the models are determined, and the physician scheduling outcomes under both models are explored by solving the models. The study examines the impact of the scheduling models on hospital operational costs, physician workload, and patient allocation under different operational conditions and demands. Next, sensitivity analysis explores how variations in parameters such as physician rank, patient volume, and working hours influence the optimal scheduling solution. Based on the analysis results, we propose the best scheduling strategies for different scenarios. This research provides relevant decision making recommendations for hospital managers who can select the most suitable optimization scheme according to their specific operational needs.

Paper ID: 362

Paper Title: Research on Construction of Online Medical Triage Model Integrating Statistical Prior and Semantic Understanding

Authors: Jule Guo, Yunkai Zhai, Prof. Yan Qiao

Abstract: In online healthcare settings, the rapid classification of user-reported medical texts can enhance service efficiency and user satisfaction. To address the issues of semantic sparsity and multi-class imbalance in medical text classification, this paper proposes AFF-BERT-SP (Adaptive Feature Fusion BERT with Structural Priors). For structured representation, the model employs an improved TF-IWF algorithm incorporating Mutual Information and a low-frequency term protection strategy. This process retains the top 800 non-low-frequency features with high MI, along with 200 low-frequency but high-MI structural features. To capture semantic information, the model incorporates deep semantic features extracted by a BERT model. Ultimately, the model fuses these dual-modal features via an attention-based fusion mechanism, yielding the novel intelligent medical text triage model AFF-BERT-SP. Experiments on a real-world medical dataset show that the proposed model achieves a TOP-3 hit rate of 85.76% and an MRR of 87.31%, demonstrating a significant improvement over baseline models. This marked performance substantiates the model's practical value for medical triage by effectively addressing the issues of inadequate feature representation and underutilized semantic information in existing methods.

Paper ID: 103

Paper Title: Proprietary or Open-source? Strategic Competition in Enterprise Generative AI Markets

Authors: Ji Lin, Prof. Yinlian Zeng, Jun Li

Abstract: In emerging enterprise generative AI solution markets, firms increasingly compete through open-versus-proprietary strategies. When the AI solution provider keeps its technology closed, it competes with an established proprietary provider in a duopoly. When it adopts an open-source strategy, however, a third-party entrant may enter by building on openness-induced technological spillovers, transforming the market into a three-player game involving one proprietary provider and two open-source providers. The resulting cross-firm technological spillovers further complicate competition and equilibrium outcomes. We develop a game-theoretic model to examine how the AI solution provider's open-versus-proprietary choice affects competition in enterprise generative AI solution markets.

In particular, we study (1) how quality investments and prices are endogenously determined across closed and open regimes, (2) how the degree of openness affects equilibrium investments and solution quality through technological spillovers, and (3) how the AI solution provider's choice influences consumer surplus and social welfare. We show that openness does not uniformly improve market outcomes. When

competitive diversion dominates, the AI solution provider may prefer to remain closed, and openness may even reduce welfare. By contrast, when spillover gains and market-expansion effects are sufficiently strong, openness can improve solution quality and enhance both consumer surplus and social welfare.

Session SU12 (Track 3 Digital Transformation and Society)

Paper ID: 272

Paper Title: Balancing Moore's Strategic Triangle in an Agentic Public Service Stack: An Empirical Study of Public Value in AI-Driven Hyper-Personalized Service Delivery

Authors: Stany Nzobonimpa

Abstract: As public sector organizations get ready to adopt agentic AI to enhance service delivery, the move toward hyper-personalization is raising more governance questions than "traditional", conversational GenAI have. What is increasingly at stake is the emergence of an agentic public service environment in which AI systems do not merely respond to citizen queries, but act through persistent memory, retrieval, delegated tools, and multi-agent orchestration. In this paper, we revisit Mark Moore's strategic triangle to examine how public value is shaped when service delivery is mediated by such agentic infrastructures. We posit that while hyper-personalization may improve responsiveness and perceived usefulness, it may also disrupt legitimacy and rules if individualized adaptation obscures the public logic, rule consistency, and institutional accountability expected of public sector organizations.

To investigate these tensions, we propose a controlled experimental approach in which we deploy, using the open-source AI orchestrator LibreChat , an agentic platform built specifically for this purpose. Using an existing public service known for Canadians as the Canada Pension Plan retirement service as a hypothetical example, we compare a standard policy retrieval agent with a hyper-personalized agent across simulated citizen scenarios generated through Python-programmed virtual users that we call "PyCitizens". We conduct multi-stage analyses of these interactions and show that agentic service design matters and that hyper-personalization may come at a cost. We argue this cost may not necessarily be what a cautious, policy-bounded service delivery organization wants.

Paper ID: 73

Paper Title: Bridging Digital Learning and Sustainability: Experiential Pathways to SDG 12 in Higher Education

Authors: Prof. Norita Ahmad, Professor Mai Zaki

Abstract: The urgency of sustainable development demands innovative responses from Higher Education Institutions (HEIs), which are uniquely positioned to embed sustainability into curricula and promote responsible consumption and production. This paper explores how digital learning environments can serve as experiential pathways to advance United Nations (UN) Sustainable Development Goal 12 (SDG 12): Responsible Consumption and Production, through two case studies from the American University of Sharjah (AUS), United Arab Emirates (UAE). Drawing on the theoretical framework that positions sustainability and digitalization as "megatrends shaping the economy and society" (Guandalini, 2022, p. 457), this research demonstrates how thoughtfully designed digital learning experiences can simultaneously achieve pedagogical excellence and environmental sustainability.

The first case study examines the Information Systems Strategy (ISS) course, a capstone experience where students develop strategic IT plans addressing real-world business challenges through industry partnership with one of the biggest e-commerce platforms in the UAE. Through digitally mediated collaboration and mentorship, students design systems that optimize operational efficiency while incorporating sustainable practices, particularly addressing environmental impacts of product returns such as carbon emissions and packaging waste. The course integrates SDG 12 through sustainability-focused IT strategy development, operational efficiency principles, and ethics-driven leadership frameworks that prepare students to become responsible digital practitioners (Ahmad et al., 2023; Toro-Troconis et al., 2023).

The second case study explores the Introduction to Arabic Digital Humanities (ADH) course, which engages students with cultural sustainability through digitization of Arabic cultural assets. Students work with digital archives, including the Arabian Gulf Digital Archives (AGDA), and participate in virtual exchange programs exploring ethical dimensions of cultural heritage. The course promotes responsible consumption of digital cultural resources while requiring students to create and preserve new datasets, addressing the critical gap in accessible Arabic digital tools and data and demonstrating how digital learning can advance sustainability across diverse disciplinary contexts (Zaki & Grazioli, 2025).

Both courses demonstrate measurable environmental and social impacts despite traditional classroom delivery. Digital platforms for collaboration and mentorship reduced reliance on printed materials and decreased commuting-related emissions, while enhancing student engagement through flexible, continuous interaction (Sangiuliano Intra et al., 2023). Students gained practical experience addressing sustainability challenges, from optimizing business processes to preserving cultural

heritage through ethical digital practices, illustrating how digital learning environments can bridge theoretical knowledge and real-world application.

Key findings reveal that experiential learning anchored in real-world challenges deepens student understanding of sustainability and fosters critical thinking (Backman et al., 2019). The integration of industry mentorship and virtual collaboration platforms empowered students to contribute meaningfully to sustainability discourse while developing technical competencies. However, challenges including alignment with external partners, limited digital infrastructure for underrepresented languages, and digital equity concerns highlight the need for intentional scaffolding and institutional support when designing digital learning pathways to sustainability.

This paper contributes to the Digital Transformation and Society track by demonstrating how HEIs can serve as "living labs for smart, sustainable cities" (Martínez-Acosta et al., 2023), advancing SDG 12 through digitally mediated curricula. The findings offer practical recommendations for embedding sustainability across disciplines, emphasizing the design of digital learning experiences that prioritize disciplinary relevance, strategic technology adoption, and cross-cultural collaboration. As HEIs navigate the intersection of digital transformation and sustainability, these case studies provide actionable models for preparing students to become agents of change in responsible consumption and production through the deliberate integration of digital learning and sustainability goals.

Paper ID: 373

Paper Title: Mapping Digital Responsibility

Authors: Shahban Shah, Hongying Foscht

Abstract: The global imperative for digital transformation has evolved toward a responsible paradigm integrating ethical, social, and environmental considerations. This paper addresses critical gaps in digital responsibility, where a persistent research-practice divide exists and empirical studies remain rare. It highlights the scarcity of research in Practice and the underutilization of Design Science Research (DSR) for building actionable solutions. Employing a DSR approach, this paper develops, presents, and empirically evaluates PASSEE, a strategic mapping framework that integrates six dimensions—data privacy, analytics, security, and social, economic, and environmental factors—to align digital and sustainable objectives. The framework was initially developed through an exploratory literature review and is pilot-tested in 13 workshops with student startups. This research makes three contributions. First, it provides a methodological exemplar by applying DSR to digital responsibility, demonstrating its utility in bridging the research-practice gap. Second, it introduces PASSEE as a strategic mapping framework. Third, empirical testing reveals that PASSEE enhanced student start-up concepts and enabled identification of future competitive gaps through the lens of digital responsibility.

Paper ID: 302

Paper Title: A Framework for Evaluating the Effectiveness of Key Technology Applications in Libraries: Measurement from Technological, User, and Institutional Perspectives

Authors: Qinglin Cui, Heng Hou, Prof. Peng Xiao

Abstract: Emerging technologies, as cutting-edge innovations with transformative potential, are increasingly being adopted in libraries. However, existing research lacks systematic frameworks to evaluate their application effectiveness, leaving early adopters facing significant uncertainty regarding risks and outcomes. To address this gap, this study develops a comprehensive evaluation framework for emerging technology applications in libraries from three perspectives: technology, users, and institutions. Drawing on usability, accessibility, technology acceptance, and socio-technical systems theories, the framework is organized into three core dimensions—usability, inclusivity, and suitability—and comprises 14 secondary and 40 tertiary indicators. A combined weighting approach, integrating expert-based subjective weighting and the CRITIC objective method, is employed to determine indicator importance. The results show that inclusivity ranks highest, followed by usability and suitability, underscoring the primacy of user-oriented considerations in the evaluation of emerging technologies in libraries. By providing a multi-perspective and operationalizable evaluation model, this study advances the assessment of emerging technologies and supports more evidence-based decision-making in library practice.

Paper ID: 349

Paper Title: Application Privacy Policy Compliance Detection and Market Current Situation Analysis Based on Text Classification and FactCC

Authors: Hou Zhu, Jianing Yu

Abstract: Privacy policies play a crucial role in safeguarding personal information rights on internet platforms. However, they often suffer from poor readability, complex language, and non-compliance with regulatory standards. Therefore, this study aims to develop an automated framework for detecting the sufficiency of privacy policy compliance using natural language processing (NLP) techniques, and to analyze the current status of application privacy policy in the market. The study establishes a NLP-based framework aligned with the Information Security Technology - Personal Information Security Specification, incorporating 19 core elements of privacy policies. The framework employs text classification, named entity recognition, and factuality detection to identify, extract, and assess potential compliance insufficiency. Experimental results demonstrate the effectiveness of the proposed framework in identifying privacy policy compliance insufficiency with high accuracy. Furthermore, research found that over 80% of the applications privacy policies were inconsistency with normative requirements, and the average degree varied significantly among

different types of applications. Among them, photo beautification applications exhibited the most severe compliance insufficiency on average and accounted for the largest proportion of applications with compliance insufficiency.

The proposed framework can be applied to the automated detection and analysis of privacy policy compliance insufficiency, enhancing the reliability of policy compliance assessment and regulatory enforcement.

Session SU01 (Track 27 Risk and Optimization for Service Systems Considering Digital Transformation)

Paper ID: 188

Paper Title: ORPR: An OR-Guided Pretrain-then-Reinforce Learning Model for Inventory Management

Authors: Lingjie Zhao, Xue Yu, Yongzhi Qi, Hao Hu, Jianshen Zhang, Yingzheng Ma, Shuyu Han, Prof. Wei Qi, Zuo-Jun Max Shen

Abstract: As the pursuit of synergy between Artificial Intelligence (AI) and Operations Research (OR) gains momentum in handling complex inventory systems, a critical challenge persists: how to effectively reconcile AI's adaptive perception with OR's structural rigor. To bridge this gap, we propose a novel OR-Guided "Pretrain-then-Reinforce" framework. To provide structured guidance, we propose a simulation-augmented OR model that generates high-quality reference decisions, implicitly capturing complex business constraints and managerial preferences. Leveraging these OR-derived decisions as foundational training labels, we design a domain-informed deep learning foundation model to establish foundational decision-making capabilities, followed by a preference-based reinforcement learning (RL) fine-tuning stage. Uniquely, we position RL as a deep alignment mechanism that enables the AI agent to internalize the optimality principles of OR, while simultaneously leveraging exploration for general policy refinement and allowing expert guidance for scenario-specific adaptation (e.g., promotional events). Validated through extensive numerical experiments and a field deployment at JD.com augmented by a Difference-in-Differences (DiD) analysis, our model significantly outperforms incumbent industrial practices, delivering real-world gains of a 5.27-day reduction in turnover and a 2.29% increase in in-stock rates, alongside a 29.95% decrease in holding costs. Contrary to the prevailing trend of brute-force model scaling, our study demonstrates that a lightweight, domain-informed model can deliver state-of-the-art performance and robust transferability when guided by structured OR logic. This approach offers a scalable and cost-effective paradigm for intelligent supply chain management, highlighting the value of deeply aligning AI with OR.

Paper ID: 43

Paper Title: You, Me, or We? Co-Productive Principal-Agent Dynamics

Authors: Professor Guillaume Roels, Vladimir Smirnov, Ilia Tsetlin, Andrew Wait

Abstract: **Problem Definition:** Projects are often initiated by a single person—a principal—who then decides whether to form a team by sharing project value with an agent. We ask: when does a principal form a team, and which operating mode emerges in equilibrium—single execution by the principal, delegated execution to the agent, or joint execution?

Methodology/Results: We consider a co-productive principal-agent model with endogenous team formation. In the second-best, joint execution is less frequent than optimal, whereas both single and delegated execution are chosen too much. With a linear contract, common with non-financial output (credits, co authorship) or in entrepreneurial ventures, there is too much single execution, i.e., the principal does not form a team often enough, and either too little joint execution when one of the workers has low productivity, or too little delegation otherwise. Overall, the inefficiency in project execution (due to moral hazard) appears less severe than the inefficiency in the principal's team formation decision (due to project hoarding).

Managerial Implications: Managerial under-delegation fundamentally stems from project hoarding; that is, principals do not partner enough. When principals choose to form a team, they then might delegate too much; paradoxically this happens when agents have low productivity. While the existing literature focuses on eliciting agent effort for a given operating mode, our analysis suggests the decision to form a team (or not) is a more critical issue.

Paper ID: 265

Paper Title: How Digital Triage Quality Influences Patient Behavior: Evidence from Hospital Data

Authors: Kuo Liang, Prof. Yichuan Ding, Dongdong Ge, Xian Wang

Abstract: Digital triage systems are becoming an important interface between patients and healthcare providers, but little is known about how triage recommendation quality shapes patient behavior and downstream operational outcomes. Using proprietary data from the digital guidance system of Shanghai Municipal Hospital of Traditional Chinese Medicine, we study how recommendation quality, recommendation rank, weather, and other contextual factors affect whether patients follow recommendations, complete registration, or cancel appointments. We find that recommendation quality is a primary driver of patient follow-through and conversion, while recommendation positioning and external conditions further influence these behaviors. Motivated by these findings, we develop a large-language-model-based triage system to improve recommendation quality and evaluate its impact on patient behavior. Our study

highlights the central role of recommendation quality in digital triage and demonstrates the operational value of AI-enabled guidance systems in healthcare.

Paper ID: 110

Paper Title: Online Demand Fulfillment in Highly Asymmetric Markets

Authors: Hailun Zhang, Zhen Xu, Jiheng Zhang, Jiheng Zhang

Abstract: Problem Definition: We study online demand fulfillment with limited flexibility in highly asymmetric markets where some locations have moderate to high market shares while others have very low shares. Xu et al. (2020) is the first to establish that a positive generalized chaining gap (GCG) is a necessary and sufficient condition for bounded performance, which is defined as the expected lost sales as the total market size grows. While a high GCG signals a better performance, the presence of high market asymmetry results in a low GCG and a larger performance bound, making the bound less useful for assessing actual system performance. Therefore, understanding system performance in highly asymmetric markets remains an important question.

Methodology/results: We introduce a network condition called-connectivity, which ensures that after removing markets with a total market share in the order of ϵ , the remaining markets are still connected through the available suppliers. We prove that-connectivity is both necessary and sufficient for maintaining bounded performance in highly asymmetric markets. This is achieved through a carefully designed online fulfillment policy that utilizes network partitioning and advanced analyses of mean-reverting processes using probability methods in an asymptotic context. Additionally, we offer strategies for network design to reduce the risk of ϵ -disconnectivity.

Managerial implications: Our findings indicate that even the well-known long chain structure may not ensure bounded performance in highly asymmetric markets, especially when low-demand markets are dispersed throughout the network. Instead, a “hub and spoke” network configuration with a shorter embedded long chain can help reduce the risk of ϵ -disconnectivity and enhance system performance.

Paper ID: 127

Paper Title: Model Explanation, Accuracy Feedback, and Use of Algorithmic Advice: A Field Experiment

Authors: Yang Zhan, Zike Cao, Zheng Zhang, Liping Xiong

Abstract: The "black-box" nature of modern AI algorithms continues to hinder trust in AI systems. In collaboration with a major Chinese retail chain specializing in fresh goods, we conducted a large-scale field experiment across 230 brick-and-mortar stores and involving more than 1,000 stock-keeping units to investigate how algorithmic transparency mechanisms—model explanations and accuracy feedback—influence

managers' adoption of AI-based ordering recommendations. We find that while accuracy feedback significantly improves adoption, the combined provision of both information types produces a counterintuitive *dysergy effect*, reducing adoption below levels achieved by accuracy feedback alone. We further demonstrate that this effect is driven by the interaction between explanation type and performance verification. Our findings offer nuanced insights into the complementarity of different algorithmic transparency mechanisms and carry important implications for the design of human-algorithm collaboration systems in practice.

Session SU02 (Track 28 AI for Finance)

Paper ID: 404

Paper Title: Beyond Public Disclosure: Identifying Private Corporate Visits via Mobile GPS Traces

Authors: Xianfeng Hao, Qingsong Ruan, Shujing Wang, Prof. Yudong Wang

Abstract: Corporate site visits are a crucial channel for investors to acquire information. While publicly disclosed visits often convey positive signals, the nature of undisclosed, private corporate visits remains largely unexplored. Utilizing a novel alternative dataset of mobile device GPS traces around the headquarters of Chinese listed companies, we construct a Hidden Site Visit indicator to identify private visits by financial professionals. Interestingly, we find that, unlike public visits, abnormally high private visits exhibit significant negative return predictability. Moreover, these negative returns are primarily realized around subsequent earnings announcement windows. Furthermore, we show that private visits forecast deteriorating firm fundamentals. Finally, we find that trading on this negative private information is primarily driven by non-fund institutions, whereas mutual funds do not exhibit similar trading patterns. Overall, our findings highlight the asymmetric information content of private versus public investor interactions.

Paper ID: 383

Paper Title: Incentivizing Digital Workforce: Digitalization, Compensation Design, and Productivity

Authors: Cunyi Yang, Yan Zeng, Shuchi Zhang

Abstract: We study when workforce digitalization raises productivity and when it fails or becomes counterproductive. We develop a principal-agent model in which digital tools expand workers' productivity potential but increase the effective cost of effort and the scope for hidden slack. When contracts are not adjusted, digitally skilled employees can mimic digitally lagging peers; when liquidity is tight, digital spending can crowd

out incentive pay. Together these forces generate a deeper transformation, greater failure region in which productivity declines as digitalization deepens. We test the model's predictions using a large-language-model-based (LLM-based) workforce digitalization index constructed from 10-K disclosures for 5,590 U.S. public firms. Empirically, digitalization is weakly related to labor productivity on average, but the interaction between digitalization and compensation incentives is strongly positive, especially among financially constrained firms. The results imply that returns to digital capital depend critically on contractual design and financial slack.

Paper ID: 410

Paper Title: When Competition Backfires: Broker Learning and Commission Fees-
Abstract ONLY

Authors: Xindan Li, Baolian Wang, Wei Xiong, Xuwei Yang, Yinhong Zhao

Abstract: This paper examines how learning and competition shape brokerage commission fees in a plain-vanilla Chinese setting. We document three facts: substantial price dispersion across investors, higher fees for naïve investors, and widening dispersion over time. To explain these patterns, we develop a dynamic model in which brokers compete for naïve and sophisticated clients while learning types through repeated interactions. The model shows that an incumbent's information advantage can sustain persistent market power—even over sophisticated investors—and that additional broker entry can backfire by raising markups on naïve investors and widening dispersion. Exploiting branch-level variation in rival presence, we provide causal evidence consistent with these predictions. Quantitatively, although the average number of brokers per city more than doubled over the sample, intensified competition slightly offset—rather than accelerated—the secular decline in fees.

Paper ID: 385

Paper Title: Talk to AI-Equipped Investors: A Field Experiment

Authors: Yupeng Lin, Zhenghui Ni, Yichen Su, Nianhang Xu

Abstract: We run a large-scale randomized controlled trial (RCT) with 2,722 Chinese listed firms to examine how perceived AI bots shape managers' disclosures and market reactions. In online earnings conferences (OECs), we randomize the questioner's identity as either human or AI while holding information content fixed. Managers are 13% less likely to answer AI-styled questions, with stronger effects when an image signals AI identity. Linking manager and firm traits to responses shows smaller declines at state-owned enterprises and larger declines for managers who are female, older, or have a computer science background. Conditional on responding, managers provide longer, timelier answers with more neutral narratives to AI styled questions. Using high-frequency data, we find that investors withhold trading during AI question

windows. Overall, our results are consistent with AI playing a disciplinary role on voluntary disclosure.

Paper ID: 384

Paper Title: Identity Disclosure and Social Transmission Bias: A Natural Experiment from WeChat

Authors: Xianfeng Hao, Prof. Yudong Wang, Liangyu Wu, Prof. Wenfeng Wu

Abstract: On December 18, 2018, WeChat replaced the anonymous “Like” button for its articles with a real-name “Wow” button. Leveraging this policy mandating identity disclosure in content transmission, we explore how identity disclosure affects social transmission bias and its economic consequences. We find that post-policy, users disseminate articles with greater consideration for impression management than before. Moreover, highly shared articles have lower predictive power for future stock returns, resulting in more substantial stock price reversals, and the policy change harms retail investors. Our findings reveal that identity disclosure significantly amplifies social transmission selection bias and its effects on stock prices.

Session SU03 (Track 10 AI-Driven Service Innovation: From Personalization to Hyperautomation)

Paper ID: 72

Paper Title: Algorithm-Augmented Gatekeeping: Combining Human and Machine Intelligence in Screening Programs

Authors: Jiatao Ding, Michael Freeman, Prof. Tinglong Dai

Abstract: Screening programs serve as critical gatekeeping mechanisms across diverse sectors, including healthcare diagnostics, financial fraud detection, and cybersecurity. Traditionally, these programs relied on human experts to filter high-volume inputs. The advent of artificial intelligence (AI) offers the potential for massive scalability and improved accuracy. However, purely autonomous AI often lacks the nuanced judgment of human experts, while purely human systems are constrained by cognitive load and high operational costs. The challenge for service designers is therefore not to choose between human or machine, but to design an optimal augmented gatekeeping system that synergistically combines both.

Current literature often treats AI as a standalone replacement or a simple decision support tool. This paper addresses the gap in understanding how to jointly optimize (1) the AI’s operating point on the ROC curve, (2) the strategic referral of cases from AI to human experts, and (3) the final adjudication rules for discordant cases. Crucially, we investigate how this optimization must adapt to two pervasive factors: the informational

effect (AI improving human accuracy through evidence) and behavioral biases (algorithm aversion or automation bias).

Our analytical characterization reveals that the optimal gatekeeping strategy falls into four distinct regimes, or corresponding mixed strategy regimes, based on the economic and clinical context:

- AI as an Advisor: The human remains the final authority in conflicts, with the AI providing initial triage and informational value to boost human accuracy.
- AI as a Strict Filter: Driven by high resource constraints, the system aggressively restricts the pipeline, only allowing cases with unanimous human-AI agreement to proceed to costly follow-ups.
- AI as a Safety Net: Operating under a mandate to avoid catastrophic false negatives, the system triggers a referral if either the AI or the human flags a case as positive.
- AI as the Arbiter: The system transitions to full automation, completely removing the human grader from the loop when the AI's standalone cost-efficiency and accuracy render human intervention unnecessary.

We find that the system-best AI performance is often different from its standalone best, shifting its operating point to maximize the human's informational gain. Furthermore, we show that the optimal human referral fraction is frequently an interior solution, providing a precise knob for managers to calibrate expert workload against system accuracy.

Paper ID: 163

Paper Title: Efficient Budget Allocation for Large-Scale LLM-Enabled Virtual Screening

Authors: Weiwei Fan

Abstract: Screening tasks that aim to identify a small subset of top alternatives from a large pool are common in business decision-making processes. These tasks often require substantial human effort to evaluate each alternative's performance, making them time-consuming and costly. Motivated by recent advances in large language models (LLMs), particularly their ability to generate outputs that align well with human evaluations, we consider an LLM-as-human-evaluator approach for conducting screening virtually, thereby reducing the cost burden. To achieve scalability and cost-effectiveness in virtual screening, we identify that the stochastic nature of LLM outputs and their cost structure necessitate efficient budget allocation across all alternatives.

To address this, we propose using a top- m greedy evaluation mechanism, a simple yet effective approach that keeps evaluating the current top- m alternatives, and design the explore-first top- m greedy (EFG- m) algorithm. We prove that EFG- m is both sample-optimal and consistent in large-scale virtual screening. Surprisingly, we also

uncover a bonus ranking effect, where the algorithm naturally induces an indifference-based ranking within the selected subset. To further enhance practicality, we design a suite of algorithm variants to improve screening performance and computational efficiency. Numerical experiments validate our results and demonstrate the effectiveness of our algorithms. Lastly, we conduct a case study on LLM-based virtual screening. The study shows that while LLMs alone may not provide meaningful screening and ranking results when directly queried, integrating them with our sample-optimal algorithms unlocks their potential for cost-effective, large-scale virtual screening.

Paper ID: 30

Paper Title: Robust surgery scheduling with patient feature and downstream resource constraints

Authors: Yu Wang, Shuzheng Zhang, Gang Qu

Abstract: The physical condition of patients is heterogeneous and complex, making it challenging to accurately predict surgery duration and postoperative recovery length before surgery, which brings challenges to the hospital in surgery scheduling. Medical informatization has produced a large amount of medical data, and the effective use of the diagnosis and treatment data of history patients can provide guidance for the surgery scheduling of newly arrived patients.

This paper proposes a machine learning approach that constructs a patient feature-based uncertainty set, taking into account the uncertainty of surgery duration and postoperative recovery length. To minimize total costs during the scheduling period, a two-stage robust optimization model is established from the perspective of patient segmentation, and a column and constraint algorithm is designed to generate accurate solutions. Numerical experiments with real hospital data show that the proposed method can improve the quality of surgical scheduling and alleviate downstream unit shortages.

Paper ID: 168

Paper Title: Cloud-Enabled Transformation of Outpatient Service Line Design: Strategic Quality-Speed Tradeoffs and Regulatory Implications

Authors: Weixiang Huang, Qingyuan Sang, Wenhui Zhou

Abstract: The rapid emergence of cloud hospitals is fundamentally reshaping outpatient service delivery, enabling healthcare institutions to evolve from single-service-line operations to diversified multi-channel systems. This study investigates strategic decisions in outpatient service line design and channel selection under quality-speed tradeoffs and the impact of the government's regulation on system performance. We develop a game-theoretic model featuring a healthcare institution serving a market with

two segments of consumers heterogeneous in quality and speed preferences. The healthcare institution strategically selects between a mass strategy (uniform services via offline channels) and a segmentation strategy (differentiated services via cloud-enabled dual channels). We find that cloud hospital adoption induces the institution to increase quality (resp., speed) for the quality (resp., speed)-preferring segment (with or without changing the total quality and speed in the market) and raises either one or both of the service prices. Furthermore, the marginal cost of quality/speed improvement exhibits non-monotonic effects on cloud adoption benefits, and cloud adoption may or may not increase social welfare. Finally, for the regulation aiming to improve the service quality of cloud hospitals by regulating the quality gap between offline and cloud hospitals, we find that it may paradoxically reduce the service quality owing to the diminished segmentation advantages and create a triple welfare loss (consumer surplus reduction, institutional profit decline, and social welfare deterioration). Our results caution policymakers against the unintended consequences of cloud hospital regulation and guide managers in optimizing service line strategies with digital transformation.

Paper ID: 158

Paper Title: A Two-Stage Stochastic Programming Approach for Physician Scheduling with Multi-Disciplinary Teams Demands

Authors: Guowei Hu, Liping Zhou, Yihui Wang

Abstract: The rapid development of internet hospitals has transformed healthcare delivery by integrating online and offline channels. This integration requires physicians in large public hospitals to serve patients across multiple channels. Moreover, different departments may not only manage general outpatient clinics but also organize clinics for specific diseases, while simultaneously addressing the Multi-Disciplinary Team (MDT) consultations. The resulting multi-channel, multi-type, highly dynamic, and uncertain nature of healthcare demand poses a significant challenge for physician scheduling. To address this challenge, we propose a two-stage stochastic programming model that determines daily physician schedules in the first stage and dynamically assigns physicians to fulfill realized MDT demands in the second stage. A solution approach based on sample average approximation and Benders decomposition is proposed to solve the problem. Extensive numerical experiments are conducted to evaluate the performance of the proposed method and derive managerial insights.

Session SU04 (Track 4 Smart and Intelligent Port and Shipping Logistics Services)

Paper ID: 46

Paper Title: Transitioning to electrification: Optimal strategies for ship fleet replacement

Authors: Ziyu Cui, Xiaowen Fu, Huan Jin, Anthony Chen, Prof. Kun Wang

Abstract: To reduce carbon emissions, some shipping companies are strategically transitioning their fleets from diesel-powered ships to electric ones. However, the question of how to cost-effectively design this fleet conversion and the construction of charging stations for electric ships remains a critical issue. In this paper, we present a Mixed-Integer Nonlinear Programming (MINLP) model to minimize the total cost of designing the ship fleet replacement plan within a given planning horizon. At the planning level, the yearly strategic transition schedules for purchasing and salvaging ships are obtained, while the optimal strategy for charging station construction is also determined to satisfy annual cargo demand and charging demand. Then, our model integrates the operational level to determine optimal fleet deployment strategies and operational decisions. Meanwhile, the impact of real-world factors such as waterway depth and emission cost are discussed, respectively. Moreover, we introduce two subsidy schemes and compare their effectiveness on the fleet electrification process. Finally, the proposed model is applied to the Yangtze River shipping network in China using real data. The results show that the shipping company will initially invest in lower-cost electric ships with a limited budget, followed by the acquisition of larger ships. The charging stations are strategically established in the downstream areas, coinciding with the initial deployment of electric ships. Moreover, the impacts of fuel prices and emission cost of diesel-powered ships on the electrification process are compared, with the results indicating that the increase in emission cost has a more pronounced effect on the total cost compared to the rise in fuel prices. Additionally, the subsidy schemes' effect is explored, revealing that financial incentives markedly accelerate the fleet electrification process.

Paper ID: 40

Paper Title: Integrated Optimization of Berth and Quay Crane Allocation under Dynamic Double-Line Multi Ship Mooring Mode

Authors: Chun Gan, Prof. Caimao Tan, Prof. Junliang He

Abstract: With the continuous growth of global trade, world container shipping volumes have increased dramatically, leading to increasingly strained berth resources at container ports. Traditional single-berth mooring modes exhibit numerous limitations when addressing the current diversified and high-density vessel arrival patterns,

particularly in complex scenarios where large mainline container vessels and small-to-medium feeder vessels operate simultaneously. How to efficiently manage the berthing scheduling of different types of vessels has become a key bottleneck in enhancing ports' comprehensive competitiveness. This paper conducts in-depth research on berth and quay crane allocation problems under the "dynamic multi-vessel double-berth mooring" mode, aiming to significantly improve port berth utilization and quay crane operational efficiency.

This paper innovatively proposes a "dynamic multi-vessel double-berth mooring" operational mode that breaks through the limitations of traditional single-berth mooring by allowing mainline vessels to share berth resources with multiple feeder vessels and introducing a dynamic replacement mechanism for feeder vessels. This mode fully utilizes the operational time differences between mainline and feeder vessels (12-20 hours for mainline vessels, 2-5 hours for feeder vessels) to achieve dynamic optimization of berth resource allocation. The mode not only enhances berth utilization but also effectively saves container storage space. Particularly when transshipment containers exist, quay cranes can directly perform ship-to-ship container transfers without yard intermediation, significantly reducing transshipment costs and improving operational efficiency.

Based on the proposed operational mode, this paper constructs a mixed nonlinear programming model for joint optimization of berths and quay cranes. The model comprehensively considers multiple practical constraints including berth allocation, time window management, vessel length constraints, continuous quay crane operations, and differentiated bay allocation. The model aims to minimize position deviation costs, time delay penalties, and quay crane usage costs while encouraging feeder vessel dynamic replacement and direct transshipment operations through reward mechanisms. Addressing the nonlinear characteristics of the model and computational complexity of large-scale problem solving, this paper designs an efficient particle swarm optimization (PSO) algorithm incorporating multi-strategy initialization and constraint repair mechanisms to ensure high-quality solutions within reasonable time.

To comprehensively validate the model's correctness and algorithm effectiveness, this paper designs four different-scale numerical experiment cases based on actual port operations, covering scenarios from small-scale (1 mainline vessel with 4 feeder vessels) to ultra-large-scale (8 mainline vessels with 32 feeder vessels). Through comparative analysis with the CPLEX commercial solver, performance comparison of different mooring modes, and sensitivity analysis of key factors including vessel arrival punctuality, berth average service duration, and berth mainline vessel ratio, the comprehensive performance of the proposed mode and algorithm is systematically evaluated.

Experimental results fully demonstrate the effectiveness and superiority of this research. Compared with the CPLEX solver, the designed PSO algorithm can obtain near-optimal solutions in significantly shorter computational time, with an objective function gap value of only 10.8%, demonstrating excellent computational efficiency. Compared with

the traditional "single-berth mooring" mode, the "dynamic multi-vessel double-berth mooring" mode shows significant advantages in all test cases, with an average improvement rate of 46.63% in comprehensive operational costs, with small-scale cases showing more significant improvement of 83.7%. Sensitivity analysis reveals several important findings: vessel arrival punctuality analysis shows that when punctuality decreases from 100% to 70%, the objective function value increases by approximately 26.4% on average, but an uncertainty threshold effect emerges when punctuality further decreases; berth average service duration analysis reveals a distinct performance critical point at approximately 0.7; berth mainline vessel ratio analysis indicates that as the mainline vessel ratio increases, system performance exhibits a nonlinear declining trend, particularly pronounced in medium-to-high ratio intervals.

This research provides new theoretical perspectives and practical tools for port operation management, offering important theoretical significance and application value for alleviating port berth resource constraints and enhancing port comprehensive competitiveness, providing scientific basis for the design and implementation of intelligent port scheduling systems.

Paper ID: 201

Paper Title: Deep Reinforcement Learning for Container Stacking

Authors: Dr. Mingzhong Huang, Prof. Hang Yu, Prof. Junliang He, Prof. Gangyan Xu

Abstract: Efficient yard management is paramount to the operational fluidity of container terminals. This work investigates the real-time container stacking problem, which requires immediately assigning stochastically arriving containers to storage slots to minimize future rehandling operations. This problem is notoriously challenging due to the curse of dimensionality. While traditional approximate dynamic programming relies on the Bellman equation to evaluate future states, such value function approximations are strictly scale-dependent and lack transferability across differing yard configurations. To address these limitations, we model the dynamic container stacking process as a Markov decision process and propose a deep reinforcement learning framework. By integrating the soft actor-critic algorithm with a self-attention mechanism, our approach approximates future state values via neural networks. This architecture creates a scale-generalizable agent capable of dynamically extracting spatial dependencies and evaluating states regardless of instance size. While the initial training process is computationally time-consuming, the resulting agent executes high-quality stacking decisions instantaneously, strictly fulfilling real-time operational requirements. Out-of-sample experiments demonstrate the robust generalization and superiority of our approach over traditional baselines. Finally, our findings offer crucial managerial insights: port operators can adopt this highly flexible policy to resiliently manage fluctuating cargo volumes and varying yard layouts without incurring prohibitive model retraining costs.

Paper ID: 174

Paper Title: Tracing the Morphology of Maritime Clusters: A Dynamic Quantitative Analysis of Spatial Boundaries and Industry Structure in China

Authors: Borui Gao, Benedict Jun Ma, Dr. Louise Lu LI

Abstract: Maritime clusters, as spatial agglomerations of shipping, port, and service-related industries, are critical to national competitiveness and regional economic development. However, the use of static administrative boundaries to delineate maritime clusters obscures their true spatial evolutionary patterns. Limited accessibility to maritime data and the absence of a standardized quantitative framework hinder systematic cross-regional comparisons and constrain the generation of action able policy insights. This study develops a data-driven methodology to detect a maritime cluster, delineate maritime cluster boundaries and quantify their spatial scope and density distribution. Using registration data from 279,790 maritime enterprises in China from 2000 to 2020, we apply the Density-Based Spatial Clustering of Applications with Noise (DBSCAN) algorithm to detect whether and where clusters form, and to assign each enterprise to a specific cluster. Convex hulls are then employed to delineate the spatial footprint of each cluster by connecting its outermost points, enabling the calculation of cluster area and internal firm density. Standard deviation ellipses further trace the directional evolution and dispersion patterns of each cluster over time. A tripartite classification of firms into low-, medium-, and high-value-added sectors reveals pathways of industrial upgrading. The proposed replicable framework for the dynamic identification and comparative analysis of maritime clusters addresses a core methodological gap in economic geography.

Paper ID: 60

Paper Title: Routing and scheduling problem for mothership and drones in shore-to-ship delivery

Authors: Prof. Yadong Wang, Mengyan Yang, Qiaolin Hu

Abstract: As vessel delays and port congestion intensify, shore-to-ship deliveries face increasing challenges. While drones provide fast and flexible delivery, their limited payload and battery endurance restrict independent operations in maritime environments. Existing studies largely overlook the coordination of a mothership and drones under dynamic constraints in shore-to-ship delivery. To address these gaps, this study explores a mothership-drone system, where the mothership supports drone takeoff and landing, provides battery resupply, and delivers supplies to customer vessels, thereby extending drone range and improving delivery efficiency. An integer linear programming (ILP) model based on a time-expanded network is developed to optimize routing and scheduling, minimizing total delivery costs, including mothership sailing time, drone flight time, and fixed deployment costs. The model accounts for critical operational constraints, such as drone payload capacity, maximum flight

duration, takeoff and landing nodes selection, and mothership-drone synchronization. To solve large-scale instances efficiently, an adaptive large neighborhood search (ALNS) algorithm with a tailored adjustment strategy is proposed. Experimental results show that the algorithm outperforms commercial solvers and benchmark heuristics in solution quality and computational efficiency, significantly improving the efficiency of generating feasible solutions. In addition, compared with the mothership-drone mode and the drone-only mode, the proposed mothership-drone coordination mode substantially reduces operating cost and improves service coverage.

Session SU05 (Track 11 Sustainable AI Operations: Low-Carbon Design and Management of Compute Services)

Paper ID: 285

Paper Title: T-ILS: A Transition-based Iterated Local Search Heuristic for the Computational Resource Leveling Problem

Authors: Jiaqi Huang, Boxiao Chen, Yining Sun, Yijui Chang, Xingyu Lu, Prof. Wai Kin (Victor) Chan

Abstract: With the ever-growing demand for big data computation, data centers face the problem of inefficiency in cluster utilization caused by the pronounced peak-valley effects in computational resource usage. To address this pressing issue, we present a novel resource leveling problem for cloud computing scenarios: the Computational Resource Leveling Problem (CRLP). Unlike the classical Resource Leveling Problem (RLP), which schedules tasks under simple temporal constraints and merely mitigates resource fluctuations, CRLP incorporates temporal constraints and resource constraints, aiming to minimize a weighted multi-objective function that includes start-up costs, peak penalties, and deviation penalties, all with time-varying unit costs over the planning horizon. To tackle this NP-hard problem, especially for large-scale instances, we propose the Transition-based Iterated Local Search (T-ILS) heuristic that adheres to a solution transition mechanism to fulfill the temporal constraints. We prove that T-ILS has comprehensive solution space exploration capabilities and introduce innovative local search strategies specifically designed for CRLP. Experimental results show that T-ILS outperforms existing methods and can efficiently process large instances of up to 30,000 tasks in under 13 minutes. This algorithm has been deployed at Ant Group, yielding substantial operational benefits, including reduced CPU core usage and cost savings of millions of RMB.

Paper ID: 183

Paper Title: Zero-Order Feedback-Based Optimization for Distributed Energy Management

Authors: Ruiyang Jin, Yujie Tang, Prof. Jie Song

Abstract: Distributed energy management is a typical optimization problem that requires coordination among multiple agents to satisfy specific targets. However, existing distributed algorithms for this problem still face challenges, including unknown system models, nonconvexity, and privacy issues. To address these challenges, we propose and analyze two distributed algorithms, where the agents do not share their information and instead perform local updates using zeroth-order feedback from a central coordinator to estimate the gradient of the global objective function. One algorithm applies 2-point Gaussian smoothing-based gradient estimators and has the oracle complexity bounded by $O(d/\epsilon^2)$ to get ϵ -error solutions under both convex and nonconvex settings (d is the dimension of decision space). In contrast, the other algorithm applies a coordinate finite-difference gradient estimator and achieves a lower complexity bound $O(d/\epsilon)$. We conduct empirical experiments on a load curtailment problem to validate their performance.

Paper ID: 150

Paper Title: Achieving Efficient and Sustainable Allocation in Decentralized Computing via Nash Equilibrium

Authors: Dongwei Xie, Xiupeng Chen

Abstract: With the rapid growth of large-scale model training, inference services, and high-performance computing tasks, the demand for intelligent computing continues to rise, while expanding computing supply has led to significant energy consumption and carbon emissions. Balancing computing demand with resource efficiency and low-carbon objectives has thus become a central challenge in computing market design.

Currently, computing service markets remain predominantly centralized, exemplified by Huawei Cloud. These platforms use unified schedulers to manage global resources, enabling efficient task allocation and pricing. While efficient and stable, centralized markets face limitations: concentrated pricing power, restricted access for small suppliers, and insufficient reflection of heterogeneous resources' marginal value. Under low-carbon constraints, such systems risk overusing high-carbon resources, reducing green operational performance.

Decentralized computing trading platforms have emerged in response, aggregating heterogeneous resources via open markets, distributed coordination, or on-chain matching. Platforms such as Akash, Aethir, and io.net demonstrate this model's viability and its potential to direct tasks toward energy-efficient, low-carbon nodes. However, existing mechanisms often rely on fixed pricing or simple bidding, which inadequately capture cost structures, capacity limits, and carbon-cost heterogeneity, limiting price discovery and distorting allocation.

To address these challenges, we propose a decentralized trading mechanism based on supply function bidding. Suppliers submit supply functions specifying quantities at

different prices, reflecting economic costs, capacity limits, and low-carbon operational expenses. The platform performs centralized clearing to determine optimal allocation and pricing, enhancing signal continuity and guiding resources toward low-carbon, high-efficiency nodes, improving economic and environmental performance.

We further model the trading process as a non-cooperative game with coupling constraints, including aggregate demand, network capacity, and carbon emission limits. Under suitable conditions, the game admits a unique Nash equilibrium, and we quantify efficiency loss relative to the centralized optimum. To preserve privacy in distributed environments, we design a decentralized marketclearing algorithm requiring only limited exchange of non-sensitive information, prove its analytical convergence, and demonstrate its ability to achieve efficient market clearing under economic and low-carbon constraints.

Paper ID: 282

Paper Title: Simulation-Based Calibration of Time-Varying Queueing Models

Authors: Gongbo Zhang, Prof. Fan Zhang

Abstract: Carbon-aware scheduling, autoscaling, and capacity planning for AI inference clusters increasingly rely on offline simulation to evaluate candidate policies under diverse demand and carbon-intensity scenarios before committing these policies to production, where a poorly chosen strategy can cause SLA violations or waste energy and capacity. The fidelity of such simulation-based evaluation hinges on whether the underlying queueing model accurately reproduces the transient congestion dynamics of the real system, making model calibration a critical methodological prerequisite. This paper studies the simulation-based calibration of time-varying queueing models from request-level logs of inference serving systems, with the goal of estimating the parameters of a nonhomogeneous Poisson arrival process that jointly reproduces transient request-arrival and response-latency dynamics. Unlike arrival-only maximum likelihood estimation, which fits the request process in isolation, our approach formulates a joint calibration objective that simultaneously matches both time-indexed request counts and average response latencies, thereby producing simulators that faithfully capture transient congestion in multi-server accelerator pools.

A central technical challenge is that perturbations to the arrival-rate parameters alter the event structure of the simulated sample paths: inserting or removing an arrival changes the total number of customers, so that customer-level matching objectives become unstable under gradient estimation. To address this, we introduce a perturbation-stable surrogate objective based on time-indexed summaries. The observation horizon is partitioned into time bins, and the calibration loss is defined in terms of binned request counts and binned average response latencies. These binned summaries remain well-defined even when the perturbed and nominal trajectories contain different numbers of requests.

Building on this formulation, we develop a gradient estimator based on measure-valued differentiation (MVD). The estimator operates by sampling a perturbation time from a density proportional to the absolute sensitivity of the arrival rate, inserting one additional arrival at that time, and evaluating the resulting loss increment with an appropriate sign. This signed-insertion construction yields an unbiased estimator of the gradient of the calibration objective, without requiring pathwise differentiability of the discrete-event sample paths. The gradient estimator is combined with projected stochastic approximation for parameter updates, forming the MVD Stochastic Approximation for Queue Calibration (MVD-SAQC) algorithm.

We further propose a trace-driven variant that conditions on the observed service-time sequences, resampling only the arrival-side randomness across simulation replications. This variant targets a conditional calibration objective in which the service environment is treated as given, effectively isolating the inferential effort on the nonstationary arrival process. By eliminating service-side sampling noise, the trace-driven variant yields lower-variance gradient estimates under the same computational budget.

The unbiasedness of the MVD gradient estimator and the convergence of the projected stochastic approximation recursion are established under standard regularity conditions. Numerical experiments on a synthetic $M(t)/G/5$ instance with sinusoidal arrival rate demonstrate that the trace-driven MVD-SAQC reduces parameter estimation error by approximately 43% compared to the fully simulated variant and substantially outperforms finite-difference stochastic approximation and simultaneous perturbation stochastic approximation baselines. Meanwhile, the arrival-only MLE, despite achieving the smallest parameter error, yields the largest calibration objective value, confirming that fitting the request process alone does not ensure accurate reproduction of transient latency dynamics.

These results establish joint simulation-based calibration as a necessary methodological foundation for building high-fidelity digital twins of AI compute services, producing simulation output that downstream carbon-aware and cost-aware optimizers can rely on.

Paper ID: 236

Paper Title: The Impact of Computing Task Flexibility on the Coordinated Optimization of Power and Computing Power Systems

Authors: Qin Guo, Ronggang Cong

Abstract: Under China's "dual carbon" strategy, aligning variable renewable energy with the rapid growth of computing demand is essential. To address temporal mismatches within electricity-computing power coupled systems, this study develops a multi-energy collaborative optimization model featuring a source-load interaction scheme enabled by computing power flexibility. This collaborative optimization reduces daily power system operating costs by 8.5% and substantially enhances

renewable energy utilization. By further dispatching transferable computing tasks to renewable-surplus periods, the source-load interaction scheme decreases computing system power supply costs by 13.86% through intra-period power reallocation and by 20.40% through inter-period coordination. Economic and environmental analyses reveal a nonlinear value regarding scheduling flexibility: coordination benefits peak at a 6–8-hour scheduling window. Beyond this window, additional reductions in cost and carbon emissions become limited due to the saturation of renewable-surplus absorption capacity and the declining marginal substitution of thermal generation. Sensitivity analysis demonstrates that overall system costs are primarily dictated by capacity investment costs, whereas the marginal benefit of extending the scheduling window beyond 8 hours is minimal. The results imply that computing power flexibility must be strategically coordinated with renewable energy investment optimization to enhance the economic and environmental performance of renewable integration.

Session SU06 (Track 1 Intelligent Digital Health Systems and Healthcare Transformation)

Paper ID: 18

Paper Title: From Diagnosis to Workflow: Funding Scale and AI Deployment Trends in Clinical Decision Support using a Five-tier Complexity Framework

Authors: Pek Hooi Soh, Zelyn Lee

Abstract: Healthcare artificial intelligence deployment exhibits systematic patterns associated with funding scale across different AI complexity levels. Analysis of 395 Clinical Decision Support startups (2010-2024) using a five-tier AI complexity framework reveals strong associations between mega-funding (>\$100M) and operational workflow deployment. Across three technology eras, 80-100% of mega-funded companies deployed workflow systems. High Complexity AI shows 70-85% clinical focus at bootstrap through growth funding levels, shifting to 50% clinical/workflow balance when mega-funded. These observed patterns persisted across pre-deep learning, deep learning boom, and democratization eras, suggesting fundamental market dynamics in healthcare AI deployment.

Paper ID: 210

Paper Title: Designing Proactive Healthcare Networks with Mobile Clinics for Comorbidities

Authors: Yafei Shi, Shandong Mou

Abstract: Intelligent digital health systems are driving new models of healthcare delivery, particularly in underserved rural areas. Mobile clinics provide a proactive

screening approach to reach elderly individuals who face mobility challenges. However, organizing these outreach services requires complex logistical planning. Elderly patients frequently suffer from co-morbidities. Consequently, they often require multiple diagnostic tests in a single visit, such as blood tests, ultrasounds, and electrocardiograms. Meeting these complex needs demands the coordinated deployment of a heterogeneous fleet of specialized medical vehicles.

This study investigates a coordinated mobile clinic routing problem tailored for co-morbid elderly populations. In our model, a central hospital dispatches a heterogeneous fleet of vehicles. Each vehicle is equipped for specific tests and constrained by a daily service capacity. To capture realistic patient behavior, we treat demand as endogenous using a distance-decaying function that reflects the reality that an elderly patient's willingness to walk to a screening stop decreases exponentially with distance. Furthermore, we introduce a synchronized multi-vehicle time window mechanism to ensure a seamless screening process.

We formulate this challenge as a Mixed-Integer Linear Programming (MILP) model. The objective is to minimize the total operational costs. These include fixed vehicle costs, travel expenses, and penalties for unfulfilled requests and waiting time, while still meeting minimum screening coverage requirements. We develop an Adaptive Large Neighborhood Search (ALNS) algorithm. Using a dynamic suite of destroy and repair operators, the ALNS efficiently explores the solution space and resolves strict synchronization constraints. The computational results indicate that the ALNS algorithm generates high-quality routing and scheduling plans efficiently. Our analysis also highlights the cost implications of varying screening coverage targets. This work ultimately presents a robust quantitative approach to mobile clinic routing. It offers a practical digital decision-support tool to optimize community-based healthcare services.

Paper ID: 262

Paper Title: An Interpretable DRG Subdivision Method Using Tree-Structured Multi-Objective Optimization

Authors: Prof. Ben Niu, Shuowen Zang, Gaocheng Cai

Abstract: Traditional healthcare payment mechanisms, such as fee-for-service, are prone to inducing provider-induced demand for medical services and weak incentives for cost containment. Diagnosis-Related Groups (DRG) system, as a bundled payment mechanism based on case-mix classification, has been shown to standardize clinical practice patterns and promote the rational allocation of healthcare resources. Consequently, the DRG system has gradually become an internationally recognized tool for the management of inpatient healthcare payments. However, during the localized implementation of the DRG system, existing DRG subdivision methods still face two major challenges. Firstly, conventional subdivision methods, primarily decision trees, fail to integrate official evaluation metrics with subdivision rules and often cannot accommodate multiple performance objectives. This makes it difficult to

generate DRGs that comply with grouping rules while performing well across multiple objectives. Secondly, in some cases, these limitations may even prompt undesirable strategic behaviors by healthcare providers, such as cherry-picking.

To address these challenges, this study proposes a DRG subdivision method based on a mathematical programming model and a tree-structured multi-objective subdivision framework. In formulating the mathematical programming model, multiple DRG subdivision rules are incorporated as constraints. The model is optimized for two primary objectives: maximizing intra-group homogeneity and inter-group heterogeneity. This is a high-dimensional, nonlinear, and combinatorial problem, making it challenging for traditional mathematical programming methods to solve efficiently. To address this limitation, this study develops a tree-structured multi-objective subdivision framework. First, a decision tree model is adopted as a surrogate for generating DRG subdivision rules, transforming the original optimization problem into a tree-structured search task under multiple constraints while preserving clinical interpretability. Second, a non-negative adaptive LASSO regression model is introduced to quantitatively characterize patient severity, providing a refined representation of clinical complexity. Finally, the framework leverages the global exploration capability and parallel search advantages of metaheuristic algorithms. It performs multi-objective optimization within the tree-structured search space to identify a Pareto-optimal DRG set.

Empirical analysis demonstrates several advantages of the proposed method compared with several existing methods. Each DRG set generated by the framework fully complies with all predefined DRG subdivision rules while achieving a better balance between intra-group homogeneity and inter-group heterogeneity. The framework also accurately captures the relationship between disease severity and healthcare resource consumption, and effectively controls the proportion of high-cost outlier cases within each subdivision group. These results indicate that the method can support more refined and rational DRG design.

In summary, the study proposes a standardized DRG subdivision framework that provides theoretical foundations and technical guidance for local healthcare insurance authorities. Model constraints can be flexibly adjusted according to local grouping policies. Using local data and the adjusted subdivision framework, they can generate DRG sets that reflect patient severity and healthcare resource consumption. Such flexibility is crucial for the sustainable implementation of the DRG system.

Paper ID: 420

Paper Title: CMFH-Net: A Cross-Modal Frequency Enhancement and Hierarchical Distance-Aware Fusion Network for Multimodal Semi-Supervised 3D Medical Image Segmentation

Authors: Prof. Xinqiang Wang, Wenhuan Lu

Abstract: To address the inherent challenges of multi-modal 3D medical images (e.g., brain tumors and soft tissue tumors), including significant cross-modal heterogeneity, strong long-range contextual dependency, and high difficulty in cross-modal feature alignment and fine-grained detail extraction, as well as the negative transfer problem commonly induced by existing fusion mechanisms, we propose a semi-supervised 3D medical image segmentation model based on cross-modal frequency enhancement and hierarchical distance-aware fusion, namely Cross-Modal Frequency Enhancement and Hierarchical Distance-Aware Fusion Network (CMFH-Net). With the hierarchical distance-aware fusion mechanism, we adopt distance-aware attention to capture the long-range dependencies of 3D volumetric data, thus enhancing cross-modal global context modeling and deep shared semantic representation. The proposed cross-modal frequency enhancement mechanism models the complementary feature correlations of multi-modal data in the frequency domain, realizes joint enhancement of spatial and frequency domain information, and optimizes detail recovery in the decoder stage and cross-modal information fusion. Combined with the semi-supervised consistency constraint strategy, our method fully exploits the complementary information of dual modalities to improve the generalization and robustness of the model under limited annotation conditions. Extensive experimental results demonstrate that CMFH-Net outperforms existing mainstream multi-modal semi-supervised methods under different labeling ratios, with more prominent advantages especially in the 5% low-annotation regime.

Paper ID: 295

Paper Title: Bridging the Implementation Gap: Engineering Trust in the Era of Agentic AI

Authors: Prof. Robin Qiu

Abstract: While global consensus on the need for ethical artificial intelligence has grown, a critical "implementation gap" remains between high-level policy mandates and day-to-day software engineering. As the industry transitions from standalone predictive models to complex, decentralized Agentic AI and embodied robotics, the stakes for system safety, autonomy, and accountability are higher than ever. High-level philosophical debates must now be translated into compilable code and rigorous system architecture.

This presentation provides a comprehensive, actionable framework for operationalizing trustworthiness, drawing from the core methodologies detailed in *Responsible AI*:

Principles, Governance, and Global Practice. We will explore the "Golden Thread" that connects global regulations directly to engineering execution through four distinct pillars:

- The Compass (Principles): Rather than just listing off virtues, the book grounds core tenets like autonomy and fairness in vivid, high-stakes case studies, ranging from autonomous vehicles to personalized learning networks.
- The Map (Governance): If you are confused by the fragmented landscape of global AI regulations, the "RAI Crosswalk" detailed in these chapters is worth the price of the book alone. It provides clear, practical compliance mapping for the EU AI Act, the NIST AI RMF, and ISO/IEC 42001.
- The Journey (Lifecycle): The text introduces the Responsible AI Development Lifecycle (RDLC), offering concrete "Engineering Gates" that development teams can implement from initial ideation all the way to system retirement.
- The Vehicle (Operations & Engineering): This is where the book truly shines for technical audiences. It dives deep into the bedrock required for the incoming wave of Agentic and Embodied AI.

Session SU07 (Track 12 Data-Driven Intelligence: Integrating Analytics, Artificial Intelligence, and Machine Learning for Smarter Decision-Making)

Paper ID: 151

Paper Title: Modeling Heterogeneity in the Commitment-Engagement Link

Authors: Toshikuni Sato, Takumi Kato

Abstract: This study proposes a Bayesian hierarchical model to investigate heterogeneity in the relationship between customer commitment and engagement by integrating construct measurements and textual customer reviews. While traditional models often assume a uniform impact of commitment on engagement, the proposed approach incorporates textual evaluations of customer experiences to capture diverse response patterns in behavioral engagement. The empirical analysis reveals significant individual differences in how affective and continuance commitment relate to engagement outcomes. The results indicate that the impact of these two commitment dimensions may vary based on specific experiential attributes. In several cases, either the affective or the continuance psychological pathway appears more prominent in driving engagement. Although these findings should be interpreted with caution because of multicollinearity inherent in the measurement scales, this study provides a granular framework for managers to strategically tailor experiential attributes to activate specific commitment drivers. The proposed method contributes to a deeper understanding of the psychological mechanisms that drive customer engagement.

Paper ID: 290

Paper Title: Bridging Skill Gaps: Graph Analysis of Marketing Labor Holes

Authors: Prof. Luna Yang, Prof. Satish Mahadevan Srinivasan, Dr. Xianfang Tan

Abstract: We develop a network-based approach to characterize competency configurations at different career levels and compensation groups in marketing. This paper contributes to the understanding of skill-based career mobility in the context of AI-enabled disruption in the labor market. We analyze 10,024 marketing positions from major U.S. job boards using a bipartite network analysis that connects skills with compensation-tiered job clusters, with current flow betweenness centrality scores to identify bridging competencies that enable transitions from lower- to higher-compensated positions. Our results indicate that skills such as AI/Machine Learning in Marketing, A/B Testing, Salesforce Marketing Cloud and Project Management are important connectors, with sensitivity analysis of node removal pointing to increases of 2.1–7.6% in average path length and decreases of 1.9–17.7% in network efficiency with node removal. These results indicate that some transferable skills are enabling transitions between different groups of compensation. This research also indicates that the skillset AI and machine learning in marketing has had a strong impact on network connectivity. The study provides valuable insights for workforce development and suggests training programs focus on these skills with high current flow betweenness to facilitate career progression and reduce wage barriers in rapidly changing marketing industries.

Paper ID: 17

Paper Title: “Cure Sometimes, Relieve Often, Comfort Always”

Authors: Qiusi Yan, Yachen Guo, Siyin Chen

Abstract:

The modern workplace is shaped by two intensifying demands that seem to place professionals in a difficult position. First, as AI increasingly commodifies core technical tasks—from legal discovery to medical diagnostics—professionals face mounting pressure to differentiate themselves (Faulconbridge et al., 2025). To remain consequential, they must cultivate new forms of expertise (Kim et al., 2025), especially relational expertise: translating technical judgment into guidance that others can trust, use, and act upon (Pakarinen & Huising, 2025). Simultaneously, professionals confront a powerful normative demand to address widening social inequalities by serving the underserved (George et al., 2016). Despite growing institutional pressure to bridge this gap through pro bono legal aid (Rhode, 2005) and charity care (Engel, 2006), unmet need remains vast: such as 92% of civil legal problems go unaddressed due to supply scarcity (Legal Services Corporation, 2022). Viewed through a traditional resource-

constraint perspective, these pressures seem incompatible: time spent on unpaid charity is framed as a distraction from surviving the paid-market “arms race” (DeVoe & Pfeffer, 2007), and professionals often cite paid workload as a barrier to participation (Rumsey, 2019).

In this paper, we advance a generative expertise view grounded in social exchange theory (Cropanzano & Mitchell, 2005), arguing that charity work can resolve this dilemma by functioning as a learning hub where professionals develop relational knowledge that transfers into paid encounters. Social exchange theory distinguishes economic from social exchange: both are relational, but they differ in what is exchanged, how obligations are specified, and which norms govern interaction (Blau, 1964). Translating to the context of professional encounters, paid service is often relational yet typically organized by an economic exchange frame in which payment clarifies deliverables and foregrounds efficiency and accountability (Sharma, 1997). By contrast, unpaid charity shifts the encounter into a social exchange script: without a price anchor, expectations become less contract-like, clients more often seek reassurance and recognition alongside solutions, and professionals are positioned as benevolent public-facing guides (Grant, 2007). Returns become socioemotional—gratitude, trust, moral approval—feedback that is richer and more immediate than in many paid interactions. Because charity encounters cannot rely on money to coordinate roles and demands, professionals must actively generate engagement and trust through concrete relational moves—practicing relational expertise (Pakarinen & Huising, 2025) that paid efficiency pressures often compress. Critical questions remain that guide our inquiry: How—through what micro-mechanisms—do professionals participating in charity services generate relational expertise, and how does that expertise shape paid service?

Context. We studied medical professionals providing unpaid charity care livestreams (unpaid, public-facing health education) and paid medical consultations (fee-based, case-specific advice) on GoodDoctor.com (pseudonym), a leading online healthcare platform in China (see Figure 1 for comparison). This context is fitting as China’s healthcare system faces intensifying demand amid persistent access constraints (World Bank, 2018). In this high-volume, efficiency-driven environment, digital platforms have emerged as a critical interface where physicians must navigate the dual demands of standardized, rapid paid service and the growing public expectation for accessible, humanized care (Kellogg et al., 2020). We adopted a full-cycle mixed-methods design (Ranganathan, 2018), starting with inductive qualitative fieldwork to identify the micro-mechanisms of learning relational expertise, followed by deductive quantitative analysis to test their prevalence and impact at scale.

Study 1: Qualitatively theorizing the connecting mechanism between charity care and paid consultation. We contacted 58 physicians who provided charity care and constructed matched qualitative bundles for each, triangulating interview narratives with livestream replays and paid consultation records. Our analysis reveals an interesting trajectory: while physicians often initiated these livestreams with a casual “sense of experimentation” [DR#5]¹, they quickly encountered a distinct interactional order that disrupted their standard professional scripts, forcing them to realize that “you definitely can’t behave the same way” as in the efficiency-driven clinic [DR#7]. Confronted by a lay audience seeking “emotional support” rather than just technical answers [DR#4], physicians were compelled to codify *relational heuristics*: portable, low-cognitive-load interactional rules that they develop to manage professional–client relationships, aiming to sustain clients’ engagement in the service encounter.

Three relational heuristics emerged as the most prominent: a) lay translating, where they abandoned jargon for “simple, vivid, everyday language” to demystify medical fears [DR#42]; b) emotional holding, where they learned to “validate anxiety” rather than dismiss it [DR#4]; and c) collective bonding, where they replaced authoritative distance with inclusive language to build a sense of “we” [LS#4 from DR#11]. Crucially, this learning was transferable; physicians described “mentally replaying” these newly codified scripts in their subsequent paid work, such as utilizing “one key analogy” or “one sentence of reassurance” when facing fee-paying clients.

Study 2: Quantitatively linking charity care to relational heuristics and paying client satisfaction. To validate whether the relational heuristics identified in our qualitative study (See Figure 2 for grounded model) represent a generalizable mechanism transferable to paid service, Study 2 utilizes a longitudinal platform-wide dataset that contains all charity livestreams between August 2022 and January 2024² (1,759 livestreams by 176 physicians), further linked to 12,595 paid consultations across defined pre- and post-event (livestream) windows. By leveraging an event study design that controls for time-invariant physician characteristics, we find a significant, sustained increase in client satisfaction within paid services immediately following charity episodes (ATT = +0.211, $p = 0.002$; see Figure 3), which robustly supports our main effect (H1). This finding challenges the traditional resource-constraint perspective by demonstrating that prosocial engagement functions as a learning hub rather than a depleting distraction. To elucidate the mechanism (H2) and rule out mere reputation effects, we utilized zero-shot Large Language Model classification to quantify the

¹ DR denotes physician interviewees; LS denotes charity livestream sessions.

² Charity livestreaming on the platform began in August 2022; January 2024 marks the end of our data collection period.

prevalence of emotional holding, collective bonding, and lay translating within the text of paid interactions. Consistent with a generative expertise view, we document distinct pre-post increases in the usage of all three heuristics in paid consultations, with mediation analyses confirming that this explains approximately 12.5% of the satisfaction gain (see Figure 4), validating the hypothesized indirect pathway.

Proposed Study 3: Experimentally validating the impact of relational heuristics.

To strengthen causal inference and rule out alternative explanations (e.g., reputation effects), Study 3 utilizes a randomized vignette experiment to test whether the specific relational heuristics codified in charity work directly drive client satisfaction. We will recruit online participants to act as potential patients and present them with a transcript of a consultation regarding COVID-19 symptoms. Using a between-subjects design, we will manipulate the physician’s communication style while holding the technical diagnosis constant: the control condition utilizes standard medical terminology, while the treatment condition integrates the heuristics identified earlier. We expect higher satisfaction and greater willingness to choose the physician in the treatment condition, validating the heuristics as the direct causal mechanism.

Potential Contributions. These findings advance the relational turn in professional work by showing how the economic feature of encounters (free vs. paid) reshapes relational scripts in ways that enable expertise development. By identifying specific, codifiable relational heuristics forged in low-stakes charity settings and carried into paid practice, we also contribute to research on prosocial work by moving beyond reputational “halo effects” to unpack the cognitive and interactional micro-foundations through which prosocial engagement generates transferable relational expertise.

Figure 1. Comparison of Platform Interface Functions in Public-Facing Unpaid Livestreaming and Case-Specific Paid Consultations

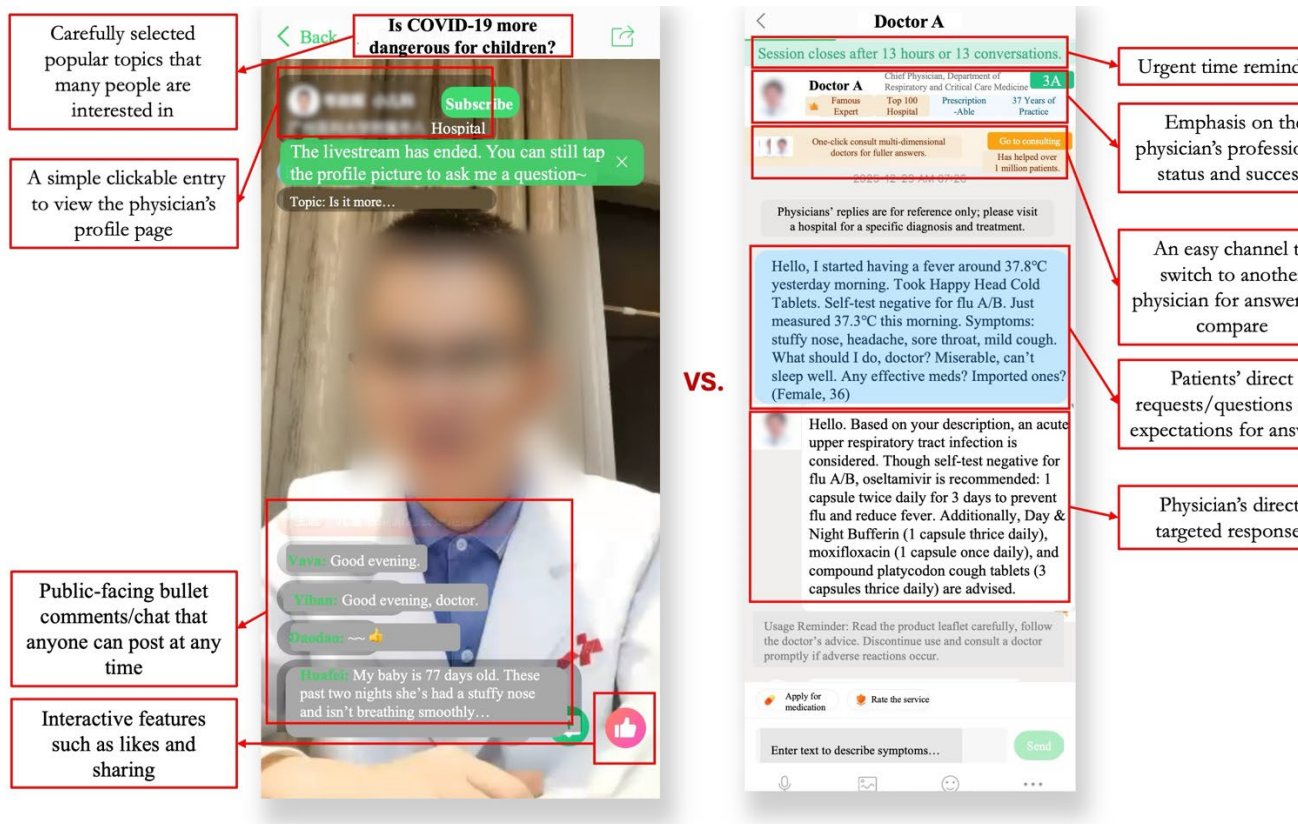


Figure 2. A Grounded Model of How Professionals Participating in Charity Services Generate Relational Expertise That Shapes Paid Service?

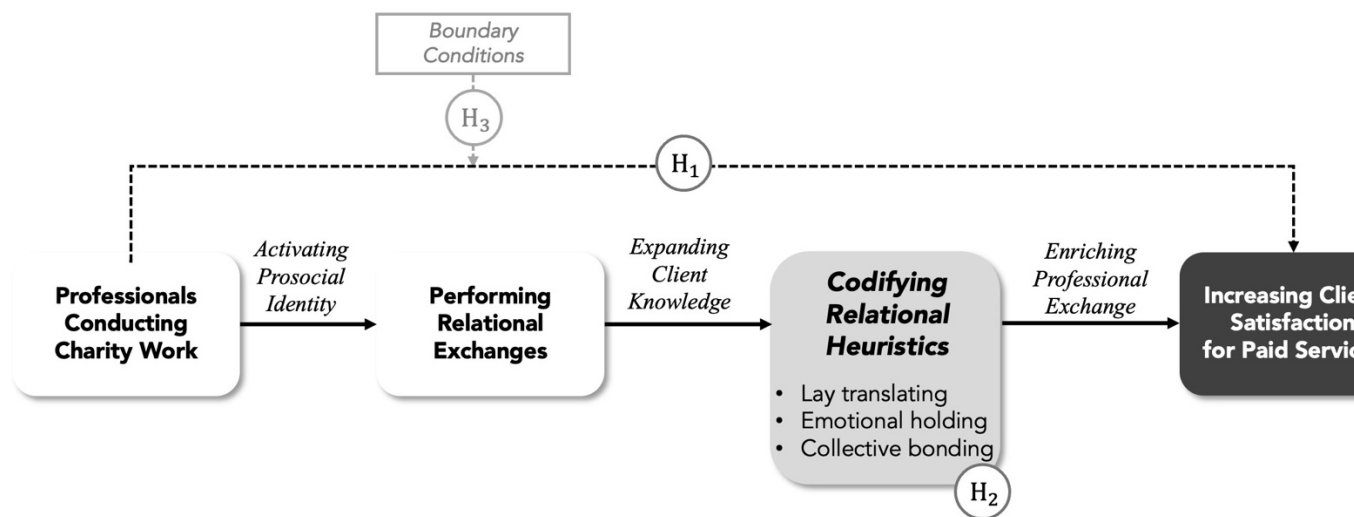


Figure 3. Main Effect Analysis: Event Study Specification and Causal Forest Estimation

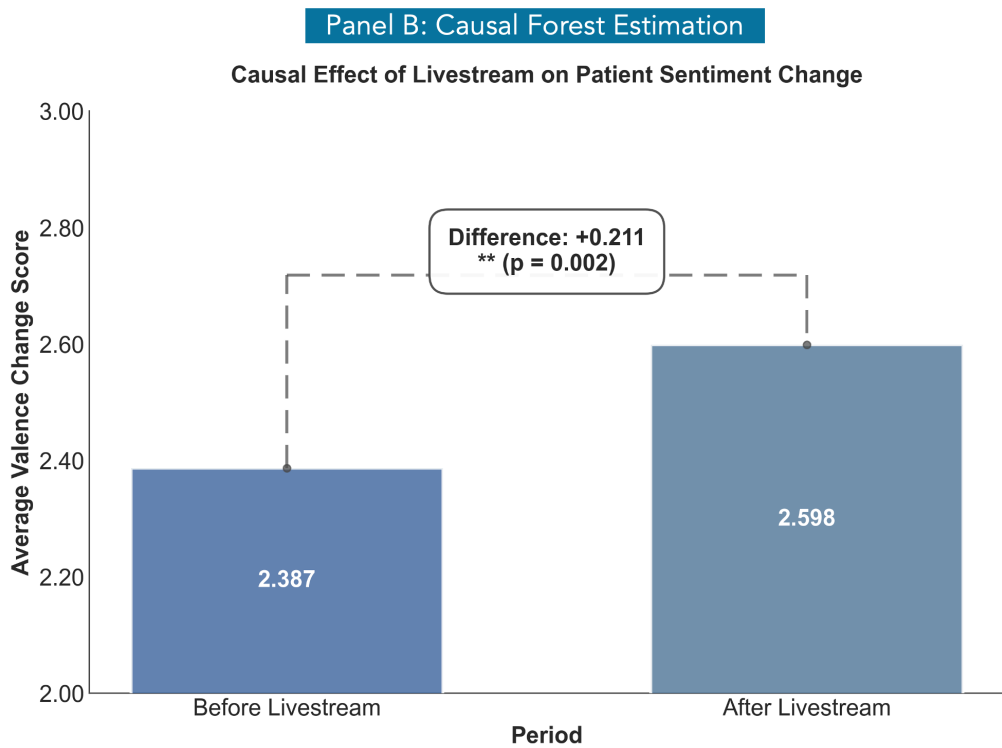
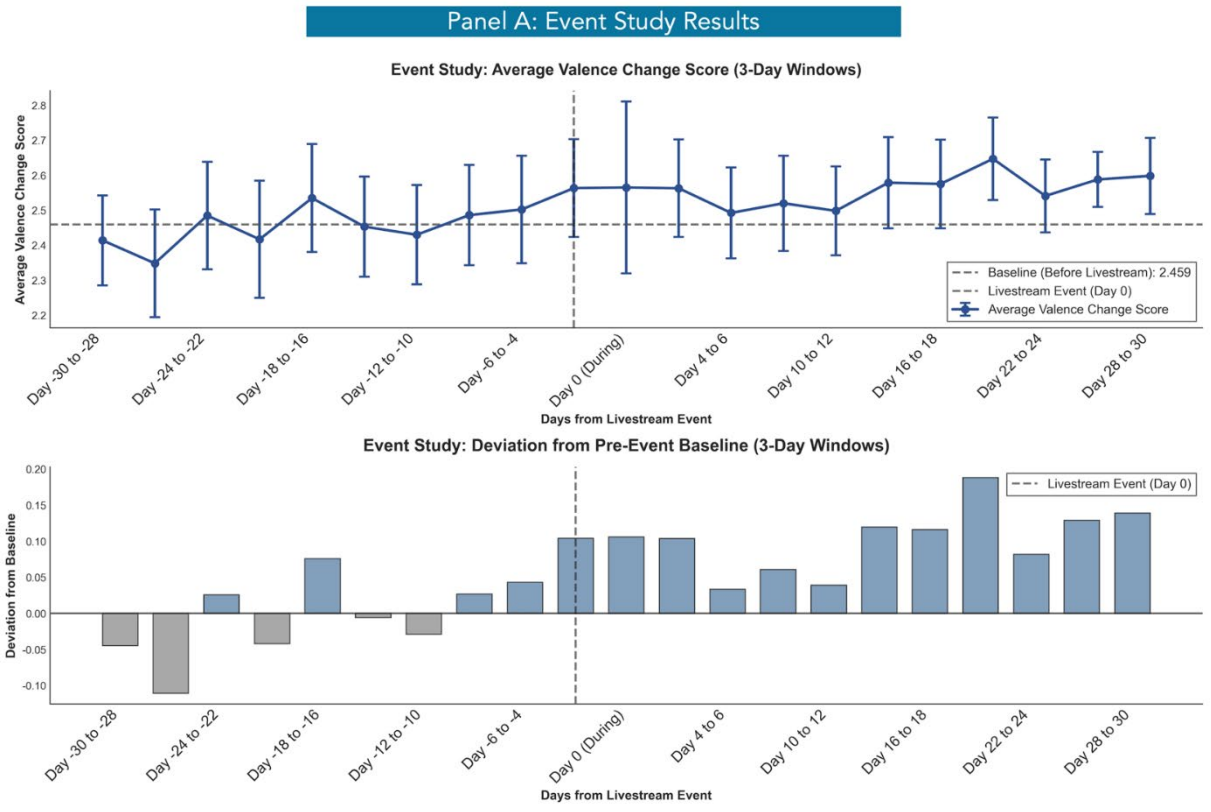
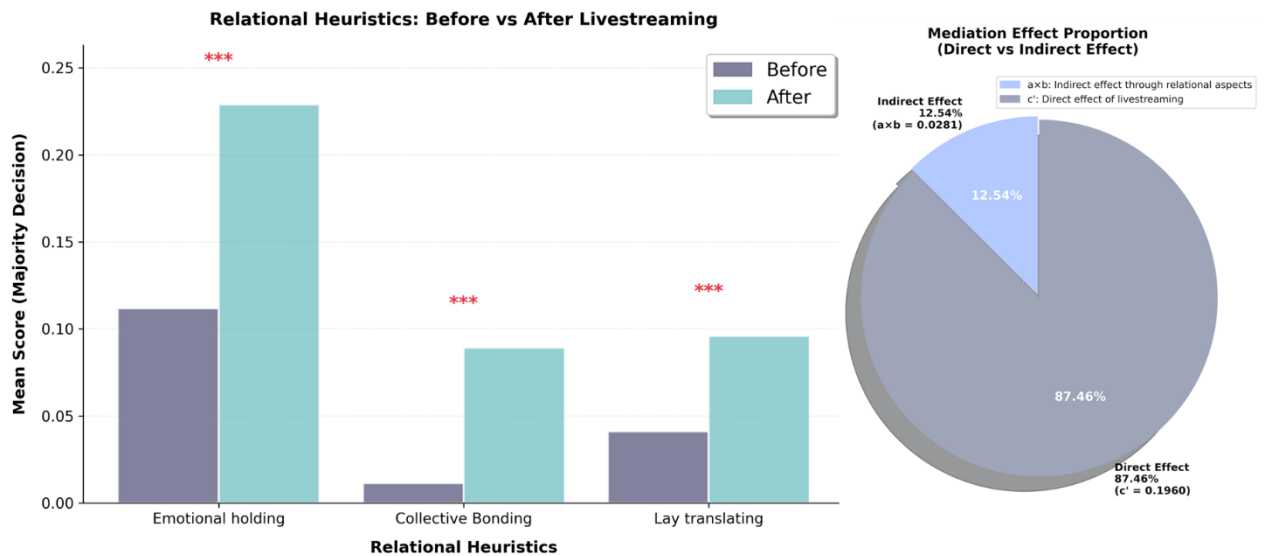


Figure 4. Mechanism Analysis: The Cultivation of Relational Heuristics and Its Mediating Role



Paper ID: 83

Paper Title: Decision Trajectory Metrology for Vision Models: Measuring Stability, Explaining Dynamics, and Guiding Adaptive Inference

Authors: Dr. Zhenyu Xue

Abstract: Despite rapid progress in vision models, their inference dynamics remain largely black-box: we observe final predictions but lack reproducible descriptors of how decisions form and stabilize along computation. We propose a measurement-first framework that turns intermediate predictions into a decision trajectory object and enables process-level interpretability for adaptive computation. From each trajectory we extract simple stability measures—lock depth, instability flips, and commit time—along with a minimal regime taxonomy and deployment-compatible decision indices. Across multiple training regimes and distribution shifts, we reveal a consistent geometry-reshaping phenomenon: training systematically redistributes trajectory mass toward earlier stable regions while isolating irrecoverable failure modes, structures that are invisible to terminal accuracy alone. These measurements directly inform simple, deployment-visible adaptive inference policies and yield predictable accuracy–cost trade-offs evaluated offline from traces. Our results suggest that trajectory-based measurement provides both an interpretable lens and a practical design signal for training and deploying resource-rational vision systems.

Paper ID: 146

Paper Title: Unlocking Latent Crowd Wisdom via Dual-Path Expectancy Violation Modeling for Fake News Detection

Authors: Yiping Chen, Xuelong Chen

Abstract: The proliferation of fake news necessitates effective automatic detection to mitigate its societal harm. While crowd wisdom (e.g., user comments) is widely leveraged, current methods face two primary limitations: they often neglect the relationship between the emotions and topics expressed in source posts and those reflected in their corresponding comments, and they are susceptible to noise or misinformation within these comments. To address these gaps, following the design science research paradigm, we propose a theory-driven artifact named dual-path expectancy violation framework for fake news detection (DEVF). Specifically, DEVF operationalizes expectancy violation theory through three core mechanisms (1) a relational module that quantifies social expectancy violations (SEV) by analyzing emotional and topical divergence between posts and responses; (2) a cognitive module that captures cognitive expectancy violations (CEV) by leveraging external knowledge as a credible anchor to identify inconsistencies between social discourse and verifiable facts; and (3) a gating mechanism that dynamically fuses SEV and CEV components based on their importance for individual news items. Evaluations on the Weibo21 dataset demonstrate that DEVF significantly outperforms state-of-the-art baselines, achieving an accuracy improvement of 2.2% and an F1-score increase of 0.026. We validated the rigor and robustness of our framework through extensive ablation studies and parameter sensitivity analyses. By decoding signals of expectancy violations, our framework effectively unearths latent crowd wisdom, advancing both the performance and interpretability of fake news detection. More importantly, this framework acts as a diagnostic tool that distinguishes between factual conflicts and manipulative social intent. This enables a tiered intervention strategy for platform governance: automatically filtering high-confidence factual errors while routing complex social violations to human experts. This optimized workflow significantly reduces cognitive load on human moderators and improves resource allocation efficiency.

Session SU08 (Track 28 AI for Finance)

Paper ID: 387

Paper Title: Uncertainty about "Uncertainty"

Authors: Xiangyu Wang, Ying Chen, Kotaro Inoue, Yosuke Kimura, Jin Xu

Abstract: The past twenty years have witnessed growing claims of ignorance in firm disclosures, as managers increasingly attribute outcomes to “uncertainty” rather than to concrete, identifiable causes. This paper examines the impact of such “uncertainty

attribution” on stock market uncertainty. It helps assess whether the widely held belief in the informativeness of managerial explanations still holds as attribution targets shift from informative to uninformative. We develop a causality-sensitive BERT model to measure firm-year uncertainty attribution intensity based on MD&A texts of U.S. public firms (2003–2022). Event study results show that uncertainty attribution in disclosures raises stock market uncertainty. We rule out that this increase stems from higher volatility in firm fundamentals. Instead, an information choice in beauty contest model and additional empirical evidence indicate an informational mechanism: lower-precision public disclosures resulting from uncertainty attribution prompt investors to rely more on dispersed private signals. Our study is among the first to demonstrate how managerial attribution shapes disclosure informativeness and identifies a novel channel through which uncertainty is transmitted from the real economy to financial markets.

Paper ID: 407

Paper Title: How does the development of next-generation artificial intelligence impact energy stability?

Authors: Tingqiang Chen, Chengping Wang, Jiaqi Wang

Abstract: Energy stability is the lifeline of high-quality economic and social development. As next-generation artificial intelligence accelerates the transformation of energy systems, whether it will empower or disrupt energy stability has become a critical real-world issue concerning national security. This study constructs a comprehensive evaluation system for energy stability encompassing the entire chain of “infrastructure-supply-consumption-environment” based on panel data from 30 Chinese provinces spanning 2012–2023. Utilizing the establishment of National New Generation Artificial Intelligence Innovation Development Pilot Zones (NGAI) as a quasi-natural experiment, employ dual machine learning models to identify the intrinsic mechanisms through which AI development impacts energy stability. Furthermore, analyze the moderating effects of support from multiple stakeholders—including governments, institutions, and individuals—on this impact through the lens of patient capital. Results show that: (1) NGAI significantly promotes energy stability, and this finding is validated through robustness and endogeneity tests. (2) NGAI promotes energy stability by alleviating the misallocation of innovation factors and enhancing the enabling role of digital infrastructure. (3) The moderating effect of patient capital exhibits complex subject heterogeneity. Patient capital originating from institutional investors significantly amplifies policy effects regardless of whether it is injected into regional economies or the AI industry. In contrast, government patient capital demonstrates a significant reinforcing effect only when focused on the AI industry. Meanwhile, the moderating effect of individual investors is insignificant at both levels. (4) The policy effects are more pronounced in eastern and western regions, as well as in economically developed and non-resource-based areas. (5) Further analysis reveals that the NGAI not only promotes energy stability but also reduces interregional energy inequality. This study provides empirical evidence for understanding the enabling

mechanisms of next-generation artificial intelligence in enhancing energy stability, while also offering policy insights for promoting the coordinated high-quality development of artificial intelligence and energy systems.

Paper ID: 405

Paper Title: Nature Transition Risk

Authors: Prof. Haoyu Gao, Dr. Fukang Chen, Dr. Minhao Chen, Prof. Hao Liang

Abstract: Regulatory discretion in conservation policy creates a distinct and underexplored source of nature transition risk. Exploiting the UN Biodiversity Conference in Kunming, a policy shock that heightens political commitment to biodiversity protection, we find that firms with greater nature-related subsidy exposure, signaling susceptibility to discretionary government mobilization, exhibit significant negative cumulative abnormal returns around the event. The decline is driven by an expanded risk premium (discount rate channel) rather than revised cash-flow expectations. The effects are stronger among firms in more fiscally constrained and conservation-pressured regions. While affected firms increase biodiversity disclosures, investors price the operational disruption of conservation mandates without expecting earnings from subsidy-linked ties, suggesting that institutional discretion induce unhedged transition risks if underlying regulatory frictions remain unaddressed.

Paper ID: 403

Paper Title: Text features and fundraising performance of medical crowdfunding

Authors: Prof. Zhi-Qiang Jiang

Abstract: Medical crowdfunding has become a vital alternative financing mechanism for patients confronting catastrophic healthcare expenditures. This systematic review our research on the causal and correlational links between textual features and fundraising outcomes, focusing on the application of natural language processing (NLP) techniques and their utility in predicting and explaining donor decision-making. Accumulating evidence demonstrates that textual content is a pivotal determinant of fundraising success rate, total funds raised, and average individual donation size, with distinct textual dimensions exerting heterogeneous effects through psychological and social mechanisms. The findings offer insights for crowdfunding platforms to optimize project curation algorithms and for help-seekers to craft more persuasive fundraising narratives.

Paper ID: 401

Paper Title: Know Thyself? Managerial Self-Assessment Accuracy and Fund Performance

Authors: Yi Li, Prof. Wei Zhang

Abstract: We construct a measure of managerial self-assessment miscalibration by applying large language models to quarterly managerial narratives in the Chinese mutual fund market. We find a robust negative relation between miscalibration and subsequent risk-adjusted fund returns. Mechanism tests show that miscalibrated managers exhibit weaker stock-selection and market-timing ability and engage in value-destroying behaviors, including excessive trading and inefficient risk-taking. Using manager turnover events as a source of identification, we provide evidence consistent with a causal effect of managerial miscalibration on performance deterioration. We further show that managers with greater miscalibration receive worse third-party ratings and are less likely to be promoted, although investor capital flows remain largely insensitive to this dimension of managerial quality. Overall, our findings identify accurate self-assessment as a distinct and economically important component of human capital in delegated asset management.

Session SU09 (Track 10 AI-Driven Service Innovation: From Personalization to Hyperautomation)

Paper ID: 66

Paper Title: Warehouse Assortment Selection with Constant-Factor Guarantees via Birkhoff--von Neumann Decomposition

Authors: Xiaobo Li, Hongyuan Lin, Fang Liu

Abstract: The rapid growth of e-commerce has intensified the challenge of efficient order fulfillment, particularly as front-end warehouses operate under strict capacity constraints. In such systems, determining which products to stock at each warehouse is a critical driver of fulfillment cost, especially when customer orders ideally should be satisfied entirely from a single front-end warehouse. This paper develops a scalable heuristic for warehouse assortment selection in both single- and multi-warehouse settings, based on the Birkhoff–von Neumann (BvN) decomposition. The method begins by solving a linear programming relaxation of the original problem and uses its solution to form a doubly stochastic matrix. A BvN decomposition of this matrix then produces a set of feasible solutions, and the heuristic outputs the best-performing one. We show that this heuristic achieves constant-factor performance guarantees. The approximation ratio is bounded by the maximum order size in single-warehouse systems and by the ratio of the maximum order size to the positive fulfillment cost gap between the cheapest and second-cheapest warehouses in multi-warehouse systems.

Remarkably, these guarantees hold under arbitrary demand distributions, providing the first distribution-free result for this setting. We further develop a reduced BvN algorithm that efficiently performs the decomposition in polynomial time and can incorporate business constraints such as non-overlapping assortments and full-coverage requirements. Extensive numerical experiments, including a real-world case study and synthetic instances, demonstrate that the proposed heuristic consistently outperforms existing algorithms, with performance gains that become more substantial as the number of products, warehouses, and order complexity increase.

Paper ID: 79

Paper Title: Managing Public Health Surveillance Operations with Endogenous Population Growth

Authors: Hui Lin, Nan Liu, Guohua Wan, Prof. Shan Wang, Schnall Rebecca

Abstract: Public health surveillance is "the continuous, systematic collection, analysis and interpretation of health-related data" to guide public health actions (WHO 2012). In addition to traditional recruitment approaches, such as facility-based methods and community outreach, modern surveillance efforts increasingly rely on social media and online platforms. A central operational challenge in these efforts is recruiting a sufficient number of participants within a targeted time frame to ensure unbiased estimation of population health status. In this talk, we introduce a dynamic programming model to support decision-making in participant recruitment and service for public health surveillance. Using data from a large-scale epidemiological study designed to assess HIV risks, we demonstrate that our approach can substantially improve recruitment efficiency and reduce associated costs.

Paper ID: 32

Paper Title: Real-time scheduling of multi-test outpatient services: integrating appointment plans with operational uncertainties

Authors: Junpeng Wang, Yanan Zhu, Yang Wang, Erik Demeulemeester, Abraham Punnen

Abstract: Efficient scheduling of diagnostic tests is critical to outpatient care, directly impacting hospital performance and patient satisfaction. Traditional scheduling approaches struggle to accommodate dynamic factors such as patient tardiness and variability in test durations. This study addresses the real-time scheduling problem for outpatients requiring multiple diagnostic tests (RTOMT) in a clinical appointment setting. At each decision point, the problem involves routing an idle patient to the next diagnostic test and assigning the next patient to an available device, with the objective of minimizing the total patient waiting time. To address this problem, we propose a Genetic Programming (GP) approach that integrates a simulation model, a basic rule

set, and an evolutionary process. A dual-tree representation is employed to jointly encode patient-related routing decision and device-related assignment decision. Using real data from a partner hospital, we construct a set of benchmark instances and evaluate the proposed approach against both the hospital's current scheduling practice and representative methods from the literature. Computational results demonstrate that the GP-based approach achieves substantial reductions in patient waiting time. We also investigate an extended scenario that introduces tardiness penalties to reflect common hospital policies, finding that the overall waiting time increases slightly by 5.1% while the on-time patients experience a 15.9% reduction. Finally, a real-world case study validates the effectiveness and practical applicability of the GP-generated scheduling rules.

Paper ID: 104

Paper Title: When Ratings Compete: Revisiting the Role of Product Reviews in Differentiated Markets

Authors: Wenjuan Yang, Jinxiang Wei, Xiaodong Wang

Abstract: Product reviews are a critical information channel in e-commerce and online marketplaces, shaping consumer decisions and competitive outcomes. Yet there is limited theoretical understanding of how review distributions influence pricing competition between differentiated firms. This paper examines competition between two vertically differentiated firms in a two-period game-theoretic model. In period 1, consumers choose based on prior beliefs; in period~2, they partially update beliefs from reviews, with information diffusion captured by review intensity. The analysis focuses on three review elements: average rating difference, rating variance, and review intensity. A larger average rating difference strengthens the perceived quality gap, increasing the high-quality firm's pricing power and profit while reducing those of the low-quality firm. Rating variance has asymmetric effects: it robustly benefits the low-quality firm, whereas its effect on the high-quality firm can be non-monotonic because competition-softening and signal-dilution forces work in opposite directions. Review intensity can either amplify or attenuate each firm's advantage depending on the rating gap and dispersion, generating threshold and non-monotonic comparative statics. Across periods, reviews can induce skimming or penetration pricing; relative to a no-review benchmark, they can also generate asymmetric gains, profit-ranking reversals, and a win-win outcome. Together, these findings highlight that firms should manage product reviews as a strategic lever in differentiated markets, with implications for their pricing strategy and profitability.

Paper ID: 165

Paper Title: Measuring empathy with large language models reveals its consequences for patient behavior in online healthcare

Authors: Li Zhang, Hong Wu

Abstract: Empathy plays a central role in effective doctor–patient communication, yet most empirical research focuses on physicians’ empathic expressions alone while overlooking patients’ varying emotional needs. In digital healthcare environments where communication is primarily text-based, whether physicians’ responses match patients’ emotional expectations may be particularly consequential for patient behaviour. Here we introduce the concept of empathy matching, which captures the alignment between patients’ empathy needs and physicians’ empathic expressions during online consultations. Using large language models, we develop a scalable method to identify empathy needs and empathic expressions from large-scale doctor–patient interaction texts. The approach demonstrates high agreement with human annotations across multiple prompt strategies and models. Applying this framework to 8,825 online consultation orders from a major healthcare platform, we examine how empathy matching shapes patients’ subsequent physician selection behaviour. The results show that insufficient empathy—when physicians’ empathic responses fall below patients’ emotional needs—significantly increases the likelihood that patients switch doctors in subsequent consultations, whereas excessive empathy does not produce a comparable effect. Further analyses reveal that this effect is stronger in contexts with higher physician status, higher service price, and greater disease complexity. These findings highlight the behavioural consequences of emotional alignment in digital healthcare interactions and demonstrate how large language models can enable scalable measurement of empathy in real-world communication data. More broadly, the study provides new insights into how emotional dynamics in online service interactions shape user decision-making.

Session SU10 (Track 4 Smart and Intelligent Port and Shipping Logistics Services & 2 AI Readiness and Smart Infrastructure: Industrial and Urban Perspectives)

Paper ID: 55

Paper Title: Resilience of Inland Waterway Networks: A Bayesian Analysis of Vessel Trajectory Data

Authors: Dr. Louise Lu Li, Dr. Shiguan Liao, Prof. Samuel Shuai Liu

Abstract: Inland waterways transport (IWT) is essential for regional logistics, especially in landlocked countries and locations, as it provides a cost-efficient and environmentally advantageous means of freight and passenger transport. Statistics

show that IWT accounts for about 14% of intercity freight in the United States (United States Maritime Administration 2024) and about 8.69% of national freight in China (Ministry of Transport of China 2023). However, due to their complex network nature, inland waterways in low-lying regions are susceptible to natural disasters such as tropical cyclones (TCs). TCs account for almost 75% of the sources of damage to maritime infrastructure caused by natural disasters (Cao and Lam 2018). They are commonly known as “typhoons” or “hurricanes” when reaching a particular threshold of wind speeds and can produce strong winds, heavy rainfall, and storm surges on inland waterways, damaging port and channel infrastructure and causing casualties and cargo loss. In the United States, Hurricane Harvey in 2017 resulted in the closure of ports along the Gulf Coast for more than two weeks, including Houston, Galveston, Texas City, Freeport, and Corpus Christi, incurring financial damages of up to \$2.5 billion (United Nations Conference on Trade and Development, 2024). In Europe, the David and Eleanor typhoons caused 21 deaths and \$324 million in losses.

TC events are considered inevitable, leading to a shift in the emphasis of transport planning and research from preventing disruptions beforehand to building resilience of transport infrastructures (Baroud et al. 2014). Many countries have implemented subsidies to improve the resilience of IWT. The government of the United States introduced the “*Infrastructure Investment and Jobs Act*” in 2021, designating 16.6 billion dollars of new funding for the improvement of inland waterways and port infrastructures. The European Commission has allocated 635 million euros to improve the reliability and predictability of navigation in IWT. The Ministry of Transport of China has launched the “*Outline of the Medium and Long-term Development Plan for Scientific and Technological Innovation in the Transportation Sector (2021-2035)*” to improve IWT security. Evaluating the resilience of IWT and understanding its response mechanisms to TC events ensures the operational and maintenance capabilities of the transportation system.

The resilience of maritime infrastructures generally refers to their inherent ability to adapt and recover normal functioning against disruptions. The research focus of maritime resilience studies has advanced from individual ports to port systems and shipping networks. Port resilience studies commonly use case studies (Rousset and Ducruet, 2020), risk assessments (Izaguirre et al. 2021), simulation models (Jian et al. 2019, and scenario analyzes (Thekdi and Santos 2016) to measure port service delays or economic losses due to disruptions. Validating the assessment is difficult, as some studies are based on hypothetical disruption scenarios and do not consider probability and secondary impacts on the connected components of the network (Verschuur, Koks, Li, and Hall 2023). Network resilience studies examine the interdependencies of port nodes and shipping network structures and generally use topological and hierarchical properties to measure network vulnerabilities to TC, but few consider the varying probability of maloperation and the redistribution process of ship traffic (such as rerouting) in response to such events, resulting in an incomplete understanding of network resilience.

This study proposes a time-dependent Bayesian Network (BN) Modelling framework that captures the dynamic evolution of disturbances in inland waterways during a typhoon event, modeling how resilience fluctuates over time. Unlike traditional static BN models, this approach integrates temporal variables (e.g., ship traffic) to simulate real-time cascading failures and recovery processes. In addition, the study uses a probabilistic risk assessment tool that quantifies uncertainties in node failures, recovery rates, and traffic flow disruptions using real-time Automatic Information System (AIS) data. This approach leverages AIS datasets to calibrate the BN, ensuring the model reflects actual ship behavior (e.g., rerouting patterns, congestion) during disruptions. We also design two metrics to identify the nodes that are of greater importance to maintaining the resilience of the inland waterway network. Understanding the most critical and vulnerable parts could help transport planners prioritize resources to those components to ensure functionality. A case study is conducted on the inland waterway network of the Pearl River Delta of southern China for validation. The main contributions of the study are listed below.

- Introducing a dynamic, data-calibrated BN model for inland waterways resilience.
- Using actionable metrics for critical node identification.
- Providing a scalable decision support tool validated through a high-stakes case study.

Paper ID: 172

Paper Title: Strategic Information Acquisition for Shore Power Adoption in Smart Ports

Authors: Prof. Bo Lu, Dr. Yuxin Liu, Dr. Yonggang Li, Prof. Jian-Jun Wang

Abstract: With the deep integration of digital technologies into infrastructure planning and service operations within smart ports, shore power has transformed from a conventional emission-reduction facility into an intelligent port service underpinned by information sensing, operational monitoring, and adaptive decision-making. Nevertheless, despite substantial investments in shore power infrastructure, its actual utilization rate remains disappointingly low across numerous ports. A core predicament lies in the fact that efficient shore power deployment hinges on the coordination between ports and shipping companies: while ports invest in infrastructure construction and service capacity building, the actual uptake of shore power is determined by shipping companies' operational statuses and cost incentives—information that is typically privately held and incompletely observable to ports. Such information asymmetry undermines ports' capacity to intelligently manage shore power services and diminishes the efficacy of digitalization-oriented investments. To tackle this challenge, this study constructs a continuous-time differential game model to investigate how strategic information acquisition effects shore power adoption under diverse information structures. The analysis characterizes equilibrium strategies and shows that stronger information capability can improve strategic coordination, reshape

investment incentives, and effectively increase shore power utilization. These findings reveal that the adoption of shore power systems hinges not merely on physical infrastructure, but also on ports' digital capabilities to perceive, infer, and respond to users' heterogeneous operational conditions. Accordingly, this research provides a theoretical foundation for advancing smarter and more sustainable governance of maritime logistics systems.

Paper ID: 40

Paper Title: Integrated Optimization of Berth and Quay Crane Allocation under Dynamic Double-Line Multi Ship Mooring Mode

Authors: Chun Gan, Prof. Caimao Tan, Prof. Junliang He

Abstract: With the continuous growth of global trade, world container shipping volumes have increased dramatically, leading to increasingly strained berth resources at container ports. Traditional single-berth mooring modes exhibit numerous limitations when addressing the current diversified and high-density vessel arrival patterns, particularly in complex scenarios where large mainline container vessels and small-to-medium feeder vessels operate simultaneously. How to efficiently manage the berthing scheduling of different types of vessels has become a key bottleneck in enhancing ports' comprehensive competitiveness. This paper conducts in-depth research on berth and quay crane allocation problems under the "dynamic multi-vessel double-berth mooring" mode, aiming to significantly improve port berth utilization and quay crane operational efficiency.

This paper innovatively proposes a "dynamic multi-vessel double-berth mooring" operational mode that breaks through the limitations of traditional single-berth mooring by allowing mainline vessels to share berth resources with multiple feeder vessels and introducing a dynamic replacement mechanism for feeder vessels. This mode fully utilizes the operational time differences between mainline and feeder vessels (12-20 hours for mainline vessels, 2-5 hours for feeder vessels) to achieve dynamic optimization of berth resource allocation. The mode not only enhances berth utilization but also effectively saves container storage space. Particularly when transshipment containers exist, quay cranes can directly perform ship-to-ship container transfers without yard intermediation, significantly reducing transshipment costs and improving operational efficiency.

Based on the proposed operational mode, this paper constructs a mixed nonlinear programming model for joint optimization of berths and quay cranes. The model comprehensively considers multiple practical constraints including berth allocation, time window management, vessel length constraints, continuous quay crane operations, and differentiated bay allocation. The model aims to minimize position deviation costs, time delay penalties, and quay crane usage costs while encouraging feeder vessel dynamic replacement and direct transshipment operations through reward mechanisms. Addressing the nonlinear characteristics of the model and computational complexity of

large-scale problem solving, this paper designs an efficient particle swarm optimization (PSO) algorithm incorporating multi-strategy initialization and constraint repair mechanisms to ensure high-quality solutions within reasonable time.

To comprehensively validate the model's correctness and algorithm effectiveness, this paper designs four different-scale numerical experiment cases based on actual port operations, covering scenarios from small-scale (1 mainline vessel with 4 feeder vessels) to ultra-large-scale (8 mainline vessels with 32 feeder vessels). Through comparative analysis with the CPLEX commercial solver, performance comparison of different mooring modes, and sensitivity analysis of key factors including vessel arrival punctuality, berth average service duration, and berth mainline vessel ratio, the comprehensive performance of the proposed mode and algorithm is systematically evaluated.

Experimental results fully demonstrate the effectiveness and superiority of this research. Compared with the CPLEX solver, the designed PSO algorithm can obtain near-optimal solutions in significantly shorter computational time, with an objective function gap value of only 10.8%, demonstrating excellent computational efficiency. Compared with the traditional "single-berth mooring" mode, the "dynamic multi-vessel double-berth mooring" mode shows significant advantages in all test cases, with an average improvement rate of 46.63% in comprehensive operational costs, with small-scale cases showing more significant improvement of 83.7%. Sensitivity analysis reveals several important findings: vessel arrival punctuality analysis shows that when punctuality decreases from 100% to 70%, the objective function value increases by approximately 26.4% on average, but an uncertainty threshold effect emerges when punctuality further decreases; berth average service duration analysis reveals a distinct performance critical point at approximately 0.7; berth mainline vessel ratio analysis indicates that as the mainline vessel ratio increases, system performance exhibits a nonlinear declining trend, particularly pronounced in medium-to-high ratio intervals.

This research provides new theoretical perspectives and practical tools for port operation management, offering important theoretical significance and application value for alleviating port berth resource constraints and enhancing port comprehensive competitiveness, providing scientific basis for the design and implementation of intelligent port scheduling systems.

Paper ID: 57

Paper Title: AI deployment for heterogeneous ports: Strategic choices between independent R&D and outsourcing

Authors: Prof. Bo Lu, Guixian Zhang

Abstract: Artificial intelligence (AI) technology is the key support for the intelligent transformation of ports. This study examines optimal AI technology deployment strategies for heterogeneous ports operating within co-opetition networks. We consider

the ecological synergy characteristics, deployment effect uncertainty and port heterogeneity, construct a dual-market game-theoretic model to analyze the strategic choice between independent R&D and outsourcing. The results reveal that deployment decisions of port are shaped not only by cost-benefit considerations but also by the interplay of co-opetition structures, technological ecosystems, and AI technology risks. A cooperation paradox is identified, expansion of the cooperative market may reduce AI technology level when both ports pursue independent R&D, particularly under the expected effect of deployment is low. This outcome that underscores the technology investment motivational barriers in loosely coupled alliances. Conversely, when ports form a unified technology ecosystem, cooperative market growth positively correlates with the AI technology deployment level, driven by ecological synergy effects. If one port opts for independent R&D while the other outsources third-party AI technology, competitive advantage hinges on whether the former's AI deployment effect exceeds a critical threshold. The study delineates a multidimensional strategic space defined by cooperative market scale, competition intensity, AI technology deployment effect uncertainties and R&D costs, provide theoretical support for ports in choosing AI technology deployment strategy.

Paper ID: 21

Paper Title: Using Association Logic for Smart Construction: How Macau's 369 Co-op Town Bridges Fragmented AI Readiness

Authors: Dr. Limeng Yu, Prof. Xue Pang, Dr. Jingwei Guo

Abstract: This paper examines how association logic, a governance logic deeply embedded in Macau S.A.R China(Macau)'s socio-political structure, facilitates the integration of artificial intelligence (AI) readiness in the transition toward smart construction. Although AI-enabled technologies such as digital twins, intelligent monitoring systems, and data-driven construction management are increasingly promoted in urban development, their effective adoption depends not only on technical capacity but also on institutional coordination, human capital alignment, and governance mechanisms. In many cities, AI readiness remains fragmented due to organizational silos, uneven technological capability, and limited cross-sector collaboration. These challenges are particularly pronounced in small and hybrid economies. Macau offers a distinctive case. Often described as a "Society of associations", Macau relies heavily on civic associations as intermediaries between the state, market, and community. Following the 1999 handover, associations underwent a process of governmentalization, aligning closely with public policy agendas while retaining strong social legitimacy. Existing research has emphasized the role of associations in social governance, political participation, and economic coordination, yet their contribution to AI readiness and smart construction remains underexplored. Drawing on an indepth qualitative case study of Incubator A, a hybrid organization registered as both a private enterprise and a civic association, this study analyzes how associational governance bridges fragmented AI readiness across technical, human, and

institutional dimensions. The findings show that association logic operates through trust-based governance, resource co-mobilization, and participatory adaptability, transforming fragmented AI initiatives into integrated smart construction capability. By integrating institutional logics theory with Macau-focused association, and AI readiness in technology management, this paper conceptualizes association logic as an adaptive intermediary in AI governance. The study contributes to research on institutional logics, smart construction, and AI governance, and offers scenario-planning approach pursuing inclusive and coordinated AI-enabled urban development.

Session SU11 (Track 11 Sustainable AI Operations: Low-Carbon Design and Management of Compute Services & 19 AI-driven complex service system modeling and decision-making)

Paper ID: 237

Paper Title: Platform Merger, Resource Refill, and Welfare Effects in Computing Markets

Authors: Pro. Ronggang Cong, Han Pu

Abstract: Facing the computing power market with heterogeneous demands, this paper constructs a theoretical model that considers platform mergers, heterogeneity of high-end and low-end tasks, resource backfilling systems, and queuing delay constraints. Pre-merger, high-end tasks are exclusively served by high-end platforms, while low-end tasks compete on low-end platforms. Post-merger, unified resource allocation operates under two governance regimes: strict isolation and partial backfilling. By incorporating queuing delays into user utility and market coverage, we systematically analyze changes in market structure, profits, consumer surplus, and social welfare. The research findings are as follows: First, mergers enhance low-end market performance through unified scheduling and capacity coordination, facilitating full market coverage.

Second, backfilling creates significant stratified redistribution effects — increasing low-end consumer surplus while compressing high-end effective capacity, prolonging high-end wait times, and reducing high-end surplus. Third, backfilling effects are conditional: in low-valuation, unsaturated markets, moderate backfilling may improve platform profits and total welfare; however, excessive backfilling or active high-end markets cause high-end losses to outweigh low-end gains, reducing total profits and welfare. The critical insight is that post-merger platform success depends not on resource expansion, but on institutional design governing boundaries between high-end resource reservation and low-end task backfilling.

Paper ID: 171

Paper Title: Distributed Gradient Tracking Algorithm with Gradient Noises

Authors: Xiaozheng Fu

Abstract: We focus on distributed online stochastic optimization. Networked nodes cooperatively track the optimal solutions of the time-varying global cost function, which is the sum of local cost functions. Each node only has access to an unbiased stochastic gradient estimate of its local cost function. A novel distributed online stochastic gradient tracking algorithm integrated with the prediction of the dynamic optimal solutions is proposed, which adopts an intermediate variable to track the average of local gradient measurements and conducts one-step prediction based on the linear dynamics of global optimal solutions. Theoretically, we prove that the algorithm can track the dynamic global optimal solutions in mean square, and derive an upper bound on the mean-square average tracking error. We then establish a dynamic regret metric to evaluate the performance, and prove that its upper bound decreases with the increase of the network size, which addresses a key limitation of existing methods where performance degrades with more nodes. For the prediction-free case, we further show that with a fixed step size of $\sqrt{P_K^D/K}$, the dynamic regret achieves $R_K^d = O\left(\sqrt{KP_K^D}\right)$, which is consistent with the performance of centralized online stochastic optimization algorithms. Numerical simulations on a 2D target tracking task in sensor networks validate the theoretical results, showing that the algorithm outperforms existing distributed stochastic gradient descent methods in dynamic tracking scenarios. The proposed method provides an efficient solution for real-time cooperative optimization in large-scale networked systems with time-varying objectives and stochastic gradient information.

Paper ID: 107

Paper Title: An LLM-Driven Agent-based Model for Monopoly Dynamics in Academic Data Market

Authors: Kangzheng Ge, Zhou He

Abstract: This study addresses the monopolistic dynamics in China's academic data market, characterized by predatory pricing and institutional boycotts, which traditional static economic models fail to capture. We propose an LLM-Driven Agent-based Model (ABM) to simulate the evolutionary game between monopolistic data providers and heterogeneous universities. Methodologically, the hybrid generative agent framework replaces rule-based algorithms with LLM-powered cognitive engines, enabling simulation of bounded rationality and strategic decision-making. Key findings reveal that demand-side subsidies exacerbate market inefficiencies: the monopolist absorbed 89% of government subsidies through targeted price discrimination, leaving

the data accessibility of vulnerable universities unchanged. This research explores the shift from Homo Economicus to Homo Generativus in computational economics, highlighting LLMs' capability to model complex socioeconomic systems. Policy implications include establishing public open-access infrastructures and implementing algorithmic antitrust auditing to mitigate AI-driven market distortions.

Paper ID: 287

Paper Title: Reinforcement Learning Hyper-Heuristic Workflow Scheduling for Distributed Cloud Systems

Authors: Dingyu Zhou, Jiaqi Huang, Yijui Chang, Mr. Yonghao Zhang, Runqing Miao, Prof. Wai Kin (Victor) Chan

Abstract: Workflow scheduling in distributed cloud computing environments is critical but notoriously challenging due to the combinatorially large and dynamically changing state-action space of multi-machine assignments. Traditional heuristics lack adaptability to dynamic workloads, while standard Deep Reinforcement Learning (DRL) approaches suffer from poor scalability and unstable training when directly mapping individual tasks to machines. To overcome these limitations, we propose a Reinforcement Learning Hyper-Heuristic (RLHH) framework that elevates decision-making from atomic assignments to the dynamic selection of high-level scheduling strategies. Our approach utilizes a Bottom-Up Graph Convolutional Network to correctly encode task Directed Acyclic Graph (DAG) dependencies and employs an order-agnostic aggregation network to resolve task ordering ambiguities in dynamic states. Extensive experiments on real-world Alibaba Cluster Trace workloads demonstrate the superiority of RLHH across diverse problem scales. Specifically, RLHH achieves a mere 3.17% average performance relative gap compared to Gurobi, while the Gurobi solver exhibits a 3.53% average dual bound gap in verified optimal instances. Furthermore, RLHH consistently surpasses both traditional heuristics and standard learning-based methods across all evaluated scales. Ultimately, RLHH provides a highly scalable and stable solution to effectively tackle the huge and dynamic state-action space problem in advanced cloud systems.

Paper ID: 22

Paper Title: Flexibility Value of Reshoring Capacity Under Policy Uncertainty and Domestic Competition

Authors: Xiao Tan, Panos Kouvelis, Sammi Tang

Abstract: Problem definition: Companies operating global supply chains face growing policy uncertainties that affect the costs of importing raw materials (RM) and finished goods (FG) from low-cost to developed countries, as well as the relative profitability of production in different countries. This has prompted the need for diversified global

supply chains often involving the addition of onshore production alongside existing offshore facilities. Motivated by recent developments in the U.S. clean energy sector, this paper adopts a game-theoretic model to analyze a global firm's reshoring capacity decision and output quantity competition with a domestic manufacturer under policy uncertainty. We examine the effects of these policies on operational decisions and profitability for both firms.

Methodology/results: We show that the impact of FG tariffs depends on two opposite effects: an output quantity effect that leads to reduction of reshoring investment as the expected unit cost in serving the market increases and an overflow demand effect that encourages more reshoring investment to minimize the overflow of unsatisfied production to off shore locations. RM tariffs do not affect overflow production, and the output quantity effect will always dampen reshoring investment. Because consumer tax credits directly influence market demand, when firms' output decisions are made after demand and therefore policy realization, the output quantity effect is absent. The overflow demand effect and stimulated higher demand will incentivize higher reshoring investment. Furthermore, we show that higher tariffs hurt the global firm's profit as tariffs increase its average output cost, whereas tax credits can benefit the firm. Although both policies are intended to protect domestic firms, they may negatively affect their profit when the global firm's reshoring capacity is high, intensifying competition between them. Finally, the existence of domestic competition will reduce reshoring investment when domestic manufacturing is efficient. However, when global firms have significant cost advantage, the presence of domestic competition may encourage aggressive reshoring investment.

Managerial implications: For global firms, investing in reshoring capacity creates a "real option" in production allocation in serving the market, and the provided operational flexibility enhances competitiveness in an uncertain environment. For policymakers, it is crucial to carefully consider the tariff level, which stage of a supply chain to execute trade restrictions on, and tax credit amounts to be used. Very high tariffs on moderate size markets may have unexpected effect on reshoring. Trade and industrial policies should be carefully analyzed for their effectiveness, accounting for cost disadvantages of domestic competitors and market demand strength.

Session SU12 (Track 0 Default Track)

Paper ID: 15

Paper Title: Data-driven Simulation Optimization and Learning for Digital Twins

Authors: Enlu Zhou

Abstract: A digital twin is a virtual representation of a physical system, continuously updated with data from the physical system, enabling dynamic information exchange and decision-making. This bidirectional interaction, the key distinction from traditional

simulations, introduces unique challenges to simulation optimization. These challenges encompass streaming data, system nonstationarity, and real-time decision-making. This talk will present recent advancements aimed at addressing these issues, focusing on data-driven simulation optimization and reinforcement learning under streaming data with applications in inventory control.

Paper ID: 49

Paper Title: Making a Cloud: The Role of R&D in Software-as-a-Service

Authors: Bo Li

Abstract: Software-as-a-service (SaaS) is an emerging and important mode of software delivery. Although competition drives SaaS providers to equip their products with advanced features, there is little research on the interaction between product development and competition among SaaS providers. We investigate this interaction in a scenario in which providers can increase the value of their offering by investing in research and development (R&D) in addition to pricing. We consider two monopolistic scenarios and two duopolistic scenarios to study the impact of R&D decisions. In one of the duopolistic scenarios, we investigate whether it is prudent for an incumbent SaaS provider to discourage rival entry. In the other duopolistic scenario, we explore the role of R&D spillover. We present several insights relevant to managers based on analytical and numerical results. We discover that higher customer usage does not always result in more R&D investment by a SaaS provider and that a monopolist provider is more sensitive to R&D costs under favorable conditions. We also establish how R&D and capacity costs connect with consumer surplus. In terms of the interaction between pricing and SaaS R&D, we find that R&D investment substitutes for low pricing in most scenarios, but a combination of low R&D investment and high pricing may be required to deter potential entrants. We also learn that higher R&D costs help level the playing field for differentiated competition and that R&D spillover plays an important role in shaping competitive strategies and outcomes.

Paper ID: 74

Paper Title: Manufacturer Encroachment with Economies of Scale: Centralized vs. Decentralized Structures

Authors: Professor Jing Chen, Prof. Wei Li, Prof. Hubert Pun

Abstract: This study investigates how a manufacturer's production economies of scale influence its incentive to encroach on the retail market and the subsequent effects on the retailer, under two organizational structures: centralized and decentralized. Manufacturer encroachment can expand sales and lower average production costs due to economies of scale. Under a centralized structure, the manufacturer retains decision-making authority over the direct selling business, while under a decentralized structure,

this authority is delegated to its retail division. Our analysis shows that under no encroachment or under encroachment with a decentralized structure, stronger economies of scale consistently improve the manufacturer's profit without harming the retailer. In contrast, under a centralized structure, stronger economies of scale can backfire, as sales shift from the more efficient retail channel to the less efficient direct channel, leading to cannibalization that reduces profits for both parties. Furthermore, the profitability of encroachment is asymmetric across structures: the manufacturer may be worse off under a centralized structure when economies of scale are strong, and worse off under a decentralized structure when economies of scale are weak. From the retailer's perspective, stronger economies of scale always worsen the profit under a centralized structure but increase the likelihood of benefiting from encroachment under a decentralized one. Finally, when the manufacturer is free to choose its internal organizational structure, it prefers a centralized structure if economies of scale are weak or the direct selling cost is sufficiently low, and a decentralized structure otherwise.

Paper ID: 133

Paper Title: A Randomized Fair Solution to Algorithmic Discrimination Problem for Digital Logistics Platforms

Authors: Yimiao Wang, Minghui Lai

Paper ID: 248

Paper Title: Research on Airline Pricing Strategies Considering Passengers' Green Behavior Preferences

Authors: Ya Li, Qing Zhang, Junjie Hu, Guo Lv

Abstract: With the escalating global climate warming and environmental challenges, both civil aviation enterprises and passengers are actively seeking ways to reduce carbon emissions throughout the supply chain.

Passengers' environmental awareness continues to strengthen, with growing attention paid to the issue of in-flight meal waste. To meet evolving market demands, some airlines have introduced "green flight" services that enable passengers to participate in on-demand dining (passengers who do not require in-flight meals may cancel them in advance and receive mileage rewards redeemable for tickets or upgrades). Accordingly, this paper investigates the optimal pricing strategy of an airline offering "green flight" services when passengers with green behavior preferences are present. The airline must simultaneously decide on ticket prices and the number of mileage points awarded per canceled meal. Passengers are segmented into four groups according to the presence or absence of green behavior preferences and their high or low ticket valuations. Taking the proportions of each group into account under a fixed total passenger scale, the study

derives the airline's optimal response strategies and offers actionable pricing recommendations for practitioners.

Session SU13 (Track 12 Data-Driven Intelligence: Integrating Analytics, Artificial Intelligence, and Machine Learning for Smarter Decision-Making)

Paper ID: 190

Paper Title: Solving Contextual Stochastic Optimization Problems through Contextual Distribution Estimation

Authors: Xuecheng Tian, Bo Jiang, King-Wah Pang, Yu Guo, Yong Jin, Shuaian Wang

Abstract: Stochastic optimization models always assume known probability distributions about uncertain parameters. However, it is unrealistic to know the true distributions. In the era of big data, with the knowledge of informative features related to uncertain parameters, this study aims to estimate the conditional distributions of uncertain parameters directly and solve the resulting contextual stochastic optimization problem by using a set of realizations drawn from estimated distributions, which is called the contextual distribution estimation method. We use an energy scheduling problem as the case study and conduct numerical experiments with real-world data. The results demonstrate that the proposed contextual distribution estimation method offers specific benefits in particular scenarios, resulting in improved decisions. This study contributes to the literature on contextual stochastic optimization problems by introducing the contextual distribution estimation method, which holds practical significance for addressing data-driven uncertain decision problems.

Paper ID: 415

Paper Title: Beyond Visibility and Agility: A Configurational Approach to Supply Chain Resilience

Authors: Hao Zheng, Qiuyu Chen, Bao Xie, Xin Jin, Wenjun Zeng

Abstract: In today's rapidly evolving environment, developing supply chain resilience is essential. Previous research has highlighted the importance of resources such as artificial intelligence, supply chain visibility, traceability, and agility for achieving resilience. However, amid increasing complexity and disruption, organizations that rely on individual resources in isolation may face challenges in developing resilience effectively. To extend and update the supply chain risk management framework originally established by Cohen and Kunreuther (2007), this study integrates resource orchestration theory with fuzzy-set Qualitative Comparative Analysis(fsQCA) to investigate how configurations of resources, including artificial intelligence

involvement, supply chain visibility, traceability, and agility, contribute to supply chain resilience. Secondary data collected from the service setting reveals one distinct resource configuration: AI Trace. This configuration is conceptualized as a real option for developing resilience. Using a machine learning technique, the study further investigates the relative importance of these resources. The study also identifies their optimal allocation under the given configuration. Additionally, the study challenges the prevailing assumption that supply chain visibility and agility are indispensable for resilience. While these resources remain valuable, the findings suggest that they may not be essential under all digital-era conditions, indicating a shift in priorities for developing supply chain resilience.

Paper ID: 97

Paper Title: Dynamic Multi-Product Inventory Control with Joint and Individual Setup Costs Using Proximal Policy Optimization

Authors: Guo Feng

Abstract: Large-scale retail and e-commerce operations often involve replenishment decisions for multiple products under shared operational costs, where both joint and item-specific setup costs may arise. These operational characteristics lead to the multi-product joint inventory system problem (MP-JIS). This paper studies a stochastic multi-product inventory system with joint and individual setup costs under an infinite-horizon setting. The objective is to determine replenishment decisions that minimize purchasing, holding, and backorder costs under stochastic demand. The problem is formulated as a Markov decision process. For small instances, optimal solutions obtained via dynamic programming are used as benchmarks. To address larger systems where exact optimization becomes computationally intractable, we apply the Proximal Policy Optimization algorithm to learn replenishment policies. Numerical experiments based on two-product systems show that the learned policy achieves near-optimal performance compared with dynamic programming, with an average optimality gap of 7.545%, and outperforms classical heuristics in most scenarios. On average, the PPO policy reduces the optimality gap by 2.658% compared with the deterministic heuristic and by 10.293% compared with the weighted heuristic. These results suggest that the proposed approach can be extended to larger MP-JIS settings where dynamic programming and classical heuristics become computationally infeasible.

Paper ID: 300

Paper Title: Fairness-Constrained Optimal Model Averaging with High-Dimensional Sparsity Learning

Authors: Zeyu Chen, Dr. Wei Qian, Dr. Bintong Chen

Abstract: Model fairness has attracted growing attention in machine learning, yet remains underexplored in high-dimensional settings from a statistical perspective. We propose a fairness-constrained model averaging approach for generalized linear models that aggregates a large set of sparse candidate models to produce asymptotically fair solutions. The method achieves near-optimal estimation risk, even when the true model is not contained in the candidate set or cannot be well approximated by a single sparse model.

To support implementation, we develop a fairness-assisted stepwise sparsity learning procedure to generate candidate models. When combined with model selection, the procedure retains consistency when the true model is among the candidates, highlighting the distinction between model averaging for estimation improvement and model selection for adaptation. We demonstrate the proposed framework using a community crime dataset. The method is implemented in R and available on GitHub.

Paper ID: 187

Paper Title: Price Elasticity in Service Systems under Spatial Confounding: A Debiased Learning Approach

Authors: Han-Yuan Yeh, Prof. Yen-Chun Chou, Prof. Howard Hao-Chun Chuang

Abstract: Data-driven intelligence is transforming how service industries and digital platforms formulate pricing decisions. Large-scale platforms such as Alibaba (Deng et al. 2023) increasingly rely on causal machine learning (ML)—particularly debiased Double Machine Learning (DML)—to estimate price elasticities that directly inform algorithmic pricing in service systems. While DML effectively addresses high-dimensional confounding, it typically assumes i.i.d. samples, overlooking spatial dependencies. In service contexts, unobserved spatial factors (e.g., regional economic clusters) jointly influence demand and price. Ignoring this structure introduces substantial estimation bias and distorts pricing decisions.

To bridge this gap, we propose a framework integrating spatial analytics into DML via Moran’s Eigenvector Maps (MEM). By incorporating MEM as orthogonal spatial bases into DML’s first-stage nuisance estimation, our approach captures and mitigates endogeneity from latent spatial confounders. We evaluate this via Monte Carlo simulations across various spatial weight matrices and cross-fitting strategies.

Simulations show that under spatial dependency, conventional DML exhibits non-trivial bias in price elasticity estimation. Incorporating MEM substantially reduces this bias and improves estimation efficiency by absorbing the correlation between pricing

variables and latent spatial fields. Regarding cross-fitting, sample splitting strategies significantly affect the model's ability to exploit local dependencies, occasionally increasing estimation variance. This motivates an alternative spatial filtering procedure that provides a more stable solution independent of spatial partitioning constraints.

Finally, an empirical application using online service platform data highlights the framework's practical relevance. Overall, this study underscores the value of integrating spatial analytics with DML, enabling spatially informed pricing decisions in geographically heterogeneous markets.

Session SU14 (Track 23 Vision and Intelligent based Metrology)

Paper ID: 71

Paper Title: A Lightweight 3D Distillation Volumetric Transformer for 3D MRI Super-Resolution

Authors: Prof. Jianwei Zhao, Tao Hong, Hao Qi, Zhenghua Zhou, Hai Wang

Abstract: Although existing 3D super-resolution methods for magnetic resonance imaging (MRI) volumetric data can provide better visual images than some traditional 2D methods, they should face challenge of increasing network's parameters and computing cost for getting higher reconstruction accuracy. To address this issue, a lightweight 3D multi scale distillation volumetric Transformer, named Transformer-based dual-attention feature distillation (TDAFD) network, is proposed for 3D MRI by utilizing 3D information hiding in images sufficiently. Our TDAFD network contains several proposed dual-attention feature distillation (DAFD) modules and two designed recursive volumetric Transformers (RVT). Concretely, the proposed DAFD module contains a multi-scale feature distillation (MSFD) block for extracting global features under different scales and a feature enhancement dual attention block (FEDAB) for concentrating on the key features better. In addition, our RVT develops 2D Transformer to 3D and save network's parameters via recursion operations for capturing long-term dependencies in volumetric images effectively. Therefore, our proposed TDAFD network can not only extract deeper features via multi scale feature distillation and Transformer, but also realize the balance of performances and network's parameters. Extensive experiments illustrate that our proposed method achieves superior reconstruction performances than some popular 3D MRI SR methods, and saves number of weights and FLOPs.

Paper ID: 87

Paper Title: LLM-Guided Dynamic Proxy-Based Adapter Learning for Visual Clustering

Authors: Wenjie Zhu

Abstract: Multiple visual clustering aims to uncover complementary clustering structures from a single dataset, each corresponding to a distinct semantic perspective. Although multimodal foundation models substantially enhance semantic representation, joint multimodal optimization often results in imbalanced semantic evolution. Dominant visual semantics tend to govern representation updates, progressively steering proxies toward a limited subset of directions. This imbalance induces dynamic miscoordination between feature representations and semantic proxies, reducing clustering diversity and destabilizing training. To address this issue, we propose AdaDProxy, a dynamic proxy-guided representation adaptation framework that explicitly coordinates semantic evolution across multiple views. Instead of fine-tuning pretrained encoders, AdaDProxy freezes the multimodal backbone and introduces lightweight residual adapters for task-aware yet stable feature refinement. Learnable semantic proxies are designed to align with evolving clustering structures and to guide selective representation updates across perspectives. Furthermore, we leverage large language models to provide cluster-aware contrastive signals that inject global semantic regularization into proxy optimization. This mechanism mitigates semantic drift and strengthens inter-cluster discrimination without requiring manual annotation. Extensive experiments on multiple benchmark datasets demonstrate that AdaDProxy consistently improves clustering quality, semantic diversity, and training stability compared with state-of-the-art methods.

Paper ID: 377

Paper Title: An Integrated Rapid Path-Planning Model for Lunar Rovers Incorporating Novel Performance Evaluation Methodologies

Authors: Hang Zhou, Li Yang, Sha Lin

Abstract: Integrating the autonomous traveling capability of the new type of efficient lunar rover is the key to lunar exploration missions. Currently, the lack of precise autonomous driving capability of lunar rovers in close-range paths is a key issue for lunar exploration missions. The mainstream autonomous navigation technology for rovers mainly relies on path planning, but there is a lack of effective means to generate precise paths in the application of lunar rovers, and the effectiveness evaluation of candidate optimal paths is weak and incomplete. It is difficult to select the truly optimal solution that meets the mission requirements from the candidate paths. Moreover, the guidance and curvature path planning also have problems such as insufficient terrain data, lack of path generation methods, and weak effectiveness evaluation. Based on this, this paper designs a rapid path planning mode for the lunar rover, which can efficiently

generate a high-quality and diverse set of candidate paths. Based on this, this paper designs a rapid path planning mode for the lunar rover, which can efficiently generate optimal paths and also builds a new performance evaluation model, providing support for making the optimal path decisions that meet the individualized needs of users. Therefore, in order to verify the superiority of the improved path planning algorithm proposed in this paper, a comparative experiment was conducted between the improved path planning algorithm and the traditional path planning algorithm. The results show that the improved path planning algorithm has achieved a significant improvement in computational efficiency. Moreover, in the multi-intermediate point path planning task, the comprehensive performance of the planned path is better and more in line with the actual application requirements.

Paper ID: 75

Paper Title: DSAN: a dual-scale spatial-temporal aggregation network for robust gait recognition

Authors: Mr. Liang Ren, Prof. Xiuhui Wang

Abstract: Gait recognition technology represents a promising biometric identification method with extensive applications in fields such as visual surveillance. However, addressing the few-shot learning challenge remains an urgent issue in practical applications. In this paper, we propose a novel Dual-Scale Spatial-Temporal Aggregation Network (DSAN), which extracts gait features at different temporal scales through a dual-branch architecture. The Multi-Scale Temporal Aggregation Module (MSTA) is designed to aggregate multi-scale local temporal information from long-term gait features, employing an attention mechanism to reduce redundant information and enhance temporal feature representation. Additionally, the Covariance-guided Spatial-Temporal Attention Module (CoSTA) integrates short-term features into long-term representations through global covariance pooling and attention mechanisms, further improving feature expressiveness. Furthermore, we introduce the View Variation Adversarial Normalization (VVAN), which mitigates cross-view discrepancies under few-shot conditions via adversarial learning. Different from GaitGL, DSAN explicitly captures long-term and short-term dynamics and performs cross-scale fusion via MSTA and CoSTA. In contrast to GaitDAN's multi-discriminator formulation, VVAN employs a single multi-class view discriminator, requiring only a change in the classifier output dimension when the view set varies. Extensive experiments are conducted on the CASIA-B and OUMVLP datasets, with DSAN evaluated in a one-shot setting on CASIA-B. The experimental results demonstrate that DSAN achieves state-of-the-art performance in gait recognition tasks and effectively alleviates the adverse impact of the one-shot problem on recognition accuracy.

Paper ID: 345

Paper Title: HC-TS-LDVMNet: Robust Micro-Expression Recognition via Optical Flow, Landmarks, and Landmark Distance Variation Maps

Authors: Yecheng Han, Xianghu Yue, Wenhuan Lu, Minghao Guo, Jianguo Wei

Abstract: Micro-expressions are subtle and extremely short-lived facial muscle movements, making automatic recognition highly challenging. Existing methods often employ hierarchical self-attention networks for cross-scale feature modeling, yet they tend to overlook the unequal contributions of different facial regions and remain sensitive to key-frame selection errors. More importantly, they lack robustness when classifying the same emotion under varying expression intensities. Intensity changes can significantly affect motion magnitude and appearance details, resulting in unstable predictions. To address these issues, we propose HC-TS-LDVMNet, a three-branch architecture composed of a hierarchical Conformer with a Feature Transfer Module (FTM), a Temporal-Sensitivity-Aware Transformer (TSAT), and an LDVMNet branch. The FTM enhances cross-scale interaction, while TSAT captures long-range temporal dependencies and emphasizes key frames. To improve intensity robustness, we construct a Landmark Distance Variation Map (LDVM) from inter-frame landmark distance changes. After normalization, LDVM preserves stable geometric patterns across different intensity levels of the same emotion, enabling intensity-invariant representation learning. HC-TS-LDVMNet achieves an unweighted F1-score of 88.54% on the composite CASME II, SMIC, and SAMM dataset, demonstrating competitive performance and strong robustness.

Session SU15 (Track 24 Human–AI Collaborative Decisions)

Paper ID: 378

Paper Title: Insuring AI Systems: Human Oversight and the Limits of Autonomous Deployment

Authors: Dr. Mina Iravani, Dr. Agni Orfanoudaki, Dr. Mihalis Markakis

Abstract: As AI systems become embedded in business operations, managing the financial consequences of algorithmic errors is critical for sustainable deployment, particularly when developers bear liability for erroneous outcomes. This paper studies the role of human oversight in the insurability of AI systems and the conditions under which fully autonomous operation can be supported. We show that insurability is governed by the marginal accumulation of error risk at the autonomy boundary rather than the total probability of tail errors. As a result, systems with similar predictive performance may support very different levels of autonomous operation. For self-insured developers, fully autonomous deployment may therefore be suboptimal, highlighting the value of human-in-the-loop validation. Extending the analysis across

tasks shows that although generalizability increases accumulated error exposure, it can simultaneously expand the optimal autonomous region by altering the trade-off between value and liability. However, such scope expansion need not improve profitability and may be economically suboptimal even when it increases autonomy. We also characterize conditions under which scope expansion is beneficial for the developer.

Paper ID: 308

Paper Title: Effects of AI Based Triage Systems on Patient Behavior

Authors: Meichen Liu, Dr. Haifeng Xu

Abstract: Online appointment booking has become a predominant channel for patient registration. Patients with limited clinical knowledge select departments based on subjective symptom perception during online registration. It often causes registration errors and repetitions, deteriorating care experiences and engendering misallocation of medical resources. Therefore, some hospitals introduce AI based triage systems to improve patient satisfaction and optimize resource allocation. However, it remains unknown how such AI based triage systems influence patients' medical experiences. Our research investigates the mechanisms through which AI based triage influences patient behavior.

This study designed a quasi-natural experiment by leveraging the launch of an AI based triage system at a dental hospital in Shanghai. This hospital provides two online registration channels: its mobile app with AI based triage and the other platform without it. Based on electronic medical records, we used patients who registered through the app as the treatment group and those registering through the online platform without AI based triage as the control group. We then constructed a difference-in-differences econometric model to examine the impact of AI based triage on patients' care-seeking behavior, with particular emphasis on department selection, waiting times, registration errors, and consultation duration. At the registration stage, AI based triage significantly reduces the probability of selecting self-pay departments, thereby shortening waiting times for these departments. Yet this effect remains statistically insignificant for patients in general departments. Besides, AI based triage substantially reduces registration error rates. This effect is significant in specialized departments yet negligible in general departments. At the treatment stage, AI based triage demonstrates no significant impact on overall consultation duration. However, it can effectively reduce the treatment time of patients in general departments, while showing no substantive effect on those in specialized departments.

This study incorporates department selection behavior into the AI based triage evaluation framework. Also, it enriches the literature on AI based triage systems by examining its effects on patients' medical care seeking behavior. Furthermore, our findings reveal significant departmental heterogeneity in AI based triage efficacy.

These results provide suggestions for healthcare institutions on how to optimize AI based triage deployment.

Paper ID: 367

Paper Title: Is Involving Human Always Good? Use EEG to Understand Users' Emotional and Cognitive Experiences with Hybrid Service Chatbots

Authors: Lingyi Zhou, Xixian Peng, Chee Wee Tan

Abstract: This paper investigates consumers' reactions to hybrid service chatbots. Grounded in dual process theory, we conducted an Electroencephalogram (EEG) study to examine how hybrid agents influence emotional (System 1) and cognitive (System 2) experiences compared to fully AI-driven and human agents across varying task complexities. For high-complexity tasks, hybrid agents, much like human agents, evoke more positive emotions (reflected in increased frontal theta power) than AI Agents, while demanding greater cognitive efforts (evidenced by alpha-band desynchronization). Self-reported data further reveal that participants rate hybrid agents similarly to human agents, and they both consistently outperform AI agents. These insights underscore the dual impact of hybrid service models: preserving the emotional connection of human interactions while requesting deeper cognitive activities, particularly in complex service scenarios.

Paper ID: 48

Paper Title: Complementarity in Human–AI Collaboration: A Three-Component Theory, Conversion Mechanisms, and Empirical Validation

Authors: An Li, Chuanyin Guo, Qihong Zhao

Abstract: The binary framework proposed by Hemmer et al. (2025) in European Journal of Information Systems has emerged as a cornerstone for recent scholarly discourse on complementarity potential (CP) in Human–AI collaboration. However, we show that its decomposition into inherent (CP_{inh}) and collaborative (CP_{coll}) components is theoretically incomplete and predicated on an internally inconsistent mechanism. To address these limitations, we identify a previously unrecognized third component—degradation complementarity (CP_{deg})—and derive the necessary and sufficient conditions for the emergence of CP_{coll}, CP_{inh}, and CP_{deg}. Building on this expanded structure, we develop an integrated model of complementarity effects (CE) that not only links each CP type to its distinct performance implications but also clarifies the mechanisms underlying gain or loss generation in Human–AI collaboration. Using real-world emergency management data, we show that all three CP types arise in practice. Transitions from CP_{inh} to CE_{inh} yield the most substantial performance gains, whereas transitions from CP_{deg} to CE_{deg} uncover a systematic yet previously overlooked

source of performance deterioration. Our framework advances complementarity theory and provides a more robust foundation for designing effective Human–AI collaboration.

Paper ID: 421

Paper Title: Too Close for Comfort? Human-AI Relationship Framing and Customer Decision: Empirical Insights from Experiments

Authors: Yuguang Xie, Peiyu Zhou, Changyong Liang, Dongxiao Gu

Abstract: With the rapid advancement of voice technologies and generative AI, voice-based AI is becoming a key interface for customer service and marketing interactions. Prior research has largely treated voice-based AI as either a task-execution tool or a socially interactive agent, overlooking how different forms of human–AI relationship framing shape customer decisions and whether stronger relationships may backfire. Drawing on social response theory and expectancy violations theory, this study examines voice-based AI interactions in insurance services and proposes an inverted U-shaped effect of human–AI relationship framing on purchase intention. Compared with an instrumental relationship, a parasocial relationship enhances automated social presence and perceived warmth, thereby increasing purchase intention. However, when AI is framed as a boundary-blurring, highly intimate partner, customers are more likely to experience expectancy violations and psychological reactance, which reduce purchase intention. We further propose that age strengthens this curvilinear effect, as older customers are more sensitive to human–AI relationship cues. A field experiment and a scenario-based experiment test the proposed model. The findings reveal the dual-path mechanism through which human–AI relationship framing influences customer decision-making and offer implications for optimizing AI relationship expression in service contexts.

Session SU16 (Track 16 Platform Supply Chain Operation Optimization & 4 Smart and Intelligent Port and Shipping Logistics Services)

Paper ID: 227

Paper Title: Dynamic Government Subsidy Mechanisms for Green Transformation and Dual-Channel Coordination: An Evolutionary Game and System Dynamics Approach

Authors: Jing Wang, Qing Zhang

Abstract: Under the “dual-carbon” goals, government subsidies have become an important policy instrument for promoting firms’ green technological innovation and industrial transformation. However, existing studies mainly focus on static subsidy mechanisms, which are insufficient to capture the long-term dynamic interactions between government policies and firms’ strategic behaviors. In particular, limited

attention has been paid to the long-term equilibrium between green transformation and channel coordination in dual-channel supply chains. To address this gap, this study develops a dynamic decision-making framework involving three stakeholders—government, manufacturers, and retailers—to investigate the long-term evolutionary mechanisms of government subsidy policies.

First, under the assumption of bounded rationality, a multi-agent evolutionary game model is constructed to characterize the dynamic interactions among government subsidy strategies, firms' green technology investment decisions, and channel pricing strategies. The potential evolutionary stable strategies of the system are analyzed using replicator dynamic equations. Second, a system dynamics approach is introduced to build a policy feedback system. Through causal loop diagrams and stock–flow structures, the dynamic feedback relationships among subsidy intensity, firms' green innovation investment, consumer green demand, and channel profit distribution are captured, and simulation analysis is conducted using the Vensim platform.

By integrating evolutionary game analysis with system dynamics simulation, this study aims to systematically reveal the long-term mechanisms through which government subsidy policies influence firms' green innovation behaviors and the coordination of dual-channel interests. Furthermore, the study explores the potential policy effects of different subsidy adjustment strategies in promoting green technological upgrading and alleviating channel conflicts. From a dynamic evolutionary perspective, this research provides a comprehensive analytical framework for understanding the interactions among government subsidy policies, firms' green innovation decisions, and channel interest relationships, and offers theoretical insights and policy implications for designing dynamic subsidy mechanisms that simultaneously support green transformation and maintain supply chain coordination.

Paper ID: 20

Paper Title: Inventory Policies for Cash-Constrained Retail Service Providers

Authors: Youssef Boulaksil

Abstract: We study a cash-constrained inventory decision problem motivated by nanostores—small, self-financing retail service providers that play a critical role in consumer goods distribution in developing economies. These retailers operate under severe and

fluctuating cash limitations, which fundamentally shape how they deliver service to local customers.

We develop a multi-period stochastic model in which a retailer must allocate limited internal cash across products with heterogeneous demand, margins, and service characteristics. The model captures the tight coupling between operational decisions and financial viability that is central to many small-scale service systems. We characterize the structure of optimal policies and conduct an extensive numerical study

to examine how demand uncertainty, product attributes, and cash availability affect service outcomes.

To enhance practical relevance, we propose two simple heuristic decision rules that reflect how nanostores often operate in practice. Both heuristics perform near-optimally while requiring minimal computational effort, suggesting that effective decisions can be achieved even with limited analytical resources. Our findings provide insights for the design and management of cash-constrained service systems, with implications for retail service quality, urban logistics, and the sustainability of small businesses.

Paper ID: 19

Paper Title: An evolution analysis of living streaming governance: Deceptive advertising and non-compliant operation

Authors: Dr. Baoli Shi

Abstract: The live streaming e-commerce industry has experienced rapid development, emerging as a pivotal channel for consumer purchasing and brand marketing. Nonetheless, this growth has concurrently revealed a spectrum of challenges, including deceptive advertising by streamers, non-compliant operational practices by merchants, and difficulties in effective governmental regulation. This study develops an evolutionary game-theoretic model encompassing three key stakeholders: streamers, merchants, and the government, with the objective of elucidating the stable evolutionary strategies of each agent as well as the overall system dynamics. Furthermore, the analysis investigates the impact of merchant return policy and consumer search behavior on the system's evolutionary trajectory and convergence velocity. The findings uncover a nuanced incentive mechanism linking streamers' truthful advertising to merchants' compliance behaviors. Notably, truthful advertising does not uniformly promote compliance: when profits derived from compliant operations surpass those from non-compliant activities, truthful promotion may paradoxically amplify merchants' incentives to act non-compliantly; conversely, if compliant profits are comparatively lower, truthful advertising tends to encourage compliance. Additionally, we also show that a higher commission rate for the streamer tends to induce merchants' non-compliance behavior, however, a lower commission rate might strengthen merchant compliance incentive. The results further reveal asymmetric sensitivities among participants: merchants exhibit greater responsiveness to variations in governmental penalties than to changes in commission rates, while streamers display heightened sensitivity to commission rate adjustments and factors related to deceptive advertising. Lastly, we find that while the emergence of return policy and consumer search does not alter long-term equilibria, it significantly affects the speed of reaching different equilibrium outcomes.

Paper ID: 52

Paper Title: Two-Period Pricing and Platform Sales Model Selection Under Informed Privacy Consent

Authors: Zhongmiao Sun, Yijie Fu, Dr. Baoli Shi

Abstract: The selection of platform sales models and consumer privacy strategies are core issues in the digital economy. For the problem of pricing and sales model selection for platforms under consumer privacy disclosure, three modes, namely resale, agency, and instant retail, are considered. Based on a two-period pricing framework, equilibrium decision-making models for different sales modes are constructed and solved by using game theory and optimization methods. The results show that the establishment of price discrimination is conditional on the extra utility created by personalized services for consumers exceeding the perceived cost of privacy risk; the advantages of any single sales model in pricing and demand are not absolute, as the competitiveness of the resale model is determined by platform operational efficiency, while the relative advantages of agency and instant retail modes are influenced by commission and delivery fees. Finally, the numerical simulation shows that a conflict of interest exists between platforms and brand owners in sales model selection. The highest profits for brand owners are achieved under the agency model where they hold pricing power, whereas the platform's optimal choice is determined based on data value and its own costs. The research conclusions provide theoretical reference for platforms in designing pricing strategies and selecting sales models in the context of privacy protection.

Session SU17 (Track 25 Data Quality Management)

Paper ID: 196

Paper Title: Algorithmic equity in emergency care: Uncovering the social determinants of spatiotemporal EMS demand for responsive dispatch

Authors: Yuchen Lei, Cc Yan, Fangqi Liu, Chenlu Li, Ying Zhang, Haiyan Yu

Abstract: Equitable access to emergency medical services (EMS) is a foundational objective of public health. However, the spatial-temporal heterogeneity of emergency demand and its underlying social roots pose persistent challenges to achieving both fairness and efficiency in resource allocation. Based on a complete-year dataset of 68,934 emergency dispatch calls from Chongqing's 120 EMS system (2024), this study integrates high-resolution spatial-temporal data with machine learning models to examine the social determinants shaping EMS demand patterns and to explore algorithmically fair dispatch strategies.

Findings reveal systematic inequities: Ring 1 exhibits a per-area demand density approximately 32 times that of Ring 3, accounting for 48.4% of citywide call volume.

Temporally, winter demand exceeds summer levels by 13.3%, peaking in February. The leading chief complaints, including other injuries (11.4%), malaise (9.5%), and altered consciousness (4.5%), show differential distributions across ring zones, reflecting distinct risk profiles between urban core and peripheral populations. Drawing on these social insights, we construct and compare multiple predictive models and propose a data-driven decision framework that combines Random Forest for real-time response and LSTM for long-term planning with an equity constraint module grounded in Social Determinants of Health (SDOH), reframing algorithmic prediction from a technical instrument into a form of socially-contextualized intelligence that is capable of recognizing and actively counteracting structural inequities in dispatch.

This study quantifies how social structure shapes health-related demand and argues that embedding SDOH into emergency management systems is critical to the transition from predicting demand to enabling equitable response, providing an empirical foundation and interdisciplinary pathway toward more responsive and just health systems.

Paper ID: 118

Paper Title: The Impacts of EHR on Heart Transplants: The Role of Meaningful Use Program

Authors: Yulin Nie, Chao Zhang, Qiaochu He

Abstract: Despite the growing demand for heart transplants, procured hearts are often underutilized, primarily due to the current preservation window of less than 4 hours. Electronic Health Record (EHR) technologies hold promise for improving heart utilization, including streamlining donor-recipient matching and reducing evaluation times. However, such potential benefits have not yet been systematically validated. In this study, we leveraged the Meaningful Use (MU) program to quantify the impacts of EHR adoption across varying implementation levels. Specifically, we investigated 105 U.S. transplant centers that performed transplant surgeries each year from 2008 to 2018. We then constructed a two-way fixed-effects model paired with an instrumental variable (IV) to account for unmeasured confounders. The proposed IV captures the status of MU vendors, a factor linked to MU adoption but unlikely to directly affect organ matching procedures. The results showed that attaining MU Stage 2 has a significantly positive effect on transplant care, with an average increase of 4.3 annual transplant surgeries per transplant center. However, attaining MU Stage 1 and merely employing EHR technologies had no significant effects on transplant care. Through heterogeneity analysis, we found that small-scale transplant centers benefit more from MU Stage 2 attainment than large-scale ones. Robustness tests confirmed that our results are reliable. These findings highlight the value of intensive utilization of EHR technologies for improving transplant efficiency, especially among small-scale transplant centers.

Paper ID: 276

Paper Title: More Human-like, More Risky? The Trust-Anthropomorphism Paradox in Digital Human Live Streaming: An Explainable AI Approach

Authors: Mr. Keyan Chen, Dr. Haiyan Yu, Ms. Siqi Duan, Mr. Fangbo Fu

Abstract: Evaluating broadcaster effectiveness in live-streaming commerce remains challenging. Existing methods often rely on isolated performance metrics (e.g., conversion rates) and lack explainability regarding why a broadcaster succeeds or fails, particularly across different product contexts. To address these limitations, this study introduces an improved mixed-methods framework that integrates SHAP-based interpretability modeling and sentiment analysis. This approach not only compares performance outcomes but also identifies the core drivers underlying them.

Our results confirm that optimal broadcaster selection is highly context-dependent. In the daily consumer goods sector, highly anthropomorphic digital humans significantly enhance user interaction (by 34.2%) and conversion rates (by 18.7%), with immersion identified as a key driver. Conversely, in the healthcare sector, real human broadcasters achieve superior outcomes (41.6% conversion) by leveraging professional trust signals. SHAP analysis further quantifies user trust (SHAP +2.2) and level of anthropomorphism (SHAP +1.8) as the primary determinants of sales performance. Additionally, a 1% increase in positive sentiment correlates with a 0.93% increase in sales for daily consumer goods.

The key advantage of the proposed framework lies in its explainable and context-aware evaluation capability. It moves beyond identifying what works to revealing why it works, providing actionable strategic insights for platforms to align broadcaster type with product category—prioritizing immersive technological experiences for daily goods and human-centered trust for healthcare—thereby enabling optimized resource allocation and sales strategies.

Paper ID: 422

Paper Title: How Quality 4.0 Shapes Innovation Performance: A Nonlinear Explanation from Dynamic Capabilities

Authors: Yujia Deng, Tong Lv, Can Cai, and Hongtao Wang

Abstract: As digital technologies become deeply embedded in quality management systems, firms are increasingly adopting quality 4.0 practices. However, whether and how quality 4.0 translates into corporate innovation performance remains unclear. Drawing on dynamic capability theory, this study develops an integrated framework linking quality 4.0 to innovation performance through the mediating role of dynamic capabilities, while explicitly accounting for potential nonlinear effects.

Using a panel dataset of 6,182 firm-year observations from Chinese A-share listed firms that received government quality awards between 2010 and 2023, this study examines

the relationship between Quality 4.0 and innovation performance. This study operationalizes quality 4.0 as the coupling coordination between firms' quality management level and digital transformation. The quality management level is measured as a continuous construct, with indicator weights determined using the Analytic Hierarchy Process (AHP) and the CRITIC method. Panel regression analysis is then conducted to test the direct effect of Quality 4.0 and the mediating role of dynamic capabilities.

The results reveal a significant inverted U-shaped relationship between Quality 4.0 and innovation performance. While moderate investments enhance innovation performance, excessive investment leads to diminishing returns. Dynamic capabilities are found to partially mediate this relationship, among which innovation capability plays the most prominent role. Further analyses uncover substantial heterogeneity across industries, ownership structures, and regions, indicating that the effectiveness of Quality 4.0 is contingent on contextual conditions.

This study contributes to the literature in three ways. First, it extends research on Quality 4.0 by demonstrating its inherently nonlinear impact on innovation performance. Second, it advances dynamic capability theory by explicating the mechanism through which quality 4.0 is translated into innovation performance. Third, it provides large-sample empirical evidence from an emerging economy context, offering new insights into the boundary conditions. The findings also offer important managerial implications for firms seeking to align quality 4.0 initiatives with innovation strategies and to avoid over-investment in quality 4.0.

Paper ID: 423

Paper Title: Enhancing Public Data Supply Quality and Efficiency: A Revenue-Feedback and Trust-Building Perspective

Authors: Jing Shen, Yanrui Jing, and Yang Zhang

Abstract: Addressing the challenges of insufficient supply, poor circulation, ineffective utilization, and weak security in China's public data sector, this paper develops a four-player evolutionary game model incorporating data providers, technical support institutions, authorized operation institutions, and data demanders, examined through the dual perspectives of revenue feedback and trust building. The key findings are threefold. First, within the data flow, security technologies and information technology (IT) compensation provided by technical support institutions constitute the cornerstone of high-quality data supply. Second, in the revenue flow, cost compensation from technical institutions proves more effective; accordingly, an operational revenue distribution ratio of 50% (technical institutions), 25% (data providers), and 25% (authorized operation institutions) is proposed. Third, with respect to trust flow, increased trust revenue and reduced leakage risk for technical institutions significantly stimulate supply, whereas heightened trust loss for data demanders acts as a strong

deterrent, impeding market development. This study provides theoretical insights for improving public data governance.

Session SU18 (Track 26 AI driven Financial Service & 28 AI for Finance & 10 AI-Driven Service Innovation: From Personalization to Hyperautomation)

Paper ID: 220

Paper Title: Research on the Impact of Banking Network Structural Characteristics on Systemic Risk

Authors: Zhang Yicong

Abstract: In the financial system, the structure of the banking network exerts a significant influence on the path and intensity of systemic risk contagion; however, the nonlinearity of the contagion process presents challenges for analysing this relationship. Under the Eisenberg-Noe (E-N) model framework, this study combines machine learning methods based on Graph Neural Networks (GNNs) with the SHAP interpretability framework to analyse interbank lending networks and external asset overlap networks. We identify key structural characteristics of the banking network that affect systemic risk and proposes a targeted systemic risk reserve scheme. The findings indicate that when only interbank lending networks are considered: large banks become the primary contributors to risk contagion due to their high clustering coefficients when holding a high proportion of internal assets, whereas eigenvector centrality becomes the dominant factor when the proportion of internal assets is low. After incorporating external asset overlap networks, the clustering coefficient remains the leading factor, and small banks, which have concentrated assets and weak risk resistance, experience a relative amplification in their contribution to risk contagion. Empirical analysis using data from 42 A-share listed banks in 2025 validates the conclusions of this study.

Paper ID: 123

Paper Title: Risk-Sensitive Reinforcement Learning with Costly Signals and Information Choices

Authors: Dr. Tingjin Yan, Prof. Yun Shi

Abstract: Sample inefficiency in reinforcement learning (RL) is exacerbated in environments where informative signals are costly and decisions must account for risk, such as financial markets.

We study a provable risk-sensitive RL framework with endogenous information choices, in which an agent strategically pays to observe signals about future states and acts accordingly in a finite-horizon Markov decision process under static optimized certainty equivalents.

To jointly optimize information acquisition and action selection, we introduce a unified probabilistic decision policy that couples signal requests and actions, and characterize the induced policy space. Based on this formulation, we develop bonus-driven value iteration algorithms and establish minimax regret lower bounds as well as upper bounds. We evaluate our method on a financial market-timing task using large-language-model-based signals, illustrating its effectiveness in environments with costly information.

Paper ID: 279

Paper Title: Two-Stage Robust Optimization for Rural Mobile Medical Fleet Routing with Endogenous Service Time Trade-off

Authors: Hengjia Zhang, Prof. Canrong Zhang

Abstract: The deployment of mobile medical facilities is vital for rural healthcare accessibility, where traveling directly consumes severely limited service-time resources. Compounded by uncertain patient demand, this creates significant challenges for fleet sizing and vehicle routing. This paper proposes a two-stage robust optimization model for the Robust Mobile Medical Fleet Problem (RMMFP) to address these challenges. To solve the resulting formulation, we develop a dual-method framework: an exact Column-and-Constraint Generation (C&CG) algorithm for certified robust optimization, and a tailored Simulated Annealing-based Matheuristic (SA-MATH) for scalable scenario-wise stress evaluation. The C&CG algorithm solves the two-stage robust model on small-to-medium networks, while SA-MATH exploits the extreme-point structure of the budgeted uncertainty set to rapidly identify high-stress demand scenarios and evaluate their deterministic counterparts on large networks. Numerical experiments on instances calibrated from real rural-healthcare records validate the proposed model and solution framework. The results further reveal a saturation effect in the price of robustness, providing actionable managerial insights for cost-effective rural mobile healthcare deployment.

Paper ID: 31

Paper Title: Data-Driven Operating Room Planning and Scheduling: A Comprehensive Review and Future Directions

Authors: Yu Wang, Shuzheng Zhang, Jiafu Tang, Yu Zhang

Abstract: Operating room (OR) planning and scheduling plays a critical role in hospital operations but is inherently complex due to patient heterogeneity, demand uncertainty, and perioperative resource constraints. To address these challenges, recent advances in hospital information systems and artificial intelligence have enabled the development of data-driven optimization approaches. These approaches leverage heterogeneous clinical data to characterize key sources of uncertainty and incorporate such information into optimization models to support decision-making. This paper reviews the literature

on data-driven OR planning and scheduling from the perspectives of decision hierarchy and methodology. From a decision hierarchy perspective, this review synthesizes existing studies across capacity planning, advance scheduling, and online rescheduling, emphasizing their respective operational scope and practical limitations. From a methodological perspective, we review data-driven optimization approaches for OR planning and scheduling based on prediction-optimization coupling. These approaches range from sequential prediction then optimization pipelines to more tightly integrated learning-and-optimization paradigms. A comparative analysis of these paradigms is presented, highlighting their trade-offs across different OR planning and scheduling settings in terms of robustness, interpretability, computational complexity, data requirements, and clinical feasibility. By linking methodological paradigms with operational contexts, this review identifies key challenges and outlines promising directions for developing reliable and clinically deployable OR planning and scheduling frameworks.

Paper ID: 209

Paper Title: Data-Driven Facility Layout for Enhancing Walk Appeal in Walkable Neighborhoods

Authors: Haoran Guo, Sentao Miao, Wei Qi, Jian Cui, Zhenning Dong

Abstract: Designing walkable neighborhoods requires more than proximity-based accessibility. We develop a data-driven framework that integrates a latent class logit model with facility layout optimization to enhance residents' walking propensity. Using large-scale travel and spatial data, we quantify how en-route facility density influences walking decisions across heterogeneous trip purposes. We reformulate the layout problem as a conic program and develop scalable greedy algorithms with performance guarantees. Our approach significantly improves walk appeal while preserving accessibility.

**Session MO01 (Track 17 Data-Driven Prediction and Optimization in
Emergency Management & Resource Allocation and Scheduling in Service
Systems)**

Paper ID: 162

Paper Title: Interpretable Metric System for Academic Potential Prediction: Integrating Network Topology and Decision Support

Authors: Dr. Keqin Guan, Prof. Wai Kin (Victor) Chan

Abstract: Predicting future academic potential of early-career scientists is a critical challenge for service science, like talent management and academic resource allocation.

While complex graph neural networks offer high predictive power, their opaque nature hinders adoption in high-stakes decision-making. To address the fundamental trade-off between model complexity and interpretability, we conduct a systematic analysis to contrast complex GNNs with a simpler Interpretable Attention-based Graph Aggregation (IAGA) model that incorporates a comprehensive set of 38 explicit, hand-crafted topological features. Empirical results from two large-scale academic networks demonstrate a compelling insight that when augmented with these high-quality features, the architecturally simpler IAGA model achieves state-of-the-art performance while maintaining inherent interpretability via attention weights. Furthermore, IAGA 's attention mechanism provides essential transparency, explicitly identifying the most crucial factors—particularly scholarly social and institutional metrics—driving future potential. Our findings validate that thoughtful feature engineering can compensate for, and even surpass, the advantages of architectural complexity, providing a key principle for developing models that are both powerful and transparent for decision support in academic contexts.

Paper ID: 166

Paper Title: Context-Aware Scholar Recommendation via Conditional Diffusion on OpenAlex

Authors: Runqing Miao, Sihong Zhang, Dingyu Zhou, Mr. Yonghao Zhang, Jiadong Liu, Wei Chen, Prof. Wai Kin (Victor) Chan

Abstract: Identifying suitable research collaborators is a core capability in research-support service systems that assist project formation, expert discovery, and knowledge integration across large scholarly ecosystems. Existing scholar recommendation methods often rely heavily on historical coauthorship patterns, local graph proximity, or lexical overlap, which can underweight project-specific fit and reduce the likelihood of surfacing scientifically plausible but previously unconnected collaborators. This paper proposes an OpenAlex-based conditional diffusion framework for context-aware scholar recommendation. The framework encodes scholar-side semantic and structured signals separately, represents project context from scientific text, fuses heterogeneous evidence through a Perceiver-style latent bottleneck, and performs hierarchical denoising in the collaborator latent space before retrieval-based ranking. The empirical study uses temporally split OpenAlex author–work data and compares the proposed approach with transparent lexical and graph-based baselines. The results indicate that conditional generative retrieval can improve context-sensitive collaborator search, especially when historical collaboration evidence is sparse, and can therefore serve as a useful decision-support component for research-service platforms.

Paper ID: 203

Paper Title: MAOCG: Multi-Agent Reinforcement Learning for Opinion Consensus Guidance in Online-Offline Social Networks

Authors: Meixi Song, Ningyu Liao, Guilherme Almeida Ferreira, Prof. Wai Kin (Victor) Chan

Abstract: Guiding opinions toward a target consensus can support social governance and collective decision making. As modern technology advances, diverse and complex mechanisms in online and offline social networks increasingly interact and couple, making opinion shaping a service-system optimization problem under limited resources. This paper develops O2Net, an online-offline social network model that organically couples dual-layer network dynamics. O2Net integrates complex factors including trust, stubbornness, conformity effects, and inertia effects, and incorporates a targeted network topology to capture realistic social influence. Building on O2Net, we propose MAOCG, a multi-agent reinforcement learning method that allocates and schedules limited expert interventions over time. Starting from population-wide and individual opinions, expert agents adjust opinions, anchoring strengths, and key links to guide consensus formation. Experiments compare MAOCG with heuristic algorithms and show that it significantly improves consensus attainment in dual-layer dynamic environments, offering an effective solution for social services.

Paper ID: 222

Paper Title: Cross-City Transfer for Spatial OHCA Risk Prediction without Local OHCA Records

Authors: Chih-Yuan Yang, Mingchuan Yang, Dr. Xinglu Liu, Li Li, Bin Zhang, Prof. Wai Kin (Victor) Chan, Kexin Cao

Abstract: Out-of-hospital cardiac arrest (OHCA) causes massive mortality worldwide, and city-scale OHCA risk maps are therefore highly valuable for time-critical planning, particularly for the proactive allocation and deployment of emergency medical resources. However, many cities lack reliable historical OHCA records, making conventional data-intensive risk modeling difficult to deploy. This paper studies a cross-city transfer setting for grid-level OHCA frequency mapping when local OHCA records are unavailable in the target city. Our cross-city transfer pipeline consists of three steps. First, we train a predictor on labeled data from the source city (Virginia Beach, V A, USA) to learn associations between geographic features and OHCA frequency.

Second, we transfer the learned associations to the target city (Yixing, Jiangsu, China) to predict an OHCA frequency map, and conduct proxy validation using target-city population density.

Third, we apply SHAP to interpret cross-city transferability.

Experiments comparing multi-layer perceptron (MLP), support vector regression (SVR), and XGBoost show that MLP and SVR produce population-aligned and spatially coherent frequency patterns, whereas XGBoost is more vulnerable to fragmented predictions under domain shift. SHAP analyses further suggest that transferability is primarily influenced by the predictive model architecture and semantic heterogeneity in feature labels.

Overall, this study investigates cross-city transfer for OHCA frequency prediction in cities without local OHCA records and identifies key factors that may influence its transfer behavior and practical reliability.

Paper ID: 408

Paper Title: A DQN-based Approach for Real-Time Scheduling in 5G-V2X Edge Computing Networks

Authors: Wenbo Zhang, Zhaosheng Yao, Yu Yang, Kun Song, Jining Liu, Prof. Wai Kin (Victor) Chan

Abstract: The integration of 5G-V2X and Multi-access Edge Computing is pivotal for supporting the mission-critical, computation-intensive applications of next-generation Intelligent Connected Vehicles. However, the high-speed mobility of vehicles and the stochastic nature of task arrivals induce severe spatio-temporal volatility, rendering conventional scheduling paradigms—which often rely on instantaneous network snapshots—ineffective for maintaining the Ultra-Reliable Low-Latency Communication requirements. In this paper, we propose GNN-LSTM-DQN, a Deep Reinforcement Learning framework designed for adaptive, real-time task offloading within the hierarchical device-edge-cloud continuum. We construct a dual-stream perception architecture: a Graph Neural Network captures the non-Euclidean topological interdependencies of the 5G-V2X infrastructure, while a Long Short-Term Memory module internalizes latent temporal patterns of traffic-load evolution. These fused embeddings are then processed by a Deep Q-Network agent, integrated with an action masking mechanism to ensure resource-feasible decision-making under strict physical constraints. The results demonstrate that GNN-LSTM-DQN significantly outperforms the heuristic and spatial-only Deep Reinforcement Learning baselines, maintaining a robust task success rate and low latency. This study underscores the necessity of joint spatio-temporal intelligence for enabling proactive resource orchestration and ensuring service continuity in highly dynamic, non-stationary V2X environments.

Session MO02 (Track 21 Data Driven Decision Making in Service Systems under Uncertainty & 18 Reliable Facility Location and Transportation Operations in the Digital-Intelligence Era)

Paper ID: 393

Paper Title: Internalizing Behavioral Queue Aversion in EV Charging: A Decision-Dependent DRO Approach

Authors: Xuedong Wang, Hongli Xu, Prof. Caihua Chen

Abstract: As global electric vehicle fleets expand, public charging infrastructure has transitioned from a supporting utility to a critical urban bottleneck. This paper investigates a charging scheduling problem faced by service providers operating under significant distributional ambiguity and demand endogeneity. We identify a pivotal behavioral phenomenon—the queue aversion effect—where EV drivers utilize real-time station occupancy data from aggregation platforms to preemptively avoid congested facilities. This digital transparency makes the arrival distribution decision-dependent, rendering traditional exogenous stochastic models inadequate. To address this, we propose a novel data-driven framework that integrates machine learning-based demand predictors with prescriptive optimization. Specifically, we construct a two-stage distributionally robust optimization model with decision-dependent uncertainty, where the ambiguity set is centered around a regression prediction distribution that dynamically shifts with scheduling decisions. We develop a computationally efficient gap-certified relaxation-guided exact integer L-shaped algorithm, supported by an exact mean-polytope reduction, a compact MILP reformulation, and a relaxation-gap certificate, to ensure tractability for largescale urban networks. Numerical experiments using real-world data from a leading charging provider demonstrate that our approach boosts out-of-sample R^2 from 0.40 to 0.65 and significantly improves profit stability. Our findings reveal that strategic occupancy management serves as a powerful managerial lever, allowing providers to internalize the externality of queue aversion and smooth demand peaks without sacrificing service revenue.

Paper ID: 391

Paper Title: Incentives through Case Assignment

Authors: Dr. Xiaohan Zhu

Abstract: We study a dynamic contracting problem in which a principal repeatedly assigns cases to an associate whose ability is initially uncertain and whose effort is unobservable. The principal chooses between a high-intensity and a low-intensity caseload regime, and performance outcomes serve both as a basis for compensation and as a signal of the associate's latent ability. Because a heavier caseload generates a more informative performance signal, case assignment functions simultaneously as a

production decision, an incentive instrument, and an experimentation tool. We derive the optimal contract in closed form under CARA utility. The contract exhibits a belief-threshold structure: the principal assigns the high caseload whenever the posterior probability of high ability exceeds a cutoff f^* . We show that this dynamic cutoff is strictly below the myopic benchmark, so that the principal optimally experiments with a heavier workload even when its current-period return is negative. The gap between the dynamic and myopic cutoffs captures a pure *learning effect* that arises because accelerated information acquisition through higher caseload intensity has option value for future decisions. Comparative statics reveal how signal quality, moral hazard severity, noise, and discounting shape the experimentation region. We extend the base model to incorporate endogenous separation decisions, belief-dependent outside options reflecting career concerns, and heterogeneous case types, and we show how each extension enriches the interaction between learning and incentive provision.

Paper ID: 398

Paper Title: Managing Cooperative Advertising in the Presence of Cross-Channel Spillover

Authors: Jixin Zhao, Zheyu Jiang, Prof. Houcai Shen

Abstract: Driven by the ubiquity of social media and the emergence of new advertising models, an increasing number of firms have adopted social media advertising in recent years, while many others continue to rely on traditional advertising. This divergence in advertising strategies generates asymmetric cross-channel spillover, i.e., substantial advertising investments by firms on social platforms can drive traffic to competing retail channels. Such spillover poses a critical challenge for cooperative advertising initiatives: although cost-sharing incentivizes advertising investment, spillover induces free-riding behavior, which may impact retail competition and reduce supply chain coordination efficiency. We develop game-theoretic models featuring one supplier and two competing retailers, distinguishing between retailer-led (retailers determine advertising intensity) and supplier-led (supplier determines advertising intensity) advertising structures. Our analysis reveals three main findings. First, in the retailer-led model, the retailer that free-rides on competitors' advertising investments may either outperform or underperform its competitor under cross-channel spillover. Second, cross-channel spillover can exert a positive or negative impact on all firms' financial performances. Third, surprisingly, our analysis reveals that spillover can act as an enabler, allowing cost-sharing arrangements to deliver mutual benefits to all supply chain firms. Our findings provide important managerial implications: Firms must align their operations with cost-sharing ratios, dominant roles in determining advertising intensity, and cross-channel spillover—given that spillover may produce opposing effects on firms' financial outcomes. Moreover, when implementing cost-sharing, differentiating retailers in terms of their advertising models and spillover-generation

capabilities can benefit all firms, despite the resulting free-riding on advertising investments.

Paper ID: 324

Paper Title: End-to-End Learning for Constrained Inventory Reconfiguration

Authors: Prof. Hongyan Dai, Ruiqi Zhang, Prof. Zihao Jiao

Abstract: The rapid growth of Device-as-a-Service and short-term PC rental markets has created new operational challenges for inventory management. In these systems, operators manage families of substitutable SKUs (e.g., laptops with different memory and storage configurations) where returned items re-enter the system after inspection lead times and can be retrofitted across configurations. This creates a “lagged supply” effect: rentals and returns in period t determine the usable supply and conversion options in period $t + 1$. Combined with dense, directed conversion constraints and integrality requirements, this structure yields a largescale mixed-integer reconfiguration problem that challenges traditional predict-then-optimize pipelines. We develop a constraint-aware end-to-end (E2E) decision-learning framework with two key components. First, a periodic graph constraint embedding encodes the time-varying conversion network, inventory states, and capacity limits using a bipartite graph neural network.

Second, ProjectNet, a differentiable feasibility projection layer, maps network outputs to operationally valid decisions satisfying all hard constraints by construction. The architecture jointly embeds return signals with demand and inventory features through an LSTM encoder to capture intertemporal dependencies. We validate the framework through a field study with a leading short-term PC rental company. Compared to human-expert decisions and predict-then-optimize baselines, our approach reduces total inventory cost by over 15% and improves service levels while maintaining full constraint feasibility.

Paper ID: 327

Paper Title: How Can Government Automobile Trade-In Subsidy Policies Boost Domestic Demand and Enhance Environmental Sustainability?

Authors: Dr. Hang Zhang

Abstract: This paper explores the mechanism of government automobile trade-in subsidy policies in boosting domestic auto market demand and improving environmental sustainability under the background of the digital-intelligence era. Based on the tripartite game model of government, automobile enterprises and consumers, this study analyzes the impact of differentiated subsidy policies on the behavioral decisions of market subjects, and verifies the dual effects of subsidy policies on activating domestic demand and promoting the upgrading of new energy vehicle industry. The

research results provide a theoretical framework and practical reference for the scientific design of industrial policies, and further lay a solid industrial foundation for the reliable operation of transportation systems in the digital-intelligence era. This study also enriches the research on the integration of industrial policy and transportation operation management, and has important enlightenment for the high-quality development of the transportation industry.

Session MO03 (Track 10 AI-Driven Service Innovation: From Personalization to Hyperautomation)

Paper ID: 339

Paper Title: Dynamically Reactive and Predictive Surgery Scheduling

Authors: Lixiang Zhao, Han Zhu

Abstract: In static daily surgery scheduling, actual progress often deviates from planned schedules due to uncertainties in surgery durations and emergency arrivals, potentially compromising patient outcomes and hospital performance. To address this, we propose a dynamically reactive and predictive surgery scheduling (DRPSS) framework that adaptively updates schedules for elective and emergency surgeries across parallel resources, including operating rooms and anesthesiologists, minimizing total workday costs while controlling emergency delays. DRPSS integrates two components: reactive scheduling, which evaluates whether to trigger rescheduling, and predictive scheduling, which optimally allocates unserved patients once rescheduling occurs. Reactive scheduling is formulated as a Value-at-Risk (VaR)-constrained Markov decision process, balancing timely adjustments against schedule disruptions. Predictive scheduling employs worst-case Conditional Value-at-Risk (CVaR) under a Wasserstein ambiguity set to evaluate additional waiting time and overtime, capturing administrators' risk preferences and admitting a closed-form solution. To support online deployment, we develop a linear-complexity algorithm for computing surgery start times and a branch-and-cut algorithm to identify the optimal schedule. Simulation and ablation experiments using real-world data demonstrate that DRPSS outperforms benchmark methods: predictive scheduling delivers robust out-of-sample performance, and the derived rescheduling policy exhibits strong generalization ability across diverse scenarios.

Paper ID: 139

Paper Title: When AI Empathy Backfires: The Mismatch Effect of Emotional Support in Human-AI Service Handoffs in Online Healthcare

Authors: Anfei Xia, Prof. Jian-Jun Wang, Jierui Zhang

Abstract: As artificial intelligence (AI) assistants become increasingly embedded in online healthcare, patient experience is shaped not by a single interaction but by a sequential service journey in which an AI pre-consultation assistant hands off the patient to a human physician.

While prior research generally suggests that empathic AI improves user evaluations, little is known about whether such benefits persist across human-AI service handoffs. Drawing on anchoring theory and expectation-disconfirmation theory, we develop and test a model of emotional support mismatch in online healthcare. We argue that although higher AI emotional support enhances the immediate pre-consultation experience, it can backfire when the downstream physician provides relatively low emotional support, because the AI interaction raises patients' affective expectations and amplifies perceived shortfalls in the subsequent physician encounter. We examine this argument using a controlled scenario-based experiment in online dermatology consultations with a $2 \times 2 \times 2$ between-subjects design that manipulates AI emotional support, physician emotional support, and AI anthropomorphism. Results show that high AI emotional support reduces overall patient satisfaction when followed by low physician emotional support, relative to a matched low-AI/low-physician baseline. This effect is fully mediated by negative expectation disconfirmation. In addition, AI anthropomorphism strengthens the mismatch effect on negative disconfirmation, whereas patient health literacy attenuates the negative impact of disconfirmation on satisfaction. Our study contributes to the IS literature by shifting attention from isolated AI touchpoints to sequential human-AI service journeys, identifying a contingent view of empathic AI design, and uncovering expectation disconfirmation as a key mechanism linking upstream AI design to downstream human service evaluations. Practically, our findings suggest that platforms should calibrate AI empathy according to expected downstream physician styles, design AI systems with handoff awareness, and tailor expectation management across user segments differentiated by health literacy.

Paper ID: 333

Paper Title: The Impact of Hashtag Challenges on User Engagement in Sports Mobile Applications

Authors: YiLin Lv

Abstract: Hashtag challenges have attracted widespread attention due to their dual features of goal-setting and social interaction. However, there is still a lack of systematic empirical research on whether hashtag challenges can genuinely promote

users' exercise engagement, their underlying mechanisms and boundary conditions, and whether heterogeneous effects exist across different user groups. This study focuses on hashtag challenges as the core research object, aiming to uncover their impact on user participation and exercise behavior. The results indicate that hashtag challenges can overall significantly increase users' exercise duration. Further analysis reveals that the positive effect is significantly weakened when challenges require "image uploading", whereas the moderating effect of exercise frequency requirements is not significant. This study verifies the positive effect of hashtag challenges on users' exercise participation, providing useful implications for optimizing the product design of fitness applications.

Paper ID: 34

Paper Title: Optimizing Server Locations in Spatial Service Systems: Parametric and Nonparametric Bayesian Optimization Approaches

Authors: Prof. Cheng Hua, Prof. Arthur Swersey, Wenqian Xing, Yi Zhang

Abstract: This paper presents a new model for solving the optimal server location problem in spatial service systems. Unlike deterministic location models, our approach accounts for server availability, varying utilization levels, and dependencies across servers using a spatial hypercube model. We prove that the problem is NP-hard and establish lower and upper bounds, as well as asymptotic results, by relating it to special cases of the classical p-Median problem. To address the computational challenge, we propose two Bayesian optimization approaches: (i) a parametric approach based on a sparse Bayesian linear model with second-order interactions, and (ii) a nonparametric approach using a Gaussian process surrogate with the p-Median objective as the prior mean function. We prove that both methods achieve sublinear regret. Numerical experiments and a case study using real-world data from the St. Paul, Minnesota, emergency response system show that our approaches consistently identify optimal solutions and outperform all baseline methods.

Paper ID: 32

Paper Title: Real-time scheduling of multi-test outpatient services: integrating appointment plans with operational uncertainties

Authors: Junpeng Wang, Yanan Zhu, Yang Wang, Erik Demeulemeester, Abraham Punnen

Abstract: Efficient scheduling of diagnostic tests is critical to outpatient care, directly impacting hospital performance and patient satisfaction. Traditional scheduling approaches struggle to accommodate dynamic factors such as patient tardiness and variability in test durations. This study addresses the real-time scheduling problem for outpatients requiring multiple diagnostic tests (RTOMT) in a clinical appointment

setting. At each decision point, the problem involves routing an idle patient to the next diagnostic test and assigning the next patient to an available device, with the objective of minimizing the total patient waiting time. To address this problem, we propose a Genetic Programming (GP) approach that integrates a simulation model, a basic rule set, and an evolutionary process. A dual-tree representation is employed to jointly encode patient-related routing decision and device-related assignment decision. Using real data from a partner hospital, we construct a set of benchmark instances and evaluate the proposed approach against both the hospital's current scheduling practice and representative methods from the literature. Computational results demonstrate that the GP-based approach achieves substantial reductions in patient waiting time. We also investigate an extended scenario that introduces tardiness penalties to reflect common hospital policies, finding that the overall waiting time increases slightly by 5.1% while the on-time patients experience a 15.9% reduction. Finally, a real-world case study validates the effectiveness and practical applicability of the GP-generated scheduling rules.

**Session MO04 (Track 16 Platform Supply Chain Operation Optimization & 12
Data-Driven Intelligence: Integrating Analytics, Artificial Intelligence, and
Machine Learning for Smarter Decision-Making)**

Paper ID: 161

Paper Title: Strategic inventory and supplier development investment under downstream competition

Authors: Shuangyu Xu, Junfeng Tian, Prof. Wei Li

Abstract: We investigate the interaction between the buyers' strategic inventory (SI) option and supplier development investment in a two-period supply chain model consisting of a common supplier and two competing buyers. Prior studies suggest that SI held by the buyer induces the supplier to lower the second-period wholesale price, thereby alleviating double marginalization. Our study adds to this literature by introducing supplier development undertaken by the buyers to reduce the supplier's second-period production cost. Two scenarios are considered in which supplier development is present: specific investment, where spillover from supplier development cannot occur, and generic investment, where supplier development yields spillover to a rival buyer. We demonstrate that without investment, SI can benefit both the supplier and the buyers when the inventory holding cost is low. However, in the presence of supplier development investment, having the SI option discourages the buyers from investing, and thus may hurt all firms, even if the inventory holding cost is absent. By examining the impact of specific investment, we show that, without the SI option, specific investment always hurts the buyers compared to no investment. In contrast, with the SI option, specific investment can benefit the buyers by inducing them to abandon inventories. We also study the impact of generic investment and find

that, without the SI option, the buyers always benefit from generic investment. Interestingly, with the SI option, generic investment can lead to higher wholesale prices in both periods for investing buyers than those under no investment. This consequently hurts the buyers.

Paper ID: 240

Paper Title: AI identity disclosure and platform regulation in digital human live streaming commerce: An evolutionary game analysis

Authors: Yanfen Zhang

Abstract: With the rapid development of digital human live streaming commerce, the issue of AI identity disclosure has become increasingly prominent alongside ongoing industry innovation. As the boundary between digital human streamers and human streamers becomes increasingly blurred, some merchants may conceal or downplay AI identity for short-term gains, thereby inducing consumer misjudgment, and making the platform face compliance risks and regulatory challenges. To address this issue, this paper develops a tripartite evolutionary game model involving merchants, consumers, and platforms to examine the dynamic interactions among AI identity disclosure, consumer reporting, and platform regulation. By incorporating different detection probabilities under strong and weak platform regulation, as well as the marginal contribution of consumer reporting to violation detection, the study derives the expected payoffs, replicator dynamics, evolutionary stable strategies, and equilibrium conditions of the system, and further verifies the results through numerical simulation. The results show that merchants' disclosure decisions are essentially shaped by the comparison between the long-term benefits of compliant disclosure and the short-term gains from concealing AI identity. Consumers' reporting behavior depends not only on reporting costs and expected compensation, but also on whether regulation can make reporting effective. Platforms' regulatory choices are determined by the trade-off between regulatory costs and the losses associated with weak governance. The system may evolve toward three typical states: governance failure characterized by concealment, consumer silence, and weak regulation; a high-conflict governance state characterized by concealment, consumer reporting, and strong regulation; and an ideal governance state characterized by voluntary disclosure, reduced need for consumer reporting, and moderate platform regulation.

Paper ID: 251

Paper Title: Strategic Governance: Analysis of Instant Refund Service Considering Fraud Risks and Repurchase Incentives

Authors: Xiaoyong Wu, Jing Chen, Weili Xue, Peixuan Li

Abstract: Problem Definition: This paper investigates the strategic implementation of an Instant Refund Service (IRS) on an online platform where firms face fraud risks and repurchase incentives. We analyze the allocation of regulatory responsibility between the platform and the seller and evaluate how the choice of regulatory lead affects the equilibrium service adoption, commission structures, and social welfare.

Academic/Practical Relevance: While an IRS reduces consumer hassle and enhances retention, it exposes the system to opportunistic fraud. We address the dilemma of who should lead fraud mitigation to maximize long-term profits in a risky e-commerce environment.

Methodology: We develop a multi-period game-theoretic model to compare three structures: a traditional mode, a platform-regulated IRS mode, and a seller-regulated IRS mode, endogenizing regulatory effort, commission rates, and repurchase sensitivity.

Results: We identify the equilibrium conditions under which providing an IRS leads to a Pareto improvement. Our analysis shows that high repurchase incentives allow sellers to strategically tolerate higher fraud risks, as the long-term value of retained customers offsets immediate fraud losses. We uncover a governance paradox where seller-led regulation diminishes service feasibility; because the platform does not adjust commissions, the seller passes regulatory costs to consumers through price premiums, leading to price distortion and lower platform profitability. Conversely, the platform has a stronger incentive to regulate than the seller to extract governance dividends through commission adjustments. We also highlight a strategic misalignment in low-risk environments where an IRS is socially optimal but platform-rejected due to fixed costs.

Managerial Implications: Our study suggests that platforms should lead regulatory efforts in high-risk environments to better align system profits. While fraud is a visible risk, sellers must recognize that long-term customer retention is the fundamental driver of service sustainability. We also highlight the necessity of platform intervention to prevent service collapse caused by seller price premiums.

Paper ID: 245

Paper Title: Supply Chain Emission Reduction Strategies Based on Blockchain Technology under Different Carbon Policies

Authors: Qianyao Zhang, Qing Zhang

Abstract: Against the background of the continuous advancement of global carbon neutrality goals, low-carbon transformation of supply chains has become an important path to achieve carbon emission reduction. Considering consumers' green preferences and trust in blockchain technology, this paper constructs a two-echelon supply chain model consisting of one manufacturer and one retailer. It investigates the emission reduction decision-making problems under carbon cap-and-trade and carbon tax policies, where the manufacturer bears the blockchain maintenance cost and the retailer undertakes the technology investment cost. Using game theory, we solve for the manufacturer's optimal carbon emission reduction level, the retailer's optimal retail price, and the blockchain technology level, and then compare and analyze the impacts of the two carbon policies on supply chain decisions, carbon emissions, and profits. The research shows that: when the carbon trading price equals the carbon tax rate, the two policies are equivalent at the decision-making level; the incentive effect of carbon policy intensity on the manufacturer's emission reduction level is influenced by the blockchain investment cost—reducing the blockchain cost can enhance the policy effect; increases in consumers' green preference and trust in blockchain both promote emission reduction investment and profit growth. This paper provides theoretical references for governments to formulate differentiated carbon policies and for enterprises to introduce blockchain technology.

Paper ID: 416

Paper Title: Configuring Supply Chain Resilience: An Integrated Fuzzy-set Qualitative Comparative Analysis and Machine Learning Approach

Authors: Hao Zheng, Qiuyu Chen, Bao Xie, Xin Jin, Wenjun Zeng

Abstract: Given today's volatile, uncertain, complex, and ambiguous environment, supply chain resilience is essential. Previous research has highlighted a diverse set of resources that contribute to supply chain resilience, including emerging technologies, inventory availability, and response capabilities. However, most extant studies have examined these resources in isolation, and limited research has explored the configurational effects of diverse resources on supply chain resilience. Specifically, this study draws on resource orchestration theory and adopts fuzzy-set Qualitative Comparative Analysis (fsQCA) to examine how configurations of resources, including artificial intelligence involvement, inventory availability, supply chain visibility, and supply chain agility, contribute to supply chain resilience. Secondary data collected from the service sector reveal one distinct resource configuration: AI Invent. This finding suggests that, although supply chain agility and visibility are essential for

resilience, managers in the digital era may need to place greater emphasis on specific resources when developing supply chain resilience. To further examine the relative importance of the two key resources identified in this study, namely AI involvement and inventory availability, we adopt a machine learning approach.

Session MO05 (Track 7 Data-driven Applications in Healthcare Operations Management & 9 Rules-based vs. Data-driven: Decision-Making Strategies for Smart, Sustainable Service Systems)

Paper ID: 42

Paper Title: Data-Driven Prediction of Biologic Treatment Response in Pediatric Crohn's Disease Using Longitudinal Single-Cell Transcriptomics

Authors: Peng Qiu

Abstract: Crohn's disease (CD) is a chronic inflammatory disorder characterized by heterogeneous disease trajectories and highly variable response to biologic therapies. In pediatric patients, early treatment decisions critically influence long-term outcomes, healthcare utilization, and cumulative bowel damage. However, therapeutic selection is currently based largely on clinical presentation rather than predictive molecular biomarkers. This leads to prolonged trial-and-error treatment strategies, delayed remission, and increased operational burden on healthcare systems.

We report on a recently completed four-year longitudinal study of treatment-naïve pediatric Crohn's disease patients. For recruited patients, we collected mucosal biopsies at initial diagnosis and during follow-up, and profiled the biopsies using single-cell RNA sequencing (scRNA-seq). The study recruits 33 newly diagnosed patients and generates multi-site intestinal single-cell transcriptomic profiles at baseline and one-year follow-up. Clinical response to biologic therapies (including anti-TNF, anti-adhesion, and anti-IL23/IL12 agents) is systematically recorded using standardized disease activity indices.

Our objective is to develop data-driven predictive models that link baseline single-cell molecular profiles to one-year treatment response. We construct patient-level feature representations from cellular composition and cell-type-specific gene expression signatures, enabled by a novel automated cell cluster annotation algorithm that improves robustness and reproducibility of scRNA-seq interpretation. These high-dimensional features are integrated with clinical variables to formulate a supervised classification framework for predicting responder versus non-responder status.

This work positions single-cell transcriptomics as an operational decision-support tool for therapy selection at diagnosis. By identifying predictive cellular biomarkers at the treatment-naïve time point, the study aims to reduce ineffective treatment cycles, shorten time to remission, and support personalized therapy allocation. More broadly,

the project demonstrates how large-scale, high-dimensional biological data can be translated into actionable predictive models to improve healthcare operations and long-term disease management in chronic inflammatory conditions.

Paper ID: 374

Paper Title: A Machine Learning Framework for Optimizing Travel Restriction Interventions in Response to Infectious Disease Outbreaks

Authors: Elias Mohellebi, Prof. Satish Mahadevan Srinivasan

Abstract:

Motivation and Background:

When an infectious disease emerges, a rapid and strategic response is crucial to controlling its spread across different groups within a population, particularly among the most vulnerable. In such times, preparedness is reflected in the ability to deploy effective interventions swiftly. Decision-makers must have Strategic Response Plans (SRPs) that enable them to use their authority effectively to not only contain the disease but also minimize human, social, material, and economic impacts. They have interventions such as random testing, social distancing, closure orders, and travel restrictions at their disposal. However, implementing these interventions presents several challenges, including resource limitations, public compliance, communication issues, economic impacts, population equity concerns, response speed, public trust, legal and ethical considerations, and the need for global coordination.

The COVID-19 pandemic revealed how crucial the availability of a robust response plan and predictive tools are in quickly containing the spread of an infectious disease. The less prepared we are, the greater our vulnerabilities. The absence of such tools leaves decision-makers unprepared, increasing the vulnerability of communities to the spread of infectious diseases. To address this gap, this research provides decision-makers with data-driven insights and a methodology for developing effective Travel Restriction Interventions (TRIs) as part of broader SRPs to infectious disease outbreaks.

Research Questions and Objectives:

This research focuses exclusively on travel restrictions between different regions (tracts) of a community as a key intervention in response to the spread of an infectious disease. It also assumes the availability or quantifiability of a nominative list of tracts, along with historical or simulated data on population distribution, human mobility, and fatalities caused by the infectious disease.

The primary objective of this work is to develop a machine learning (ML)-driven methodology that enables decision-makers to identify the most effective TRIs for minimizing fatalities and economic disruption. This methodology is adaptable to any infectious disease within a group of interconnected tracts, provided that appropriate input data is available. The methodology is demonstrated through an application

example considering the outbreak of COVID-19 in the U.S., where TRIs are deployed in the early stage of the outbreak.

Reflecting on the COVID-19 pandemic, this research raises key questions: Could decision makers have saved more lives by strategically controlling Travel Flows (TFs) between states? Could they have prevented hospital saturation by reducing peak mortality and delaying peak time? These are the pivotal questions this research seeks to explore.

Methodology:

The proposed methodology requires either historical data or simulated data. Given the ethical and logistical challenges of conducting experiments on human subjects to gather data on fatalities during an infectious disease outbreak, this research utilizes a mathematical simulation tool to generate the data needed.

This methodology involves defining a network of interconnected tracts, collecting or simulating relevant data, and training a ML model to predict two critical outbreak metrics: Peak Mortality (maximum fatalities) and Peak Time (the day when peak mortality occurs). LASSO regression with Cross-Validation is employed to derive regression equations that establish relationships between Travel Rates (TRs), the proportion of TFs still allowed following the implementation of TRIs, and these outbreak outcomes.

For demonstration purposes, a simplified simulation tool is used to generate data. However, to improve accuracy, users of this methodology should incorporate as much real-world data as possible. In cases where real data is limited, a more advanced simulation model, one that still allows TF inputs, TRIs, and preferably other interventions, should be considered to produce more realistic daily mortality estimates.

Findings and Results:

This research provides a structured, ML-driven methodology that enhances preparedness for future outbreaks by offering decision-makers a framework to develop and refine TRIs. Through its application to the U.S., the study reveals critical insights into the role of different origin states in influencing peak mortality and peak time in destination states.

Notably, long-distance travel is associated with higher peak mortality over the full outbreak period, whereas short-range travel from neighboring states plays a crucial role in the early transmission of the disease. This distinction suggests that neighboring-state travel restrictions can be particularly effective in delaying the outbreak's onset, while long-distance travel restrictions are more impactful in reducing overall fatalities.

To support real-time decision-making, this research introduces the Travel Restriction Intervention Tuning Tool (TRITT) and an initial version (V 1.0) of the MS Excel-based tool is developed. It allows users to adjust travel restrictions dynamically and predict corresponding changes in peak mortality and peak time. TRITT enables unlimited

scenario testing, providing decision-makers with an interactive means to optimize interventions while managing available resources efficiently.

Future work may extend this methodology through the development of a dedicated, more advanced simulation tool. In addition, a web-based platform, or Python package can be developed to further improve accuracy, accessibility, and applicability of TRITT.

Paper ID: 13

Paper Title: An Entropy-Based Causality Framework for Cross-Level Faults Diagnosis and Isolation in Building HVAC Systems

Authors: Prof. Jiajing Huang

Abstract: Faults, such as malfunctioning sensors, equipment, and control systems, significantly affect a building's performance. Automatic fault detection and diagnosis (AFDD) tools have shown great potential in improving building performances, including both energy efficiency and indoor environment quality. Since modern buildings have integrated systems where multiple subsystems and equipment are coupled, many faults in a building are cross-level faults, i.e., faults occurring in one component that trigger operational abnormalities in other subsystems. Compared with non-cross-level faults, it is more challenging to isolate the root cause of a cross-level faults due to the system coupling effects. Bayesian networks (BNs) have been studied for the root cause isolation for building faults. While promising, existing BN-based diagnosis methods highly rely on expert domain knowledge, which is time-consuming and labor expensive, especially for cross-level faults. To address this challenge, we propose an entropy-based causality learning framework, termed Eigen-Entropy Causal Learning (EECL), to learn BN structures. The proposed method is data-driven without the use of expert domain knowledge; it utilizes causal inference to determine the causal mechanisms between faults status and symptoms to construct the BN model. To demonstrate the effectiveness of the proposed framework, three fault test cases are used for evaluation in this study. Experimental results show that the BN constructed by the proposed framework is able to conduct building cross-level faults diagnosis with a comparable isolation accuracy to those by domain knowledge while maintaining less complexed BN structure.

Paper ID: 418

Paper Title: A Novel Early Warning Method of Deep Foundation Pit Collapse Risks Based on Temporal Knowledge Graph

Authors: Tianyu Xiang, Wenteng Fan, Yueyang Zhao, Yingbo Ji,
Assoc. Prof. Xinnan Liu

Abstract: Early warning of deep foundation pit collapse risks is critical for preventing accidents and reducing losses. Existing research predominantly emphasizes

deformation monitoring and prediction; however, comprehensive early warning for overall collapse risks remains insufficiently addressed. This paper introduces a temporal knowledge graph into deep foundation pit collapse risk warning and proposes a corresponding early warning method. First, a risk evaluation index system is constructed by selecting monitoring indicators, inspection indicators and inherent attributes, considering both accident probability and consequence severity. A risk evaluation model based on unascertained measure theory is established. Second, a temporal knowledge graph model is built with a historical information learning module and global information learning module, in which the MLP algorithm is used to learn time-series risk information for early warning. Finally, a real deep foundation pit project in Tai'an, Shandong Province is adopted to verify the proposed method. The results show that the warning results are highly consistent with the actual situation, and the warning accuracy reaches 80%. This study can provide a reference for early warning and comprehensive risk management of deep foundation pit collapse.

Paper ID: 354

Paper Title: Pixel-level Crack Segmentation and Quantification of Building Facades Using Deep Learning

Authors: Yanyao Li

Abstract: Construction industry is transitioning from large-scale development to the renovation and upgrading of aging buildings with the acceleration of urbanization. Affected by natural environmental erosion and material degradation, cracks frequently occur on building facades, which not only compromise aesthetic appearance but also pose safety risks such as detachment, water leakage, and structural deterioration. This paper proposes a deep learning-based method for pixel-level segmentation and quantitative analysis of facade cracks. First, a dataset of facade crack damage is constructed, and a multi-step preprocessing strategy is adopted to enhance image quality, providing a reliable foundation for model training. Then, focusing on the characteristics of facade cracks, targeted improvements are made to the U-Net model by introducing attention gates into skip connections, and designing a hybrid loss function combining Binary Cross-Entropy (BCE), Dice, and Focal losses. This improves the detection accuracy of fine cracks and suppresses interference from complex backgrounds such as tile textures, stains, and color variations. Furthermore, skeletonization is applied to the binary crack masks generated by the improved U-Net model to achieve precise extraction of crack length and width at the pixel level. A transformation model between image coordinates and real-world coordinates is then employed to obtain physical dimensions. Finally, a case study is conducted on the tiled facade of a university library. Experimental results demonstrate that the proposed improved U-Net model significantly outperforms the baseline U-Net, achieving a crack detection accuracy of 90.23%, an Intersection over Union (IoU) of 0.6987, and a comprehensive crack size recognition accuracy of 92.48%. The proposed method provides an efficient and reliable technical solution for pixel-level segmentation and

precise quantification of facade cracks. The high-precision crack size data obtained can serve as an important basis for safety assessment, maintenance, and renovation decision-making.

**Session MO06 (Track 17 Data-Driven Prediction and Optimization in
Emergency Management & Resource Allocation and Scheduling in Service
Systems & 13 Data Based Operations Management in Service Industry)**

Paper ID: 208

Paper Title: Prediction-Driven AI Deployment for UAV-Assisted Emergency Communication Service Systems

Authors: Ningyu Liao, Meixi Song, Prof. Wai Kin (Victor) Chan

Abstract: Natural disasters often damage ground communication infrastructure and severely degrade rescue efficiency.

Unmanned Aerial Vehicles (UAVs) can rapidly provide temporary wireless coverage for affected users. However, dynamic user mobility during evacuation makes UAV deployment decisions challenging. This paper proposes a prediction-driven UAV deployment framework PRED-PPO to improve service continuity and fairness in dynamic environments. The paper conducts extensive experiments and performs sensitivity analysis under different parameter settings. Results show that prediction-driven deployment significantly improves coverage performance.

Paper ID: 116

Paper Title: Outpatient Appointment Scheduling with Stochastic Re-entry and Patient Unpunctuality

Authors: Prof. Qiang Su, Yichen Wang, Zian Zhuang

Abstract: We study appointment scheduling in obstetric imaging clinics, where the scheduler sets arrival times for a sequence of patients. A key operational challenge in this setting is patient re-entry: because of unfavorable fetal position or poor image quality, some patients require an uncertain number of repeat scans before diagnostic criteria are met. Coupled with unpunctual arrivals and stochastic service times, this variability can induce long patient waits and clinic overtime. We formulate the problem as a two-stage stochastic optimization model under a P-Queue paradigm that explicitly captures these uncertainties and controls entropic risk to satisfy prescribed service-level targets. We show that the entropic risk of performance metrics, such as waiting time and overtime, is linear in the scheduling decisions. To mitigate numerically unstable and overly conservative solutions, we propose an adaptive risk calibration scheme that improves computational efficiency and solution robustness. Numerical experiments

demonstrate that, relative to current practice, our schedules substantially reduce patient waiting times without increasing clinic overtime. Further simulations suggest that optimal appointment intervals do not exhibit typical scheduling patterns. In particular, as re-entry probability varies, the optimal schedules change markedly and exhibit no stable structural form.

Paper ID: 229

Paper Title: V2G Pricing for Enhancing Service System Resilience under Constrained Real-Time Coordination

Authors: Yuanrui Li, Professor Junxiang Li, Ziyi Yang

Abstract: Real-time pricing (RTP) is widely used to coordinate supply and demand in active distribution systems. However, in practical electricity retail markets, nodal prices are restricted by contractual tariff bounds negotiated between suppliers and consumers. Under stressed operating conditions, the coordinating price required for restoring local balance may reach the contractual boundary while the supply–demand deviation remains outside the admissible tolerance. In such situations, price adjustment alone becomes insufficient for local coordination. This paper investigates the role of vehicle-to-grid (V2G) pricing in alleviating this limitation in campus microgrids. Electric vehicles (EVs) are modeled as the main flexible resource, while local supply, user demand, and social welfare are retained in compact form. Both V2G charging/discharging and inter-node migration are represented in an aggregate framework. Simulation results on the IEEE 33-bus campus microgrid show that EV participation significantly reduces the occurrence of boundary-limited coordination events. In particular, V2G provides temporal flexibility, while EV mobility further improves balancing capability through spatial redistribution.

Paper ID: 238

Paper Title: CVaR-Oriented Bayesian Network with Side Information for Medical Supply Chain Risk Assessment Under Disruption Propagation

Authors: Ming Liu, Xiangye Yao, Chengbin Chu, Feng Chu, Feifeng Zheng

Abstract: Medical supply chains face unique challenges including perishability, stringent regulatory requirements, and life-critical consequences of disruptions. Existing robust dynamic Bayesian network (RDBN) frameworks assess disruption propagation risk using interval probabilities, but the resulting intervals remain wide when direct disruption data are scarce, yielding coarse risk assessments. Meanwhile, abundant external signals—such as epidemiological surveillance, cold chain monitoring, and regulatory alerts—that correlate with disruption risk have not been incorporated into these frameworks. Furthermore, standard risk measures based on expected values may fail to capture the tail risks that are of primary concern in medical

supply chains. To address these gaps, this paper proposes a CVaR-oriented robust Bayesian network framework that integrates side information for medical supply chain risk assessment under disruption propagation. We develop a side information integration mechanism that maps external signals into narrowed probability intervals, reducing uncertainty without requiring additional direct disruption data. We formulate a Conditional Value-at-Risk (CVaR) robust risk evaluation model that identifies worst-case tail risk over the narrowed interval uncertainty set. The model is reformulated as a bilinear program solvable via standard nonlinear programming solvers. Computational experiments on a vaccine distribution network demonstrate that the combined framework reduces tail risk estimation error by 58.9% relative to a base line RDBN with expected-value assessment and achieves a tail risk detection rate of 0.87. The two components interact synergistically: side information narrows the intervals over which CVaR is optimized, while CVaR focuses the assessment on the tail of the narrowed distribution.

Paper ID: 182

Paper Title: A Branching Dueling Q-Network-Based Multi-Objective Hyper-Heuristic for Multi-Stage Outpatient Scheduling Problem

Authors: Zian Zhuang, Prof. Qiang Su, Yichen Wang

Abstract: This research investigates the Multi-Stage Outpatient Scheduling Problem (MSOSP), which is characterized by a hybrid clinical topology where stages follow a strict precedence, yet diagnostic procedures within each stage are order-independent. Traditional scheduling paradigms like Job Shop or Open Shop fail to capture this specific structure, leading to either overly rigid or computationally intractable results. To bridge this gap, the authors formulate the problem as a Multi-Objective Group Shop Scheduling Problem (GSSP), effectively mapping clinical stages to "groups" that enforce inter-stage precedence while allowing intra-stage flexibility. The mathematical model incorporates several realistic and complex constraints, such as report-generation delays after examinations, patient heterogeneity, and midday service interruptions caused by lunch breaks. The optimization process focuses on three conflicting objectives: minimizing the system make span, reducing total staff overtime, and limiting the maximum patient waiting time.

To address the NP-hardness and the combinatorial action explosion inherent in such a complex decision space, the study proposes a structure-aware hyper-heuristic driven by a Branching Dueling Q-Network (BDQHH). The methodology employs a hierarchical encoding scheme partitioned into three layers: patient sequencing, examination ordering, and temporal buffer management. The core architectural innovation is the decoupled branching design, which decomposes the global action space into independent branches corresponding to these encoding levels. This allows the reinforcement learning agent to learn layer-specific policies and select specialized operators—such as universal continuous operators or layer-specific structural

operators—without mutual interference. The agent's learning is guided by a sophisticated state representation and a reward mechanism that balances local solution improvements with global contributions to the Pareto archive.

Extensive numerical experiments, utilizing both synthetic data and real-world instances from a maternity hospital in Shanghai, demonstrate the superiority of the proposed framework. BDQHH significantly outperforms state-of-the-art metaheuristics and recent hyper-heuristics (such as NSGA-II, MOEA/D, and DN-AEHH) in terms of convergence, solution diversity, and reference point coverage. Ablation studies further confirm that the branching architecture is critical for navigating high-dimensional search spaces, as it effectively mitigates the "curse of dimensionality" that typically causes traditional monolithic reinforcement learning approaches to struggle. Ultimately, the research provides hospital administrators with a robust tool to achieve a more equitable trade-off between operational efficiency and patient satisfaction.

Session MO07 (Track 22 Intelligent Manufacturing and Logistics Operations Optimization)

Paper ID: 292

Paper Title: Vehicle Routing for Sustainable Urban Logistics under Urban Access Regulations

Authors: Sejeong Kang, Ilkyeong Moon

Abstract: The rapid growth of urban freight distribution increasingly conflicts with urban environmental policies such as Urban Vehicle Access Regulations (UVARs). These regulations create discontinuities in travel times, making conventional vehicle routing approaches computationally burdensome and operationally inflexible in dense urban environments. This study examines an extended Time-Dependent Capacitated Vehicle Routing Problem with Time Horizon and Access Restrictions and develops a routing framework that integrates exact optimization with Graph Neural Networks (GNNs). The proposed framework preserves optimality within a Branch-and-Price algorithm while using a GNN to accelerate the pricing process. Embedded within the exact solution procedure, the GNN uses dual information and dynamic topological constraints to dynamically screen out non-promising path segments and substantially reduce the effective state space without sacrificing exact optimality. Computational experiments on benchmark instances demonstrate that the approach improves solution efficiency while retaining exact optimality. A case study based on a German urban setting further illustrates its applicability in a real city logistics context. Overall, the results suggest that embedding a GNN within an exact optimization framework can support regulation-aware routing decisions, enabling logistics providers to maintain reliable service operations and regulatory compliance under increasingly stringent urban environmental constraints.

Paper ID: 273

Paper Title: Who Bears the Cost of Railway Network Resilience in a Warming World?

Authors: Haoyu Wang, Dongjunn Li, Jingxin Dong

Abstract: Rail freight plays a vital role in the UK economy, but climate change is placing increasing pressure on the rail network, highlighting the need to strengthen system resilience. However, improving resilience requires substantial investment, raising an important policy question: who should bear the cost? This study develops a three-tier Stackelberg game framework to investigate resilience investment pricing and cost-sharing mechanisms in rail freight systems under disruption risk and demand uncertainty. The proposed model captures sequential interactions among the infrastructure manager (Network Rail), the railway operator, and shippers. Network Rail determines resilience investment intensity and the cost-sharing ratio; the operator chooses freight charges and procured capacity; and shippers adjust booking quantities in response to price and reliability conditions. By incorporating stochastic capacity disruption and endogenous behavioral responses, the analysis reveals distinct risk-mitigation mechanisms: price adjustment reduces shortfall probability by compressing demand, whereas capacity expansion mitigates risk by enlarging effective capacity without reducing bookings. At the infrastructure level, the optimal cost-sharing rule follows a threshold structure determined by resilience investment scale and regulatory sensitivity, leading to regimes of no sharing, partial sharing, or full pass-through. Under sufficient concavity conditions, the game admits a unique subgame-perfect equilibrium. A calibrated numerical example based on UK rail freight parameters illustrates the theoretical findings. The results provide managerial and policy insights for designing incentive-compatible resilience pricing schemes that balance reliability enhancement, market demand, and regulatory constraints.

Paper ID: 128

Paper Title: Planning Human–Robot Collaborative Reconfigurable Manufacturing Systems under Workforce Absenteeism Uncertainty

Authors: Feifeng Zheng, Dr. Chenchao Zhu, Prof. Huaxin Qiu, Ming Liu

Abstract: Human-robot collaboration (HRC) is increasingly adopted in reconfigurable manufacturing systems (RMSs) to improve both flexibility and productivity in the era of Industry 5.0. However, manufacturing systems frequently experience workforce disruptions due to absenteeism caused by disasters, illnesses, and other unexpected events. At the same time, demand fluctuations and energy consumption uncertainty further complicate operational planning. Despite these challenges, most existing studies on HRC-enabled RMSs focus on scheduling problems and assume stable workforce availability. This study investigates integrated planning decisions for HRC-RMSs under uncertain workforce absenteeism. We consider the joint optimization of labor allocation, system configuration, and production planning in the presence of demand

and energy uncertainties. A stochastic optimization framework is developed to capture these uncertainties and support coordinated operational decisions. To address the resulting larger-scale problem, we develop efficient solution approaches based on column generation and learning-assisted optimization techniques. Numerical experiments demonstrate the effectiveness of the proposed methods and reveal how workforce absenteeism and human-robot collaboration influence configuration choices and production strategies. The results provide insights into designing more resilient and adaptive human–robot collaborative reconfigurable manufacturing systems.

Paper ID: 223

Paper Title: Digital Empowerment or Traditional Channel? A Tripartite Evolutionary Game Analysis of Export-to-Domestic Sales Transition under Tariff Shocks

Authors: Fuying Chen, Shanwu Luo, Tingting Tian

Abstract: Motivation and objectives: Amid rising tariff shocks and China’s national strategy for integrated domestic and foreign trade development, export-oriented manufacturers urgently need to shift to the domestic market (Wang et al., 2026). Meanwhile, digital e-commerce platforms are reshaping these enterprises’ behavior and government governance (Peng et al., 2025; Wang & Zhou, 2025). However, the complex strategic interactions among government, platforms, and manufacturers throughout this transition process remain underexplored. Therefore, understanding these dynamic mechanisms is critical for advancing the synergy between digitalization and trade resilience within the framework of smart service systems. Against this backdrop, this study addresses the following research question: How can export-to-domestic sales be achieved under tariff shocks through the coordinated efforts of government guidance and platform empowerment? Specifically, this paper aims to investigate the decision-making mechanisms of three key actors—government (G), e-commerce platforms (P), and export-oriented manufacturers (M)—during the export-to-domestic sales transition, and to identify the equilibrium conditions under which digital interventions and policy incentives can jointly realize the systematic optimization of transition outcomes.

Methodology: This study develops a tripartite evolutionary game model to explore the dynamic strategic interactions among G, P, and M, with each stakeholder assigned a binary strategy set: G chooses between Active Guidance (AG)—involving financial support and public service platforms—and Conventional Management (CM); P opts for either Deep Empowerment (DE), which provides data driven services and risk-sharing, or Traditional Channel (TC); and M selects between Active Transition (AT)—encompassing product adaptation and brand building—and Status Quo (BS). The key model parameters incorporate market scale effects, efficiency coefficients, cost variables, and benefit mechanisms. The model is analyzed using replicator dynamics to derive Evolutionary Stable Strategies (ESS), with equilibrium stability examined across parameter ranges. Numerical simulations are performed in MATLAB 2024b to validate

theoretical findings and visualize evolutionary trajectories under different scenarios of tariff shocks, subsidy levels and empowerment costs.

Key findings and implications: Preliminary results reveal that the export-to-domestic sales transition achieves systematic optimization only when all three actors adopt proactive strategies (Active Guidance, Deep Empowerment, Active Transition), as single-actor incentives prove insufficient to sustain equilibrium. Platforms play a pivotal role: deep empowerment significantly reduces manufacturers' transition costs and enhances success rates, positioning digital platforms as critical enablers. The government serves a catalytic function: active guidance not only provides direct subsidies but also improves the overall market environment and reduces platforms' information costs, generating positive spillover effects. Notably, threshold effects emerge: transition probabilities are sensitive to parameters such as the platform's revenue-sharing ratio and the manufacturer's profit margin under transition; below critical thresholds, actors tend to revert to conservative strategies. These findings carry dual implications. Theoretically, this study advances trade-digitalization research by elucidating key actors' decision mechanisms and establishing a foundational model for platform-enabled trade resilience under external shocks. Practically, the results inform differentiated policy design: governments should provide targeted subsidies to both manufacturers and platforms; platforms must transition from transaction channels to community-centered empowerment models, leveraging data assets for value co creation; and manufacturers should actively utilize platform services to offset transition costs and capture domestic market opportunities.

Paper ID: 219

Paper Title: Supply Chain Network Design with Hybrid Fixed and Mobile Factories: A Bi-Objective Location-Routing Optimization

Authors: Zixuan Li, Xu Huai, Qiang Du

Abstract: Industry 5.0 emphasizes the flexible and sustainable production systems. Fixed factories (FFs) can scale but may lack responsiveness to distributed and customized demand, while mobile factories (MFs) enable localized and adaptive production close to customers. Designing supply chain networks that effectively integrate these two types of facilities remains a strategic challenge, particularly when economic and environmental performance are considered. This study investigates a hybrid production system where FFs and MFs are integrated support manufacturing and delivery to customers. The joint decisions on facility opening, customer allocation, and delivery routes are formulated as a bi-objective location-routing problem (LRP). A Mixed-Integer Linear Programming (MILP) model is developed to simultaneously minimize total costs and carbon emissions. To efficiently solve this model, a hybrid Non-dominated Sorting Genetic Algorithm II (NSGA-II) and Adaptive Large Neighborhood Search (ALNS) algorithm, NSGAI-ALNS is developed. Computational experiments are conducted on instances of varying scales to examine how different

configurations of FFs and MFs affect the performance of supply chain networks. The results show that carbon emissions are more sensitive to early-stage network expansion, and indicate that the hybrid system can improve facility utilization and reduce costs, without increasing carbon emissions. The findings provide insights into the coordination of centralized and localized production resources in supply chains.

Session MO08 (Track 7 Data-driven Applications in Healthcare Operations Management)

Paper ID: 3

Paper Title: Revolutionizing Prime Time Efficiency: Data-Driven Robust Operating Room Planning and Scheduling with Uncertain Durations and Emergencies

Authors: Ze Cao, Xiaolei Xie, Mingda Liu

Abstract: General surgery departments suffer from workload imbalances across operating rooms (ORs) due to the uncertain nature of surgery duration and emergency walk-ins. We study a robust OR planning and scheduling problem and shed light on examining and conducting analytical investigations through the traditional proxy of prime time utilization—a metric that is widely recognized by healthcare practitioners in practice. We formulate a distributionally robust model

under a feature-driven cluster-wise Wasserstein ambiguity set to ensure prime time utilization and on-time completion. The model presents a novel risk measure, termed the clustered set reliability index (CSRI), for which three tailored approaches are constructed to derive the CSRI value, leveraging its structural properties. To solve the problem, we design an exact branch-price-and-cut algorithm and prove sufficient conditions for the CSRI dominance rule in column generation. These functions can be easily solved with terms accounting for empirical surgery distribution and turnover time, respectively. Extensive numerical experiments and a real case study are used to verify the effectiveness and efficiency of the proposed methods. The findings also offer valuable managerial insights in terms of variance consolidation effect, “dome-shaped” urgency admission policy, and hybrid emergency protocol for better decision-making.

Paper ID: 289

Paper Title: A Novel Hybrid Ordinal Learning Model with Health Care Application

Authors: Jing Li

Abstract: Ordinal learning (OL) is a type of machine learning models with broad utility in health care applications such as diagnosis of different grades of a disease (e.g., mild, modest, severe) and prediction of the speed of disease progression (e.g., very fast, fast, moderate, slow). This paper aims to tackle a situation when precisely labeled samples

are limited in the training set due to cost or availability constraints, whereas there could be an abundance of samples with imprecise labels. We focus on imprecise labels that are intervals, i.e., one can know that the sample belongs to an interval of labels but cannot know which unique label it has. This situation is quite common in health care datasets due to limitations of the diagnostic instrument, sparse clinical visits, or/and patient dropout.

Limited research has been done to develop OL models with imprecise/interval labels. We propose a new Hybrid Ordinal Learner (HOL) to integrate samples with both precise and interval labels to train a robust OL model. We also develop a tractable and efficient optimization algorithm to solve the HOL formulation. We compare HOL with several recently developed OL methods on four benchmarking datasets, which demonstrate the superior performance of HOL. Finally, we apply HOL to a real-world dataset for predicting the speed of progressing to Alzheimer's Disease (AD) for individuals with Mild Cognitive Impairment (MCI) based on a combination of multi-modality neuroimaging and demographic/clinical datasets. HOL achieves high accuracy in the prediction and outperforms existing methods. The capability of accurately predicting the speed of progression to AD for each individual with MCI has the potential for helping facilitate more individually-optimized interventional strategies.

Paper ID: 283

Paper Title: Empowering Attended Home Healthcare Service: A Robust Strategy to Pre-schedule On-Demand Newcomers

Authors: Mingda Liu, Chun Peng, Xiaolei Xie

Abstract: Problem definition: We address a high-fidelity attended home healthcare scheduling and routing problem with unpredictable newcomer arrivals. Key challenges lie in uncertain travel and service durations, the imperative of time-sensitive responses and proactive preparedness, and continuity constraints limiting route adjustments.

Methodology/results: We develop a novel adaptive optimization framework that integrates risk-aware uncertainty sets, enabling real-time adjustments to on-demand newcomers while preserving computational tractability. Our model explicitly balances route consistency for long-term patients with dynamic newcomer integration, achieving superior performance. The tailored branch-price-and-cut algorithm can solve real-world instances with up to 40 nodes to optimality.

Managerial implications: Computational experiments demonstrate that our framework resolves systemic inefficiencies in workforce utilization and service reliability endemic to conventional AHH policies, while keeping out-of-sample operating costs constant. We empirically identify the underperformance of baseline policies as stemming from their inability to accommodate on-demand newcomers, which necessitates a granular characterization of uncertainties and real-time adaptability with proactive scenario scheduling.

Paper ID: 284

Paper Title: Pooling vs. Dedication: Analytical Staffing for Multi-class Multi-Stage Emergency Department Queueing Networks

Authors: Mr. Xu Dai, Zhenghao Fan, Xiaolei Xie

Abstract: Emergency departments (EDs) seek staffing policies that sustain service quality under both stable and time-varying demand, recognizing that workload patterns and congestion timing can differ markedly between steady-state and nonstationary settings and therefore require adaptive capacity decisions. In addition, shared resources can improve utilization through risk pooling, whereas dedicated resources can generate productivity gains through learning-by-doing; because these forces may counteract each other, the optimal configuration is upon the underlying stochastic environment and workload characteristics. This study models the ED as multi-class multi-stage queueing networks under stationary Poisson and non-homogeneous Poisson Processes (NHPP) arrivals for analytics. We accordingly derive closed-form staffing and capacity-allocation rules, providing interpretable decision support for dynamic resource provisioning. With a unified performance-metrics framework, the analysis delineates domains of advantage for each service mode: pooling demonstrates superior performance in regimes of high demand volatility, load imbalance, or small system scale, whereas resource dedication excels when specialization-driven learning effects outweigh the benefits of standard pooling. The results support a contingent strategy that combines analytic dynamic allocation with an appropriate mix of pooled and dedicated resources, aligning staffing and service design with demand dynamics and learning potential to improve both efficiency and service quality.

Paper ID: 286

Paper Title: The Impact of Workload and Shift Patterns on AI Reliance in Medical Imaging: A Multi-Factor Statistical Analysis

Authors: Dr. Jia Li, Dr. Han Lv

Abstract: The integration of Artificial Intelligence (AI) in medical imaging has significantly improved diagnostic throughput.

However, the phenomenon of "algorithm reliance"- where radiologists over-depend on AI suggestions, potentially leading to automation bias and misdiagnosis - remains a critical concern. While previous studies have acknowledged this issue, the specific contextual and demographic drivers of AI reliance in real-world clinical settings are not fully understood. This study aims to investigate how varying workloads, shift patterns (day vs. night), and radiologist seniority influence the degree of AI reliance.

We conducted a retrospective observational study utilizing interaction logs and diagnostic reports from a tertiary hospital.

An objective "AI Reliance Score" was calculated for each diagnostic session by measuring the semantic convergence between the AI-generated suggestions and the radiologist's final report, combined with the behavioral adoption rate. The dataset included over 1,200 diagnostic cases handled by 45 radiologists of varying experience levels. We employed multi-level mixed-effects regression models to analyze the main and interactive effects of workload (measured by cases per hour), shift type, and seniority on the AI Reliance Score, while controlling for case complexity.

Our statistical analysis revealed significant population and temporal variations in AI reliance. First, shift patterns profoundly impacted reliance behaviors; radiologists exhibited a 28% higher mean AI Reliance Score during night shifts compared to day shifts ($p < 0.01$), likely due to fatigue and circadian rhythm disruptions. Second, workload demonstrated a strong positive correlation with AI reliance, but this effect was highly moderated by seniority. Junior radiologists (<5 years) showed a steep increase in reliance as workload increased ($\beta = 0.029$, $p < 0.05$), whereas senior radiologists maintained a relatively stable, lower level of reliance regardless of case volume ($\beta = 0.006$, n.s.). Furthermore, the combination of high workload and night shifts created a "vulnerability window" where junior radiologists' reliance scores peaked (mean=0.62), indicating a high risk of blind compliance to potentially erroneous AI suggestions.

These findings highlight that AI reliance is not a uniform behavioral trait but a dynamic state heavily influenced by clinical context and individual experience. The study underscores the necessity for healthcare operations management to move beyond static AI deployment. Instead, we propose the development of adaptive AI systems and targeted scheduling strategies that account for workload thresholds and shift-induced fatigue, thereby mitigating the risks of algorithm reliance and ensuring diagnostic safety.

Session MO09 (Track 23 Vision and Intelligent based Metrology)

Paper ID: 358

Paper Title: HC-TSNet: Dual-Branch Micro-Expression Recognition Network Based on Multi-Scale Feature Fusion and Temporal Sensitivity

Authors: Yecheng Han, Xianghu Yue, Wenhuan Lu, Minghao Guo, Jianguo Wei

Abstract: Micro-expressions (ME) are characterized by subtle and short-lived facial muscle movements, posing significant challenges for automatic recognition. Existing methods typically use hierarchical self-attention networks to model coarse-grained features through fine-grained features, addressing the issue of limited cross-scale interaction. However, these methods fail to fully consider the varying influence of fine-grained features from different regions on coarse-grained feature representations. While the extremely short duration of MEs and errors in key frame selection further complicate the recognition process, existing methods still struggle to capture subtle

temporal variations effectively. To address this, we propose HC-TSNet, a dual-branch architecture consisting of a hierarchical Conformer with an embedded Feature Transfer Module (FTM) and a Temporal-Sensitivity-Aware Transformer (TSAT) encoder. FTM injects fine-grained cues into coarse-grained features, enhancing cross-scale interaction while also focusing on the influence of different regions on the coarse-grained features. The TSAT encoder leverages a temporally sensitive self-attention mechanism to capture long-range dependencies and emphasizes key frames through attention, forming a more robust key frame emphasis mechanism. HC-TSNet effectively integrates complementary motion and geometry cues, mitigating the challenges of data scarcity in ME recognition. Experimental results show that HC-TSNet achieves strong performance compared with recent competitive models, reaching an unweighted F1-score of 88.04% on the composite dataset of CASME II, SMIC, and SAMM.

Paper ID: 348

Paper Title: Feature Disentanglement Model with Multi-level Alignments for Cross-Domain Hyperspectral Image Classification

Authors: Yunfei Xu, Minchao Ye, Prof. Weiqi Yan

Abstract: Cross-domain hyperspectral image classification (HSIC) algorithms utilize the information from the dataset with abundant samples (source domain, SD) to enhance the classification accuracy of the dataset with only a few samples (target domain, TD). This paper proposes a feature disentanglement model with multi-level alignment (FDMLA) for cross-domain HSIC. Three-level alignments are proposed: (1) Disentangler-level: A cross-domain mask mechanism (CDMM) is proposed to disentangle the domain-invariant features and domain-specific features. The domain-private mask vectors are set for each domain to capture discriminative information within the domain, while imposing a sparse consistency constraint on the cross-domain mask vectors to bind SD and TD. (2) Feature-level: A transfer and recombination adaptation strategy is proposed to align the feature space prior to disentanglement. (3) Prediction-level: To ensure domain invariance, knowledge distillation is introduced to guide TD classification using the shared information extracted from a cross-attention-based fusion module. Disentangler-level alignment provides the shared representations of disentangled features across domains for feature-level alignment. Feature-level alignment aligns original features while preserving the information that is beneficial for the classification task. It enables the disentangler to extract the domain-invariant features from original features more easily. Prediction-level alignment ensures the domain-invariance of discriminative information. FDMLA achieves overall accuracy of 94.90%, 89.08%, and 84.41% on the RPaviaU-DPaviaC, RPaviaC-DPaviaU, and Houston2018-Houston2013 datasets, respectively, significantly outperforming single-domain classification algorithms. This confirms the effectiveness of cross-domain classification algorithms in addressing the small-sample problem and demonstrates the superiority of the proposed method.

Paper ID: 254

Paper Title: Confidence Penalty-Based Multi-Model Collaborative Continual Learning Framework

Authors: Yuzhen Wu, Chen Pan

Abstract: Deep neural networks are prone to catastrophic forgetting during continual learning. To address the overconfidence issue in the prediction distributions of teacher models in knowledge distillation-based methods, this paper introduces a confidence penalty mechanism into a multi-model collaborative continual learning framework. By constraining the prediction confidence of non-target classes, the proposed approach suppresses the over-concentration of probability distributions and improves the stability of knowledge transfer. Furthermore, by integrating multi-model collaborative learning with the distillation mechanism, the method effectively facilitates the integration of new and previously acquired knowledge. To validate its effectiveness, experiments are conducted under both task-incremental and class-incremental learning scenarios on the Fashion-MNIST, CIFAR-10, and CIFAR-100 datasets. Experimental results demonstrate that the proposed method outperforms several representative continual learning approaches in terms of average accuracy and overall learning stability, effectively alleviating catastrophic forgetting.

Paper ID: 84

Paper Title: Precision Medical Image Generation Based on Large-Scale Diffusion Models

Authors: Wanli Huo, Jingyu Liu

Abstract: The scarcity of high-quality medical imaging data hinders the clinical application of artificial intelligence, particularly for rare diseases or novel imaging modalities. Traditional generative models exhibit poor adaptability with limited samples and lack stability due to insufficient image diversity. We propose a domain-adaptive generative framework to synthesize medical images under limited supervision. By integrating domain adaptation with generative foundational models, we achieve rapid transfer from natural images to medical images. A two-stage collaborative network based on diffusion models is introduced: Stage 1 trains a U-Net for image reconstruction, optimizing low-level visual fidelity to provide a foundational set of medical feature representations. Stage 2 employs a multimodal contrast model to semantically index medical imaging features, decoupling semantics into structural and textural features to focus on clinically relevant characteristics with minimal supervision. To address the introduction of unnatural features and distorted distribution estimates due to sampling randomness, the framework incorporates a quality-aware semantic closed-loop self-supervision mechanism. A quality discriminator implicitly defines high- and low-quality subspaces, while a vision-language alignment model generates real-time quality-conditional language priors to drive online prompt evolution. The

two-stage architecture synergizes with self-supervision to jointly optimize medical image fidelity and diversity. Experimental results across multiple medical image modalities demonstrate that this method significantly outperforms baseline models, achieving an average 13% improvement in downstream diagnostic task performance.

Paper ID: 258

Paper Title: Deep Learning-Based Code Identification and Authenticity Verification for Luxury Handbag

Authors: Zhigang Gao, Jian Li, Zesen Wang, Jianxiang Sun, Qichao Fei

Abstract: The current proliferation of counterfeit products in the luxury handbag market not only inflicts economic losses on consumers but also severely disrupts normal market order. Furthermore, manual authentication methods suffer from low efficiency, high subjectivity, and inconsistent standards. To address these issues, this paper proposes an integrated system for luxury handbag code pattern recognition and authenticity verification based on deep learning, enabling full-process automation from image preprocessing to the output of verification results. The overall system workflow is divided into four core stages: First, leveraging ResNet50 combined with a Spatial Attention mechanism, it performs the retrieval and classification of authentication point images, accurately filtering high-confidence images. Second, an image orientation classification model is constructed using ResNet101 to enable automatic detection and correction of $0^\circ/180^\circ$ orientations for code pattern images, ensuring standardized image input. Subsequently, the YOLOv8 segmentation model is utilized for precise localization of authentication points, integrating perspective transformation and orientation-adaptive techniques for geometric correction and cropping, thereby producing high-quality images of the authentication points. Finally, a network architecture based on ResNet101 integrated with the Spatial Attention with Dynamic Fusion (SADF) mechanism is employed for authenticity classification. Concurrently, YOLOv8-seg combined with perspective transformation is used for the detection, correction, and recognition of text regions within the code pattern. Experimental results demonstrate that the proposed system effectively enhances the accuracy of luxury handbag code pattern recognition and the efficiency of authenticity verification. It resolves issues prevalent in traditional manual authentication processes, such as extensive manual intervention, significant errors, and slow processing, offering an efficient computer vision solution for the standardization and intelligentization of luxury handbag authentication. The system exhibits high robustness and practicality in real-world industrial applications.

Session MO10 (Track 25 Data Quality Management & 14 Service Management in Healthcare)

Paper ID: 41

Paper Title: Digital Transformation of Traditional Chinese Medicine

Authors: Prof. Haiyan Yu, Xu Zhang, Zhenyu Shi, Tao Huang, Jinxiang Tang, Ling Qiao, Wei Wang, Qingcai He

Abstract: Traditional Chinese Medicine (TCM) formulations such as Huanglian Wendan Decoction (HLWDD) show multi-target therapeutic effects for conditions like palpitations, but their complex mechanisms and evidence-based strategies for herb substitution remain poorly understood. This study investigates HLWDD's anti-palpitation mechanisms and systematically assesses the feasibility of herbal substitution using an integrative approach that combines knowledge graphs (TCMKG), network pharmacology, and molecular docking. The multi-layered TCMKG integrated clinical guidelines, bioactive compounds, and disease-related targets. Network pharmacology identified 105 active compounds in HLWDD and 279 shared targets with palpitation-associated genes, highlighting core compounds—quercetin, kaempferol, and naringenin—and key protein targets—AKT1, TNF, and ALB. These compounds were found to modulate important signaling pathways, including the MAPK pathway and pathways linked to cancer. Molecular docking confirmed strong binding interactions between these compounds and their target proteins, especially with ALB. Substitution analysis, based on pharmacological proximity metrics, showed that Bupleurum and Radix Codonopsis are significantly better substitutes for Cyperus rotundus than other tested herbs. Specifically, Bupleurum achieved Pareto optimality with zero constraint deviation, while Radix Codonopsis showed the shortest network proximity distance (0.7313) and the most significant z-score (-27.7716), outperforming three alternative herbs. This integrative framework supports the modernization of TCM by linking mechanistic insights with data-driven methods for herb substitution, providing a practical blueprint for precision herbal medicine.

Paper ID: 275

Paper Title: A Reliable Pipeline for Kinematic Analysis and Multi-regional Quantification of Mouse Facial Features

Authors: Shiconghui Yuan, Siqi Duan, Yifeng Liang, Linghan Ouyang, Haiyan Yu

Abstract: Precise measurement of animal facial behavior serves as a critical window into the internal emotional states and cognitive processes within the nervous system. As a widely used model organism, mice exhibit specific facial dynamics—such as geometric deformations of the ears and rhythmic whisking—that have been shown to correlate closely with various emotional valences and arousal levels. Although existing

deep-learning tools enable automated tracking of facial landmarks, a major challenge remains in transforming large-scale raw coordinate sequences into quantitative indices with clear biological significance and establishing a robust, automated computational workflow. Here, we report a systematic computational pipeline for mouse facial features that integrates data preprocessing, multimodal feature quantification, and behavioral state assessment modules, achieving high-dimensional and precise analysis of ear, whisker, nose, and eye movements. By introducing an innovative four-point geometric ear modeling algorithm, we successfully overcome occlusions and deformation interference common in conventional pose estimation, enabling the robust extraction of the "geometric code" of emotional valence. Furthermore, this computational framework, incorporating Hilbert transforms and Principal Component Analysis (PCA), quantifies the coordination patterns across multiple orofacial regions for the first time. Validation against existing behavioral scoring systems demonstrates that our method offers significant advantages in emotional classification accuracy and inter-annotator consistency. This standardized computational scheme elevates facial behavior analysis from low-throughput manual scoring to high-throughput objective quantification, providing a reusable methodological toolkit for neuroscience that facilitates cross-laboratory collaborative research on affective disorders and neural circuit mechanisms.

Paper ID: 409

Paper Title: A Semi-Supervised Learning Approach to Predicting Pavement Conditions with Laser Crack Measure System (LCMS)

Authors: Dr. Lihui Bai, Xiaoyu Chen, Bijan Bibak

Abstract: We develop a machine learning (ML) algorithm for predicting pavement distress indices in a U.S. midwestern city's interstate parkway system. The input variables will be two distinct sets of 10-year worth of records of pavement road conditions. Visual evaluation survey records contain nine distress indices assessed by pavement engineers. Laser Crack Measurement System records consist of 13 0.1-mile LCMS measured features. Utilizing 400 samples of side-by-side 0.1-mile VES score versus manually obtained segment-length VES scores, we develop both supervised and semi-supervised learning models. Numerical results show that the semi-supervised prediction outperforms the supervised models. Future work includes an extension to predicting ordinal variables.

Paper ID: 313

Paper Title: Promote radiation dose management based on medical imaging cloud platforms

Authors: Yantao Niu

Abstract: With the popularization of radiological examinations and technological advancements, the total amount of medical radiation exposure received by the public has been continuously increasing. The justification of radiological practice and the optimization of radiation protection need to be further strengthened in clinical practice. The large-scale construction of medical imaging cloud platforms provides an unprecedented opportunity for the precise and intelligent management of radiation doses.

We need to focus on how to rely on medical imaging cloud platforms to achieve innovations in the radiation dose investigation, the establishment of dynamic diagnostic reference levels, the management of abnormal dose value, trend analysis, and risk assessment, and to look forward to the future of intelligent management centered on data governance, in order to promote the standardization of clinical operations and proactive intervention in health risks to examinees.

Brief Local Transportation Information

- From Shanghai Pudong International Airport to China Jiliang University

China Jiliang University is located in Hangzhou, so you first need to take the subway to Shanghai Hongqiao Railway Station, and then transfer to a high-speed train.

1. Take Subway Line 2: Depart from Pudong Airport Terminal 1 & 2 (North Entrance) towards Panxiang Road / National Accounting Institute. Get off at Hongqiao Railway Station, Exit B.

2. Transfer to High-Speed Train: After exiting the station, walk to the adjacent Shanghai Hongqiao Railway Station and purchase a high-speed train ticket to Hangzhou East Station.

3. Transfer to Hangzhou Metro Line 1: Upon arriving at Hangzhou East Station, transfer directly to Hangzhou Metro Line 1 (towards Xiaoshan International Airport). Ride for 9 stops to get off at Wenzhe Road Station. From there, you can take a taxi to reach China Jiliang University.

- From Shanghai Hongqiao Airport to China Jiliang University

China Jiliang University is located in Hangzhou, so you need to take the subway to Shanghai Hongqiao Railway Station first, and then transfer to a high-speed train.

1. Take Metro Line 10: Depart from Hongqiao Airport Terminal 2 towards Hongqiao Railway Station, and get off at Hongqiao Railway Station, Exit B.

2. Transfer to High-Speed Train: After exiting the station, walk to the adjacent Shanghai Hongqiao Railway Station and purchase a high-speed train ticket to Hangzhou East Station.

3. Transfer to Hangzhou Metro Line 1: Upon arriving at Hangzhou East Station, transfer directly to Hangzhou Metro Line 1 (towards Xiaoshan International Airport). Ride for 9 stops and get off at Wenzhe Road Station. From there, you can take a taxi to reach China Jiliang University.

- From Hangzhou Xiaoshan International Airport to China Jiliang University

Transfer to Hangzhou Metro Line 1: Upon arriving at Hangzhou Xiaoshan International Airport, transfer directly to Hangzhou Metro Line 1 (towards Xianghu). Ride for 8 stops and get off at Wenzhe Road Station. From there, you can take a taxi to reach China Jiliang University.

- From Hangzhou East Station to China Jiliang University

Transfer to Hangzhou Metro Line 1: Upon arriving at Hangzhou East Station, transfer directly to Hangzhou Metro Line 1 (towards Xiaoshan International Airport). Ride for 9 stops and get off at Wenzhe Road Station. From there, you can take a taxi to reach China Jiliang University.

- From Hangzhou West Station to China Jiliang University

1. Transfer to Hangzhou Metro Line 19: Upon arriving at Hangzhou West Station, take Hangzhou Metro Line 19 (towards Yongsheng Road). Ride for 8 stops and get off at West Lake Cultural Square Station.

2. Transfer to Hangzhou Metro Line 1: Transfer to Hangzhou Metro Line 1 (towards Xiaoshan International Airport). Ride for 12 stops and get off at Wenzhe Road Station. From there, you can take a taxi to reach China Jiliang University.

Hangzhou Attractions

- **West Lake (Xi Hu)**

West Lake is a freshwater lake in Hangzhou, China. It is divided into five sections by three causeways. There are numerous temples, pagodas, gardens, and artificial islands within the lake. West Lake has influenced poets and painters throughout Chinese history for its natural beauty and historic relics, and it has also been among the most important sources of inspiration for Chinese garden designers.



- **Xixi National Wetland Park**

Xixi National Wetland Park is the first national wetland park in China, combining urban life, farming, and culture. Located in the western part of Hangzhou, it preserves the traditional wetland ecological environment. Visitors can enjoy boat rides through the waterways, explore ancient villages, and experience the unique charm of Jiangnan water town culture.



- **Longjing Tea Village**

Longjing Tea Village is famous for producing Longjing (Dragon Well) tea, one of China's top ten famous teas. Located in the hills southwest of West Lake, the village offers visitors the opportunity to learn about tea culture, watch tea processing demonstrations, and taste authentic Longjing tea while enjoying the beautiful terraced tea fields.



- **Leifeng Pagoda**

Leifeng Pagoda is a five-story tall tower with eight sides, located on Sunset Hill south of West Lake. Originally built in 977 AD, it is famous for the Legend of the White Snake. The pagoda offers panoramic views of West Lake and the surrounding mountains. It is particularly beautiful at sunset, when the pagoda is bathed in golden light.



Need help during the conference?

Look for our ICSS 2026 staff and volunteers wearing the T-shirt color pictured below (Left: T-Shirt Front; Right: T-Shirt Back). Just approach anyone in this color if you have questions or need assistance!



Wishing you all a pleasant and memorable stay in Hangzhou!