# Conference Program

# 2025 the 3rd International Conference on Intelligent Control and Computing

## (IC&C 2025)

## April 25 to 27, 2025

## Changchun, China

**Sponsor**

Changchun University of Technology

**Co-organizers**

South China Agricultural University

Wuhan University of Technology

# Table of Contents

# Conference Committee

## International Advisory Committee

Yanbo Wang, Aalborg University, The Kingdom of Denmark
Wenbing Zhao, Cleveland State University, USA
Huosheng Hu, University of Essex, UK
João Calado, Polythecnic University of Lisbon, Portugal
Costantin Volosencu, Politehnica University of Timisoara, Romanian
Parames Chutima, Chulalongkorn University, Thailand
M-Tahar Kechadi, University College Dublin, Ireland
Valentina E. Balas, Aurel Vlaicu University of Arad, Romania
Tariq R. Soomro, Institute of Business Management (IoBM), Pakistan

## Conference Chairs

Mingyao Zhang, Changchun University of Technology, China
Jian Sun, Beijing Institute of Technology, China

## Conference Co-chairs

Yanjun Liu, Liaoning University of Technology, China
Dongsheng Yang, Northeastern University, China
Youqing Wang, Beijing University of Chemical Technology, China
Qinglai Wei, Institute of Automation, Chinese Academy of Sciences, China

## Local Organizing Chairs

Bo Dong, Changchun University of Technology, China
Chao Cheng, Changchun University of Technology, China
Shenquan Wang, Changchun University of Technology, China
Zhongbo Sun, Changchun University of Technology, China

## Program Chairs

Qinmin Yang, Zhejiang University, China
Huaicheng Yan, East China University of Science and Technology, China
Hongyi Li, Southwest University, China
Xiao He, Tsinghua University, China
Zhengguang Wu, Zhejiang University, China

## Program Co-Chairs

Dong Wang, Dalian University of Technology, China
Kai Ma, Yanshan University, China
Hongtian Chen, Shanghai Jiao Tong University, China
Gyu Myoung Lee, Liverpool John Moores University, UK
Yuanxin Li, Liaoning University of Technology, China
Hao Shen, Anhui University of Technology, China
Chao Shang, Tsinghua University, China

## Award Committee Chairs

Yanzheng Zhu, Shandong University of Science and Technology, China
Qiang Chen, Zhejiang University of Technology, China
Jun Hu, Harbin University of Science and Technology, China
Jiayue Sun, Northeastern University, China
Yunfeng Hu, Jilin University, China

## Special Session Chairs

Xiangpeng Xie, Nanjing University of Posts and Telecommunications, China
Biao Luo, Central South University, China
Yu Wang, Institute of Automation, Chinese Academy of Sciences, China
Ding Wang, Beijing University Of Technology, China
Keke Huang, Central South University, China
Yanning Guo, Harbin Institute of Technology, China
Hongjing Liang, University of Electronic Science and Technology of China, China
Tong Wang, Harbin Institute of Technology, China

## Publication Chairs

Bangcheng Zhang, Changchun Institute of Technology, China
Keping Liu, Jilin Engineering Normal University, China
Capella Wood, North China University of Technology, China

## Publicity Chairs

Qiang Liu, Northeastern University, China
Carlos M. Travieso-González, University of Las Palmas de Gran Canaria, Spain
Hongtian Chen, Shanghai Jiao Tong University, China
Hao Luo, Harbin Institute of Technology, China
Lickho Song, Korea Advanced Institute of Science and Technology, South Korea
Zhiwen Chen, Central South University, China
Lei Liu, Liaoning University of Technology, China

## Registration Chairs

Long Jin, Lanzhou University, China
Yingnan Pan, Bohai University, China
Bin Zhao, Changchun University of Technology, China
Liang Wu, Changchun University of Technology, China
Chok Tong Chueng, Wuhan University of Technology, China

## International Technical Committees

Jyothi Bobba, LEAD IT Corporation, USA
Sharadha Kodadi, Infosys, USA
Swapna Narla, Tek Yantra Inc, California, USA
Tirumala Rao Chimpiri, Stony Brook University, USA
Hongbo Zhou, The 54th Research Institute of CETC, China
Shaojie Li, Trine University, USA

Weibing Li, Sun Yat-Sen University, China
Javier Gozalvez, Universidad Miguel Hernandez de Elche (UMH), Spain
Jian Wang, Institute of Automation, Chinese Academy of Sciences, China
Mohd Aliff Afira Hj Sani, Universiti Kuala Lumpur, Malaysia
Fangfei Cao, Beijing Institute of Technology, China
Marcin Paprzycki, Systems Research Institute, Polish Academy of Sciences, Poland
Yiyang Chen, Soochow University, China
Parames Chutima, Chulalongkorn University, Thailand
Likui Wang, Tiangong University, China
Tariq R. Soomro, Institute of Business Management (IoBM), Pakistan
Enchang Cui, Liaoning University, China
Alaa Sheta, Southern Connecticut State University, USA
Chao Deng, Nanjing University of Posts and Telecommunications, China
Sathishkumar V E, Hanyang University, South Korea
Sanbo Ding, Hebei University of Technology, China
Esteban Vázquez-Cano, Universidad Nacional de Educación a Distancia (UNED), Spain
Yueyang Li, University of Jinan, China
Valentina E. Balas, Aurel Vlaicu University of Arad, Romania
Jilie Zhang, Southwest Jiaotong University, China
Francesco Zirilli, Sapienza Universita di Roma, Italy
Bo Zhao, Beijing Normal University, China
Prantosh K. Paul, Raiganj University, India
Tao Feng, Southwest Jiaotong University, China
Prabhat K. Mahanti, University of New Brunswick, Canada
Kaiyun He, Shandong University of Science and Technology, China
Jose Miguel Martínez Valle, Universidad de Córdoba, Spain
Junyi Wang, Northeastern University, China
Wudhichai Assawinchaichote, King Mongkut's University of Technology Thonburi, Thailand
Tiaoyang Cai, Hebei Normal University, China
Stefano Cirillo, Università degli Studi di Salerno, Italy
Zhenhua Wang, Harbin Institute of Technology, China
Petr Hajek, University of Pardubice, Czech Republic
Rui Yang, Xi’an Jiaotong-Liverpool University, China
Adrian Nicolae Branga, Lucian Blaga University of Sibiu, Romania
Weixin Han, Northwestern Polytechnical University, China
Jesuk Ko, Gwangju University, Korea
Yuchen Jiang, Harbin Institute of Technology, China
Pengda Liu, Chongqing Technology and Business University, China
Betim Cico, Epoka University, Tirana, Albania
Yang Liu, Qingdao University of Science and Technology, China
Basava Ramanjaneyulu Gudivaka, Raas Infotek, Delaware, USA
Dinesh Kumar Reddy Basani, CGI, British Columbia, Canada
Renjie Ma, Harbin Institute of Technology, China
Qihe Shan, Dalian Maritime University, China
Wei Sun, Liaocheng University, China
Hanwen Zhang, University of Science and Technology Beijing, China

Hongquan Ji, Shandong University of Science and Technology, China
Guanyu Hu, Guilin University of Electronic Technology, China
Xin Wang, Heilongjiang University, China
Quanyong Fan, Northwestern Polytechnical University, China
Liang Cao, Bohai University, China
Guangtao Ran, Harbin Institute of Technology, China
Jian Han, Ludong University, China

### Local Technical Committees

Yulian Jiang, Changchun University of Technology, China
Bing Ma, Changchun University of Technology, China
Tianjiao An, Changchun University of Technology, China
Yuhang Zhang, Changchun University of Technology, China
Yuenan Wang, Changchun University of Technology, China
Shuyang Liu, Changchun University of Technology, China
Shuaishi Liu, Changchun University of Technology, China
Yan Li, Changchun University of Technology, China
Bin Zhao, Changchun University of Technology, China
Hongtao Yang, Changchun University of Technology, China
Xiaolin Ren, Changchun University of Technology, China
Haitao Ma, Changchun University of Technology, China
Hui Li, Changchun University of Technology, China
Hong Jiang, Changchun University of Technology, China
Shinan Song, Changchun University of Technology, China
Dongxuan Xie, Changchun University of Technology, China
Hualiang Li, Changchun University of Technology, China
Xiumei Zhang, Changchun University of Technology, China
Fengye Hu, Jilin University, China
Han Wang, Northeast Normal University, China
Xin Zhang, Changchun University of Science and Technology, China
Changji Wen, Jilin Agricultural University, China
Jian Zhao, Changchun University, China
Miaolei Zhou, Jilin University, China
Qingyu Su, Northeast Electric Power University, China
Zhenhao Tang, Northeast Electric Power University, China
Yang Yang, Changchun University of Science and Technology, China

# Welcome Message

On behalf of the Organizing Committee, it is our great pleasure to welcome you to the 3rd International Conference on Intelligent Control and Computing (IC&C 2025), held in Changchun, China, from April 25 to 27, 2025. IC&C 2025 is sponsored by Changchun University of Technology, co-hosted by the School of Electrical and Electronic Engineering and the Office of International Exchange and Cooperation of Changchun University of Technology, and co-organized by South China Agricultural University and Wuhan University of Technology.

This conference brings together leading researchers, engineers, and practitioners from around the world to share cutting-edge advancements, innovative ideas, and collaborative opportunities in the fields of intelligent control, computing technologies, and their interdisciplinary applications. With a dynamic program featuring keynote speeches, invited speeches, technical sessions, and interactive discussions, IC&C 2025 aims to foster knowledge exchange and inspire future breakthroughs.

We extend our sincere gratitude to all participants, speakers, and sponsors for your invaluable contributions. Whether you are joining us in person or virtually, we hope you will enjoy the stimulating discussions, build meaningful connections, and explore the vibrant city of Changchun.

Wishing you a productive and memorable experience at IC&C 2025!

Warm regards,
IC&C 2025
Conference Chairs

# Useful Information

## Conference Venue


### HOLIDAY INN CHANGCHUN JINGYUE
长春净月假日酒店

➢ **Add:** No. 3070 Jingyue Road, Nan Guan District Changchun, 130000 Mainland China
(南关区净月大街 3070 号，长春，中国)
Website:
https://www.ihg.com/holidayinn/hotels/us/en/changchun/cgqcj/hoteldetail

## Time Zone:
➢ **UTC/GMT+8**

## April Climate & Weather Averages in Changchun:
➢ **High Temp: 17°C** ➢ **Low Temp: 1°C**

## Bank and Foreign Exchange:
➢ **The Currency is RMB here**

## Emergency Number in China:
➢ **110**

## Important Notes
- ✧ Please take care of your belongings during the conference. The conference organizer does not assume any responsibility for the loss of personal belongings of the participants.
- ✧ Please wear delegate badge during the conference. There will be NO access for people without a badge. Never discard your badge at will.
- ✧ Accommodation is not provided. Early reservation is suggested to be made for delegates.
- ✧ Please show the badge and meal coupons during lunch and dinner.
- ✧ Don't stay too late in the city and don't be alone in the remote area. Be aware of the strangers who offer you service, signature of charity, etc., at scenic spots. More Tourist Information and Security tips are available online.

## Virtual Meeting Software

**ZOOM Download:** https://zoom.us/

ZOOM Using Instruction and silde template: www.icicc.org/kits.rar

✧ ZOOM online conference room will be open 30 mins before scheduled time.

✧ It's suggested to use headset with microphone or earphone with microphone.

✧ Please choose right room to join in while test and presentation session.

✧ Prepare the PPT file of your presentation on your laptop in advance.

✧ Duration of Oral Presentation: 15 Minutes in total including 12 Minutes Presentation and 3 Minutes Q&A.

✧ Duration of Poster Presentation: 7 Minutes in total including 5 Minutes Presentation and 2 Minutes Q&A.

✧ The regular oral presentation time arrangement is for reference only. In case any absence or some presentations are less than 15 minutes, please enter the room before session starts.

**Please rename your screen name before entering the room**

| Rename screen name before entering the room | Examples |
|---|---|
| Author: Paper ID-Name | CC001-John Smith |
| Delegate: Delegate-Name | Delegate-John Smith |
| Keynote Speaker: Keynote-Name | Keynote-John Smith |
| Committee Member: Committee-Name | Committee-John Smith |

# Keynote Speeches

Speech 1

**April 26, 2025, Saturday, 9:00-9:30, GMT+8**
**Onsite Room：多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

## Prof. Junzhi Yu

IEEE Fellow

**Peking University, China**

**Speech Title: Modeling and Control for Collective Intelligence in Underwater Biomimetic Robotic Fish**

**Abstract**: Many organisms in nature show the group attributes of orderly organization, evident division of labor, and mutual cooperation, demonstrating the outstanding collective intelligence, which provides a lot of inspiration for the research of unmanned system clusters. This report focuses on the group modeling and control of unmanned systems based on underwater biomimetic robotic fish. According to the progressive relationship from "learning fish school" to "imitating fish school" to "integrating into fish school", the representative results of the team in recent years in the direction of imitating fish school intelligence will be shared, involving fish school behavior modeling, cooperative formation control, robotic fish inducting biological fish, and so on. At the end of the report, the development prospect of underwater collective intelligence will be prospected, and the corresponding research plan will be introduced.

**Bio**: Junzhi Yu (Fellow, IEEE) received the BE degree in safety engineering and the ME degree in precision instruments and mechanology from the North University of China, Taiyuan, China, in 1998 and 2001, respectively, and the PhD degree in control theory and control engineering from the Institute of Automation, Chinese Academy of Sciences, Beijing, China, in 2003. From 2004 to 2006, he was a postdoctoral research fellow with the Center for Systems and Control, Peking University, Beijing. In 2006, he was an associate professor with the Institute of Automation, Chinese Academy of Sciences, where he became a full professor in 2012. In 2018, he joined the College of Engineering, Peking University, as a tenured full professor. His research interests include intelligent robots, motion control, and intelligent mechatronic systems.

Speech 2

**April 26, 2025, Saturday, 9:30-10:00, GMT+8**
**Onsite Room：多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

# Prof. Yonggang Zhang

Chief Scientist of the National Key Research and Development Program
Director of Heilongjiang Engineering Laboratory of Navigation Instruments Deputy
Director of Navigation Instrument Engineering Center of the Ministry of Education
Excutive Dean of the College of Future Technology

**Harbin Engineering University, China**

**Speech Title: Intelligent Navigation for Unmanned Systems**

**Abstract**: With the increasingly complex application scenarios of unmanned systems, navigation tasks are facing new challenges such as dynamic environments, complex interference, and no satellite navigation signals. The technical framework in the navigation field is gradually evolving towards multi-source and intelligence. This report introduces how intelligent navigation technology can adapt to the environment, perceive the environment, and integrate swarm intelligence in three application scenarios: underwater autonomous navigation, road network assisted navigation, and cluster relative navigation, in order to improve the performance of autonomous navigation for unmanned systems in complex environments.

**Bio**: Yonggang Zhang is a Professor of College of Intelligent Systems Science and Engineering, and the Excutive Dean of the College of Future Technology, Harbin Engineering University. He is also the Director of Heilongjiang Engineering Laboratory of Navigation Instruments, deputy Director of Navigation Instrument Engineering Center of the Ministry of Education, and Member of Chinese Society of Inertial Technology. He is the Chief Scientist of the National Key Research and Development Program. His main research areas include navigation technology and information fusion. He has published more than 170 academic papers. He was the recipient of several awards including IEEE Barry Carlton Award, national talent award and Young Scientist Award of the Chinese Society of Automation.

Speech 3

**April 27, 2025, Sunday, 9:00-9:30, GMT+8**
**Onsite Room：多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

# Prof. Lixian Zhang

IEEE Fellow

**Harbin Institute of Technology, China**

**Speech Title: In-Cabin Robots for Space Stations: Research Status and Key Technologies**

**Abstract**: The in-cabin robots for space stations, including humanoid robots, crawling robots, and flying robots, are regarded as pivotal tools for advancing space station automation. Since 1998, world-leading space agencies, such as NASA and RKA, have spearheaded the development of in-cabin robots for space stations, with multiple prototypes having successfully undergone on-orbit experimental verification aboard the International Space Station. Compared to Earth-based robots, in-cabin robots working in space stations face technical challenges in terms of highly-integrated configuration design, micro-gravity motion control, and safety-critic human-robot interaction, leading to the emergence of divergent configuration schemes and technical solutions worldwide. This report will provide a systematic analysis of in-cabin robots for space stations, covering their research milestones and key technologies, and projecting their future development in in-cabin environmental monitoring, astronaut-robot collaboration, and on-orbit swarm operations.

**Bio**: Lixian Zhang received the Ph.D. degree in control science and engineering from the Harbin Institute of Technology (HIT), Harbin, China, in 2006. From January 2007 to September 2008, he was a Postdoctoral Fellow in the Department Mechanical Engineering at the Ecole Polytechnique de Montreal, Canada. He was a Visiting Professor at the Process Systems Engineering Laboratory, Massachusetts Institute of Technology (MIT), Cambridge, MA, USA, from February 2012 to March 2013. Since January 2009, he has been with the Harbin Institute of Technology, where he is currently a Full Professor and the Vice Dean of the Institute for Artificial Intelligence of HIT. Prof. Zhang currently serves as Senior Editor for IEEE Control Systems Letters, and previously served as Associate Editor for IEEE Transactions on Automatic Control and IEEE Transactions on Cybernetics. He is a winner of the National Science Fund for Distinguished Young Scholars, and has been honored with the Qian Xuesen Outstanding Contribution Award. He has been listed as a Clarivate Analytics Highly Cited Researcher from 2014 to 2023. He is a Fellow of IEEE and IET.

Speech 4

**April 27, 2025, Sunday, 9:30-10:00, GMT+8**
**Onsite Room：多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

# Prof. Youqing Wang

IET Fellow, The Dean of College of Information Science and Technology

**Beijing University of Chemical Technology, China**

**Speech Title: Theoretical Methods and Industrial Applications of Clustering Analysis**

**Abstract**: Clustering analysis is a representative unsupervised method in machine learning, which attracts widespread attention in many practical fields due to its independence from artificial label information. However, unsupervised setting and increasingly complex data (such as graph data, large-scale multi-view data, etc.) bring significant challenge to the effectiveness of clustering. This presentation would focus on introducing self-supervised information enhanced graph contrastive clustering and large-scale fast multi-view subspace clustering methods, exploring how to mine and utilize data correlations to enhance the clustering process. We further explore the remaining issues and potential industrial applications of clustering analysis.

**Bio**: Youqing Wang received the B.S. degree in Mathematics from Shandong University, Jinan, Shandong, China, in 2003, and PhD degree in Control Science and Engineering from Tsinghua University, Beijing, China, in 2008. He worked chronologically at Hong Kong University of Science and Technology, Hong Kong, China; University of California, Santa Barbara, USA; University of Alberta, Edmonton, Canada; Shandong University of Science and Technology, Qingdao, China; City University of Hong Kong, Hong Kong, China. He is currently a professor and the dean of College of Information Science and Technology, Beijing University of Chemical Technology, Beijing, China. His research interests include fault-tolerant control, state monitoring, iterative learning control, and their applications on chemical processes. Dr. Wang was a recipient of several research awards, including the NSFC Distinguished Young Scientists Fund, IET Fellow, the Journal of Process Control Survey Paper Prize, and ADCHEM2015 Young Author Prize. Dr. Wang is (was) the editorial member for nine SCI journals and he is also the member of three technical committees of International Federation of Automatic Control (IFAC).

Speech 5

**April 27, 2025, Sunday, 10:20-10:50, GMT+8**
**Onsite Room: 多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

# Prof. Qinglai Wei

IEEE Senior Member

**Chinese Academy of Sciences, China**

**Speech Title: Self-learning Optimal Control and Reasoning System**

**Abstract**: This talk mainly introduces the basic principle and research progress of self-learning control method for nonlinear systems based on adaptive dynamic programming (ADP). Adaptive dynamic programming was first proposed by American scholar P. J. werbos. Based on the optimality principle and the advanced method of integrating artificial intelligence, it is a method to solve the intelligent optimal control problem of large-scale complex nonlinear systems. Adaptive dynamic programming is based on the principle of enhanced learning, uses the nonlinear function fitting method to approximate the performance index of dynamic programming, simulates the idea of human learning through environmental feedback, and effectively solves the problem of "dimension disaster" of dynamic programming. In recent years, it is considered to be a learning control method very close to human brain intelligence. In this talk, a self-learning optimal parallel control by ADP method is proposed, the criteria of the self-learning control are presented. Finally, an introduction of the Reasoning System is developed.

**Bio**: Qinglai Wei received the B.S. degree in Automation, and the Ph.D. degree in control theory and control engineering, from the Northeastern University, Shenyang, China, in 2002 and 2009, respectively. From 2009--2011, he was a postdoctoral fellow with The State Key Laboratory of Management and Control for Complex Systems, Institute of Automation, Chinese Academy of Sciences, Beijing, China. He is currently a professor of the institute and the associate director of the State Key Laboratory. He has authored four books, and published over 80 international journal papers. He was a recipient of the Outstanding Paper Award of IEEE Transactions on Neural Network and Learning Systems and IEEE System, Man, and Cybernetics Society, Andrew P. Sage Best Transactions Paper Award. He was Associate Editors of 6 IEEE Transaction journals. His research interests include parallel control, adaptive dynamic programming, computational intelligence, neural-networks-based control, optimal control, nonlinear systems and their industrial applications.

# Invited Speeches

Speech 1

**April 26, 2025, Saturday, 10:20-10:50, GMT+8**
**Onsite Room：多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

## Assoc. Prof. Mingming Zhang

IEEE Senior Member

**Southern University of Science and Technology, China**

**Speech Title: Task-oriented brain-robot interaction technology for medical rehabilitation**

**Abstract**: Rehabilitation robotics has emerged as a global research priority, addressing the needs of one-third of the world's population requiring rehabilitation services. While these technologies partially mitigate therapist shortages, their evidence-based clinical benefits remain limited, as noted in Science Robotics (2021). Current systems face three key challenges: (1) restricted task simulation to kinematic forms, (2) difficulty balancing large workspace with high-precision tactile feedback, and (3) insufficient personalized, task-matched interaction. This talk presents advancements in upper-limb daily task and lower-limb walking rehabilitation robots, along with novel neural feedback approaches, to bridge these critical gaps and enhance clinical effectiveness.

**Bio**: Dr. Mingming Zhang is a tenured Associate Professor and PhD supervisor in the Department of Biomedical Engineering at the Southern University of Science and Technology. He has been recognized as a National High-Level Young Talent, Young Scientist of the National Key R&D Program, and recipient of the Guangdong Outstanding Young Scholars Fund. Currently serving as Director of the Brain-Robot Rehabilitation Technology Laboratory, Dr. Zhang specializes in innovative theories and key technologies in rehabilitation robotics and brain-computer interaction. His developed systems - including the task-oriented cane-assisted exoskeleton system, task-oriented tactile feedback system, and task-oriented intention decoding system - have been successfully implemented in rehabilitation training for hundreds of patients. His research findings have been published in over 100 papers appearing in prestigious international journals and conferences including Nature Communications, IEEE Transactions series (TFS, TII, TIE, T-Mech, TASE, TIM, TNSRE, etc.). Dr. Zhang has received several honors including the Science and Technology Award from the Chinese Association of Rehabilitation Medicine, Natural Science Award from the AI & Automation Association of Guangdong-Hong Kong-Macao Greater Bay Area, and Robotics Science and Technology Award of Guangdong Province. He currently serves as Associate Editor for multiple high-impact journals including IEEE TASE, IEEE TNSRE, IEEE RAL, and IEEE TMRB.

Speech 2

**April 26, 2025, Saturday, 10:50-11:20, GMT+8**
**Onsite Room：多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

# Assoc. Prof. Hongtian Chen

**Shanghai Jiao Tong University, China**

**Speech Title: Explainable Fault Diagnosis: A Bridge Between Unsupervised and Supervised Learning-based Fault Diagnosis Approaches**

**Abstract**: The increased complexity and intelligence of automation systems require the development of intelligent fault diagnosis (IFD) methodologies. By relying on the concept of a suspected space, this study develops explainable data-driven IFD approaches for nonlinear dynamic systems. More in detail, we parameterize nonlinear systems through a generalized kernel representation used for system modeling and the associated fault diagnosis. An important result obtained is a unified form of kernel representations, applicable to both unsupervised and supervised learning. More importantly, through a rigorous theoretical analysis we discover the existence of a bridge (i.e., a bijective mapping) between some supervised and unsupervised learning-based entities. Notably, the designed IFD approaches achieve the same performance by the use of this bridge. In order to have a better understanding of the results obtained, unsupervised and supervised neural networks are chosen as the learning tools to identify generalized kernel representations and design the IFD schemes; an invertible neural network is then employed to build the bridge between them. This report is a perspective talk, whose contribution lies in proposing and detailing the fundamental concepts for explainable intelligent learning methods, contributing to system modeling and data-driven IFD designs for nonlinear dynamic systems.

**Bio**: Hongtian Chen received his Ph.D. degree in College of Automation Engineering from Nanjing University of Aeronautics and Astronautics, China, in 2019. He was a Post-Doctoral Fellow at the University of Alberta, Canada, from 2019 to 2023. Dr. Chen joined Shanghai Jiao Tong University, China in 2023 as an Associate Professor in the Department of Automation. His research interests include fault diagnosis and fault-tolerant control, data mining and analytics, machine learning, and cooperative control; and their applications in high-speed trains, new energy systems, industrial processes, and autonomous systems. Dr. Chen was a recipient of the Grand Prize of Innovation Award of Ministry of Industry and Information Technology of the People's Republic of China in 2019, the Excellent Ph.D. Thesis Award of Jiangsu Province in 2020, the Excellent Doctoral Dissertation Award from Chinese Association of Automation (CAA) in 2020, and Marie Skłodowska-Curie Actions in 2023.

Speech 3

**April 26, 2025, Saturday, 11:20-11:50, GMT+8**
**Onsite Room: 多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

# Prof. Hongjing Liang

Highly Cited Researchers in Clarivate Analytics

**University of Electronic Science and Technology of China, China**

**Speech Title: Prescribed Performance Cooperative Control Research of Heterogeneous Autonomous Unmanned Systems**

**Abstract**: In recent years, the cooperative control theory of autonomous unmanned systems has been widely applied. For example, through the cooperative operation of heterogeneous autonomous unmanned systems, functions such as information sharing, task allocation, and collaborative strikes can be achieved, thereby improving operational efficiency and capabilities. The various limitations faced by autonomous unmanned systems during task execution, such as communication bandwidth, computing power, energy supply, etc., may affect the performance and cooperative capabilities. Therefore, it is necessary to study how to achieve the prescribed performance cooperative control problem of autonomous unmanned systems. To achieve cooperative control of autonomous unmanned systems with prescribed performance in different scenarios, the consensus tracking control problem of multi-UAV systems under prescribed performance and attitude constraints, and the distributed adaptive cooperative control problem of heterogeneous UAV-UGV systems under prescribed performance are considered. Two types of prescribed performance control strategies operating in different situations are proposed, effectively improving the steady-state and transient performance of systems.

**Bio**: Hongjing Liang, professor of University of Electronic Science and Technology of China, Doctoral supervisor, Highly Cited Researchers in Clarivate Analytics, NSFC-Excellent Young Scholars, "Tianfu Emei Plan" Young Scientific and Technological Talents Project and Sichuan Natural Science Foundation Outstanding Youth Science Foundation. He has been awarded the title of provincial excellent master's thesis advisor for three consecutive years. At present, his main research direction are intelligent adaptive control of multiagent systems, collective intelligence, etc. He has presided 3 national projects such as National Natural Science Foundation of China projects, and participated in 2 National Natural Science Foundation of China projects. He has published a monograph in English. He is a member of the editorial board of international SCI journals IEEE SMCM, IEEE SMCS, FNL and IJFS. He has published (including accepted papers) more than 100 academic papers in authoritative journals, and the relevant achievements have been cited and positively evaluated by many experts and scholars at home and abroad. One paper was selected for the China's 100 Most Influential International Academic Papers, one paper was selected for the Best Paper Award of Acta Automatica Sinica, and one conference paper was selected for the Best Paper Award in Theory of ICCSS 2017. He was awarded the IEEE SMC Beijing Capital Region Chapte Young Author Prize in 2020.

Speech 4

**April 26, 2025, Saturday, 13:30-14:00, GMT+8**
**Onsite Room: 多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

# Prof. Xiangpeng Xie

Vice Dean of the School of IoT

**Nanjing University of Posts and Telecommunications, China**

**Speech Title: Industrial Cyber-Physical Systems Driven by Explainable Artificial Intelligence**

**Abstract**: In the context of green industrial development, information depth perception, intelligent optimization decision-making, precise control, and self-learning are crucial for improving the control level of industrial cyber physical systems. The purpose of this report is to explore the following research topics: data-driven models and evolutionary representations of industrial cyber physical systems for dynamic interaction of all factors of production, innovative data and expert knowledge extraction and integration paradigms, and the construction of a variable topology self-organizing hierarchical hybrid fuzzy modeling framework; Construct an elastic memory event triggered communication mechanism based on the coupling mechanism between "communication mechanism control performance network resilience" of industrial cyber physical systems based on TSN technology; Aiming at the problem of online extraction of spatiotemporal characteristics, fatigue detection technology based on self-organizing interval type-2 fuzzy system and transferable class statistics and multi-scale feature fuzzy approximation technology are proposed. Then, a variable weight switching mechanism that can quantitatively describe the evolution trend of energy function at multiple sampling moments is designed to achieve interactive enhancement functions such as flexible switching fuzzy control. Finally, a brief introduction is given to the preliminary applications of the research results in fields such as intelligent manufacturing and intelligent transportation.

**Bio**: Prof. Xie has been selected for the National Excellent Young Scientists Fund, and ESI Highly Cited Researcher (Interdisciplinary Field). Awards include the Youth Science and Technology Award from the Chinese Association of Automation, the First Prize in Natural Science (2/5) from the Chinese Association of Automation, the Second Prize in Shanghai Natural Science (3/4), the First Prize in Natural Science (2/4) from China Simulation Federation, and the Most Influential International Academic Paper in China (1/4). The researcher serves as an editorial board member for IEEE TII, TFS, and TCYB journals.

Speech 5

**April 26, 2025, Saturday, 14:00-14:30, GMT+8**
**Onsite Room：多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

# Prof. Keke Huang

Recipient of National High-Level Talent Special Support Programs

**Central South University, China**

**Speech Title: Intelligent Autonomous Monitoring Method for Dynamic Industrial Processes Based on Continual Learning**

**Abstract**: Process monitoring is the basis for promoting the intelligent and autonomous operation of industrial processes. However, static learning paradigms based on closed-world assumptions are often difficult to adapt to dynamic industrial processes in open environments. To this end, this report focuses on the dynamic and open characteristics of industrial processes, analyzing the key challenges faced by process monitoring methods in open-set monitoring tasks. Subsequently, the report presents several representative dynamic industrial process monitoring methods based on continual learning. By employing strategies such as trustworthy generation of new condition data and stable memory retention of old condition, these methods enhance the plasticity and stability of monitoring models, thereby ensuring long-term intelligent and autonomous monitoring of dynamic processes. Finally, by exemplifying typical industrial processes, this report demonstrates how it supports and energizes intelligent and autonomous monitoring in dynamic industrial environments.

**Bio**: Keke Huang is a professor and doctoral supervisor at Central South University, serving as the Associate Dean of the School of Automation. He is a recipient of National High-Level Talent Special Support Programs (10,000 Talents Program) for Young Talents, a core member of the national “Huang Dania-style” teaching team and a Distinguished Young Scholar of Hunan Province. He is listed among the top 2% of scientists globally for his long-term research on modeling, optimization decision-making, and coordinated control in the process industry in 2023 and 2024. He has published over 80 high-quality research papers in IEEE Transactions or IFAC journals (including 8 ESI hot papers/highly cited papers), and has been granted over 30 national invention patents. He has led 14 research projects, including key research and development programs of the Ministry of Science and Technology, industrial internet innovation engineering projects of the Ministry of Industry and Information Technology, and general projects of the National Natural Science Foundation of China. He has received the Second Prize of National Science and Technology Progress Award in 2023, the First Prize of Hunan Province Science and Technology Progress Award in 2024, the Excellent Young Scientist Award of the Non-Ferrous Metals Society of China, the First Prize of Science and Technology of the Non-Ferrous Metals Industry of China, and the First Prize of Natural Science of the Chinese Association of Automation. Additionally, he serves as the Deputy Secretary-General of the Automation Branch of the Non-Ferrous Metals Society of China, a committee member of the Process Control Committee and the Fault Diagnosis and Safety Committee of the Chinese Association of Automation.

Speech 6

**April 26, 2025, Saturday, 14:30-15:00, GMT+8**
**Onsite Room：多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

# Prof. Yanzheng Zhu

Vice Dean of the College of Electrical Engineering and Automation

**Shandong University of Science and Technology, China**

**Speech Title: Research Advances on Bumpless Transfer Control of Switched Systems**

**Abstract**: Switched systems usually require the design of mode-dependent controllers to ensure excellent control performance. However, when the controller accompanies the switching of subsystems, the control input chattering occurs. Severe chattering of control signals may lead to system instability, time delay, mechanical damage, and other problems. Focusing on the issue of control input chattering, this report mainly provides the recent progress in the research on bumpless transfer control of switched systems, including transition-dependent bumpless transfer control methods, bumpless transfer fault-tolerant control methods based on fault reconfiguration, and bumpless transfer control methods for switched affine systems, etc. Finally, some application cases are illustrated to verify the effectiveness of the proposed methods.

**Bio**: Yanzheng Zhu received the Ph.D. degree in control science and engineering from the Harbin Institute of Technology, Harbin, China, in January 2016. From 2013 to 2015, he was a joint Ph.D. student with the Department of Electrical and Computer Engineering, Ohio State University, Columbus, OH, USA. From 2016 to 2018, he was a Postdoctoral Researcher with the College of Electrical Engineering and Automation, Shandong University of Science and Technology, Qingdao, China. From 2017 to 2019, he was a Research Fellow with the School of Computing, Engineering and Mathematics, Western Sydney University, Sydney, NSW, Australia. He is currently a Full Professor with the College of Electrical Engineering and Automation, Shandong University of Science and Technology. He has authored or coauthored more than 100 peerreviewed international journal papers and two monographs in the areas of analysis and control for switched systems. Dr. Zhu serves or has served as an Associate Editor for IEEE Control Systems Letters, Journal of The Franklin Institute, and a Guest Editor for European Journal of Control, etc. He is a recipient of the NSFC for Excellent Young Scholars. His research interests include nondeterministic switched systems, fault diagnosis and tolerant control, and their applications.

Speech 7

**April 26, 2025, Saturday, 15:20-15:50, GMT+8**
**Onsite Room：多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

# Prof. Long Jin

Recipient of National-Level Youth Talent Program

**Lanzhou University, China**

**Speech Title: Modeling and Analysis of the Matthew Effect in Social Networks**

**Abstract**: The Matthew effect is prevalent in social networks, economic systems, and scientific collaboration, characterized by the unequal accumulation of resources, often encapsulated by the saying, ``the rich get richer, and the poor get poorer.'' In real-world societies, individual interactions are typically distributed, with decisions and behaviors primarily relying on direct communication with neighbors. Consequently, distributed modeling not only provides a closer representation of real-world environments but also helps to reveal how local competition influences the evolution of global resource distribution. This paper presents a modeling framework for the Matthew effect based on distributed k-winners-take-all (kWTA) networks aimed at capturing competitive resource allocation and accumulation among individuals in society.

**Bio**: Long Jin is a professor at the School of Information Science and Engineering at Lanzhou University. He has been selected for the ``National Young Talents Program'', the Gansu Provincial Leading Talent Program. He has led multiple projects, including four National Natural Science Foundation of China (NSFC) projects, one key project under the National Key R&D Program, and several key/excellent youth projects from the Gansu Provincial Natural Science Foundation. Over the past five years, as the first or corresponding author, he has published more than 100 high-level papers in IEEE Transactions journals, Automatica, and CCF A-class journals and has been granted 24 invention patents. Since 2020, he has been continuously included in Elsevier's ``China Highly Cited Researchers.'' He has received several awards, including the Gansu Provincial Natural Science Second Prize, the China Association of Automation Natural Science Second Prize, and the Wu Wenjun Artificial Intelligence Excellent Young Scholar Award. He currently serves as an associate editor for several journals, including IEEE TIE, TIV, IEEE/CAA JAS, and Neural Networks.

Speech 8

**April 26, 2025, Saturday, 15:50-16:20, GMT+8**
**Onsite Room：多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

# Prof. Qiang Chen

Director of the Institute of Data-Driven Control and Learning Systems

**Zhejiang University of Technology, China**

**Speech Title: Spatial Repetitive Learning Control for Aperiodic Task Tracking of Rotary Motor Servo Systems**

**Abstract**: Rotary motor servo systems are widely used in many fields such as aerospace, ship propulsion, industrial robotics, etc. In those applications, the rapid and precise control of motor speed is particularly critical to guarantee the overall performance. As is well known, the repetitive learning control (RLC) is an effective control scheme to enable high-precision tracking for the systems performing periodic tasks in the time domain. However, for many aperiodic tasks in time domain, the periodicity exists in the position domain induced by the rotation of the servo motors. It is worth studying how to utilize such position-related spatial periodicity to improve the steady-state tracking accuracy of aperiodic tracking tasks. This report will briefly introduce our preliminary work on the design of spatial repetitive learning control for rotary motor servo systems.

**Bio**: Qiang Chen earned his Ph.D. degree in control science and engineering from Beijing Institute of Technology, Beijing, China, in 2012. Since 2012, He has been with the College of Information Engineering, Zhejiang University of Technology (ZJUT), Hangzhou, China. He is currently a Full Professor and the director of the institute of data-driven control and learning systems in ZJUT. He has presided over 3 National Natural Science Foundation of China (NSFC) projects including National Natural Science Fund for Excellent Young Scholars in 2022, and 1 Key Program of Natural Science Foundation of Zhejiang Province. He has published over 50 academic papers in IEEE Transactions and international journals, and has been authorized more than 60 invention patents, 15 of which were transferred. His research interests include iterative/repetitive learning control and prescribed time control with applications to electromechanical servo systems.

Speech 9

**April 27, 2025, Saturday, 10:50-11:20, GMT+8**
**Onsite Room：多功能厅 Function Room, B1**
**Zoom ID: 821 1241 9629 Password: 042527**

# Prof. Kai Ma

Vice Dean of the School of Electrical Engineering

**Yanshan University, China**

**Speech Title: Coordinated Control and Optimization for Smart Grid**

**Abstract**: Smart grid represents a new power system characterized by the deep integration of energy flow, information flow, and business flow. It accommodates a high proportion of renewable energy sources and faces complex load characteristics, necessitating frequent information exchange for coordinated operation of sources, storage, and loads. This report introduces coordinated control and optimization methods for smart grid from three perspectives, including coordinated control methods for distributed energy sources and thermostatically-controlled loads, economic dispatch and pricing strategies considering user comfort, and adaptive information transmission mechanisms for energy systems. Finally, the report provides an outlook on the application of smart grid in green ports.

**Bio**: Professor Ma Kai is the Vice Dean of the School of Electrical Engineering at Yanshan University, and the Director of the Key Laboratory of Intelligent Control and Neural Information Processing of the Ministry of Education. His research interests focus on the smart grids and integrated energy systems. In recent years, he has published more than 100 peer-reviewed papers and one academic monograph, and he has been authorized over 30 invention patents and participated in the formulation of a national standard. He has hosted 16 national and provincial-level research projects, including the National Excellent Youth Science Foundation and the Regional Joint Key Projects, and he was selected as a top young talent and a "Three-Three-Three" talent in Hebei Province, and awarded the Hebei Youth Science and Technology Nomination Award and the China Invention Association Invention and Entrepreneurship Award. Simultaneously, he is serving as senior members of IEEE, CAA, and CICC, and members of a council of Hebei Association of Automation and Hebei Association of Youth Science and Technology.

# Agenda Overview

## Day 1, April 25, 2025, Friday, Beijing Time, GMT+8

| Onsite Sign-in | | |
|---|---|---|
| **Time** | **Event** | **Venue** |
| **10:00-16:00** | Onsite Sign-in | Hotel Lobby |

| Online Pretest Session | | |
|---|---|---|
| **Time** | **Presenters** | **ZOOM Information** |
| **14:00-16:00** | Session Chair, Committee Members | Zoom ID: 821 1241 9629<br>Password: 042527 |
| | Session 3: CC1002, CC1003, CC1009, CC062, CC1008, CC033, CC1005, CC019, CC1007, CC035 | |

## Day 2, April 26, 2025, Saturday, Beijing Time, GMT+8

| Time | Schedule |
|---|---|
| **Onsite Room: 多功能厅 Function Room, B1**<br>**Zoom ID:** 821 1241 9629 **Password: 042527** | |
| **8:30-8:35** | **Welcome Message**<br><br>**Jieqiong Lin**<br><br>**Changchun University of Technology, China** |
| **8:35-8:40** | **Opening Remarks**<br><br>**Bo Dong**<br><br>**Changchun University of Technology, China** |
| **8:40-9:00** | **Group Photo** |
| **9:00-9:30** | **Keynote Speech 1**<br>**Speech Title: Modeling and Control for Collective Intelligence in Underwater Biomimetic Robotic Fish**<br><br>**Prof. Junzhi Yu**<br>IEEE Fellow<br>**Peking University, China** |
| **9:30-10:00** | **Keynote Speech 2**<br>**Speech Title: Intelligent Navigation for Unmanned Systems**<br><br>**Prof. Yonggang Zhang**<br>Chief Scientist of the National Key Research and Development Program<br>Director of Heilongjiang Engineering Laboratory of Navigation Instruments Deputy<br>Director of Navigation Instrument Engineering Center of the Ministry of Education<br>Excutive Dean of the College of Future Technology<br>**Harbin Engineering University, China** |
| **10:00-10:20** | **Coffee Break** |

| | |
|---|---|
| 10:20-10:50 | **Invited Speech 1**<br>**Speech Title: Task-oriented brain-robot interaction technology for medical rehabilitation**<br><br>**Assoc. Prof. Mingming Zhang**<br>IEEE Senior Member<br>**Southern University of Science and Technology, China** |
| 10:50-11:20 | **Invited Speech 2**<br>**Speech Title: Explainable Fault Diagnosis: A Bridge Between Unsupervised and Supervised Learning-based Fault Diagnosis Approaches**<br><br>**Assoc. Prof. Hongtian Chen**<br>**Shanghai Jiao Tong University, China** |
| 11:20-11:50 | **Invited Speech 3**<br>**Speech Title: Prescribed Performance Cooperative Control Research of Heterogeneous Autonomous Unmanned Systems**<br><br>**Prof. Hongjing Liang**<br>Highly Cited Researchers in Clarivate Analytics<br>**University of Electronic Science and Technology of China, China** |
| 12:00-13:30 | **Lunch** |
| 13:30-14:00 | **Invited Speech 4**<br>**Speech Title: Industrial Cyber-Physical Systems Driven by Explainable Artificial Intelligence**<br><br>**Prof. Xiangpeng Xie**<br>Vice Dean of the School of IoT<br>**Nanjing University of Posts and Telecommunications, China** |
| 14:00-14:30 | **Invited Speech 5**<br>**Speech Title: Intelligent Autonomous Monitoring Method for Dynamic Industrial Processes Based on Continual Learning**<br><br>**Prof. Keke Huang**<br>Recipient of National High-Level Talent Special Support Programs<br>**Central South University, China** |
| 14:30-15:00 | **Invited Speech 6**<br>**Speech Title: Research Advances on Bumpless Transfer Control of Switched Systems**<br><br>**Prof. Yanzheng Zhu**<br>Vice Dean of the College of Electrical Engineering and Automation<br>**Shandong University of Science and Technology, China** |
| 15:00-15:20 | **Coffee Break** |

| | |
|---|---|
| **15:20-15:50** | **Invited Speech 7**<br>**Speech Title: Modeling and Analysis of the Matthew Effect in Social Networks**<br><br>**Prof. Long Jin**<br>Recipient of National-Level Youth Talent Program<br>**Lanzhou University, China** |
| **15:50-16:20** | **Invited Speech 8**<br>**Speech Title: Spatial Repetitive Learning Control for Aperiodic Task Tracking of Rotary Motor Servo Systems**<br><br>**Prof. Qiang Chen**<br>Director of the Institute of Data-Driven Control and Learning Systems<br>**Zhejiang University of Technology, China** |
| **16:30-17:47** | **Session 1: Vision-based Multi-agent Collaborative Control and Intelligent Monitoring**<br>Session Chair: Dr. Bing Ma, Changchun University of Technology, China<br><br>CC021, CC032, CC017, CC041, CC030, CC060, CC043, CC034, CC031, CC039, CC038 |
| **18:00-20:00** | **Dinner** |

## Day 3, April 27, 2025, Sunday, Beijing Time, GMT+8

<table>
<tr><th>Time</th><th colspan="2">Schedule</th></tr>
<tr><td colspan="3">Onsite Room: 多功能厅 Function Room, B1<br>Zoom ID: 821 1241 9629 Password: 042527</td></tr>
<tr><td>9:00-9:30</td><td colspan="2">Keynote Speech 3<br>Speech Title: In-Cabin Robots for Space Stations: Research Status and Key Technologies<br><br>Prof. Lixian Zhang<br>IEEE Fellow<br>Harbin Institute of Technology, China</td></tr>
<tr><td>9:30-10:00</td><td colspan="2">Keynote Speech 4<br>Speech Title: Theoretical Methods and Industrial Applications of Clustering Analysis<br><br>Prof. Youqing Wang<br>IET Fellow<br>The Dean of College of Information Science and Technology<br>Beijing University of Chemical Technology, China</td></tr>
<tr><td>10:00-10:20</td><td colspan="2">Coffee Break</td></tr>
<tr><td>10:20-10:50</td><td colspan="2">Keynote Speech 5<br>Speech Title: Self-learning Optimal Control and Reasoning System<br><br>Prof. Qinglai Wei<br>IEEE Senior Member<br>Chinese Academy of Sciences, China</td></tr>
<tr><td>10:50-11:20</td><td colspan="2">Invited Speech 9<br>Speech Title: Coordinated Control and Optimization for Smart Grid<br><br>Prof. Kai Ma<br>Vice Dean of the School of Electrical Engineering<br>Yanshan University, China</td></tr>
<tr><td>11:30-13:00</td><td colspan="2">Lunch</td></tr>
<tr><td>13:00-15:30</td><td>Session 2: Image-based intelligent control and detection system<br>Session Chair: Dr. Tianjiao An, Changchun University of Technology, China<br>CC049, CC1013, CC018, CC048, CC022, CC020, CC027, CC046, CC1001, CC026</td><td>Onsite Room: 会议室 3<br>Meeting Room 3, B1</td></tr>
</table>

| | | |
|---|---|---|
| **14:00-16:30** | **Session 3: Machine Learning and Computational Models in Intelligent Image Processing**<br>Session Chair: Prof. Anand Nayyar, Duy Tan University, Viet Nam<br>CC1002, CC1003, CC1009, CC062, CC1008, CC033, CC1005, CC019, CC1007, CC035 | Zoom ID:<br>821 1241 9629<br>Password:<br>042527 |

## *Session 1: Vision-based Multi-agent Collaborative Control and Intelligent Monitoring*

**Time:** 16:30-17:47, April 26, 2025, Saturday, Beijing, GMT+8

**Onsite Room:** 多功能厅 Function Room B1

**Session Chair: Dr. Bing Ma, Changchun University of Technology, China**

**CC021**

16:30-16:37

Title: Complete Coverage Path Planning for Multiple Heterogeneous UAVs in Plant Protection

Authors: Cencen Xiao, Hanmei Zhou, Jiahao Leng, Lanfeng Hua, Shaoyu Hu, Yang Yu and Qishui Zhong

Presenter: Cencen Xiao, University of Electronic Science and Technology of China, China

Abstract: As a new type of agricultural equipment that is efficient, environmentally friendly and safe, plant protection uncrewed aerial vehicles (UAVs) have been widely used in crop pest control in recent years. Complete coverage path planning (CCPP) technology can not only improve the operation efficiency of UAVs and reduce energy consumption, but also ensure complete coverage of the target area while reducing the repetition rate. In this paper, the problem of complete coverage path planning for multi-heterogeneous plant protection UAVs is solved. The goal is to reduce operating time. Firstly, the minimum cell decomposition of the irregular farmland area is carried out. Secondly, the area to be operated is modeled as a graph structure, so that the problem is transformed into a vehicle routing problem (VRP). Finally, a probability-based random heuristic algorithm was proposed to obtain a better complete coverage path in a short time, and numerical simulations were carried out to verify the effectiveness and feasibility of the algorithm.

**CC032**

16:37-16:44

Title: Physics-Informed Dual-Output Neural Network with Multisource Fusion and Feature Engineering for Monotonicity-Constrained Prediction of Boiler Temperature and NOX Distribution

Authors: Pang Bo, Tang Zhen Hao

Presenter: Bo Pang, Northeast Electric Power University, China

Abstract: Under the rapid development of new energy industries, coal-fired power generation maintains an irreplaceable role in ensuring power system stability. However, widespread combustion instability during peak-shaving operations leads to surge in pollutant emissions and degradation in operational energy efficiency. Addressing these challenges, this paper proposes a novel hybrid modeling approach integrating mechanism-constrained feature optimization framework with physics-informed dual-output neural networks, establishing an innovative model for collaborative prediction of boiler temperature field and NOX concentration field. The research methodology encompasses three key phases: First, we construct a multi-source heterogeneous dataset by integrating three-dimensional furnace parameter distributions from computational fluid dynamics (CFD) simulations with historical operational data from distributed control systems (DCS). Subsequently, principal component analysis (PCA) and uniform manifold approximation and projection (UMAP) algorithms are employed for joint dimensionality reduction and deep correlation feature extraction in the feature space, followed by mutual information (MI) theory-based selection of critical input variables. Finally, we design a dual-output physics-informed neural network architecture that deeply integrates thermodynamic mechanisms with data-driven approaches through embedding the monotonic correlation characteristics between temperature and NOX concentration into a regularized loss function. Experimental results demonstrate that the proposed model achieves a 21.77% reduction in mean absolute error (MAE) for both temperature field and NOX concentration field predictions while strictly adhering to physical constraints. This methodology provides a solution balancing theoretical rigor and engineering applicability for combustion optimization and emission monitoring in coal-fired units, offering novel insights for achieving clean and efficient coal-fired power generation.

**CC017**

16:44-16:51

Title: Consensus Control of Multiagent Systems Based on Event-Triggered Reinforcement Learning

Authors: Xuezhi Zhou, Qishui Zhong, Lanfeng Hua, Jiahao Leng, Hanmei Zhou, Shuai Li
Presenter: Xuezhi Zhou, University of Electronic Science and Technology of China, China

Abstract: This paper addresses the issue of achieving optimal consensus control for multi-agent systems (MASs) with uncertain dynamics and proposes a reinforcement learning approach that incorporates an event-triggering mechanism. First, the MASs are modeled as directed graphs, with local and global inconsistency errors defined. Second, a distributed control strategy based on Nash equilibrium is designed to minimize the local performance index function(PIF). To reduce computational overhead and energy consumption, an event-triggering mechanism based on the energy function is introduced. By dynamically adjusting the triggering conditions, the controller is updated only when necessary, significantly reducing the update frequency. Third, the reinforcement learning(RL) algorithm within the Actor-Critic framework is employed, where the actor neural networks(NN) approximates the optimal control policy, and the critic neural networks(NN) estimates the performance index, enabling iterative optimization of the control strategy. Finally, In the theoretical analysis, the Lyapunov method is utilized to prove the convergence of system errors and network parameters, ensuring system consensus and stability. Numerical simulations demonstrate that, compared to the traditional periodic triggering method, the proposed method reduces computational costs while achieving rapid convergence and efficient operation.

**CC041**

16:51-16:58

Title: A novel multi-motor synchronous control strategy for robot arm

Authors: Tingting Wang, Wenjing Liu, Lijie Han, Huangshui Hu, Hongzhi Wang, and Cong Zhang
Presenter: Tingting Wang, Changchun University of Technology, China

Abstract: To solve the multi-motor coordination control problem of robotic arm joint drive, an improved proportional ring network coupling control strategy called RNCCS is proposed in this paper, which sets the proportional coefficient and the feedback compensation mechanism between each motor based on the traditional ring coupling control structure so that the multi-motors can realize the speed proportional synchronization according to the actual demand. For the coupling influence of the synchronization error between multi-motors, the synchronization control compensator is constructed to compensate for the secondary supply of the control signal, which increases the anti-interference ability of the system and reduces the synchronization error. Moreover, the harmony search algorithm (HSA) optimized fuzzy proportion integration differentiation (HFPID) tracking controller for speed is used in this strategy, which improves the adaptive ability and speed tracking performance of the multi-motor control system. Finally, the multi-motor synchronous control system model is built to verify the superiority of this strategy.

**CC030**

16:58-17:05

Title: Real-Time Quality Detection in Aerospace Assembly: A Vision Framework for Screw Positioning and Adhesive Detection

Authors: BenHua Zhao, HuaXing Ren, Jing Yang, YongLi Wang*
Presenter: BenHua Zhao, Beijing Spacecrafts Co., Ltd, China

Abstract: The traditional aerospace industry uses purely manual inspection during installation, which can lead to safety hazards due to human negligence. Given the remarkable achievements in computer vision, how to apply it to the aerospace industry to solve manual hazards is a problem worth studying. To address the inspection omissions inherent in manual visual inspection of cabin screw installation quality in aerospace manufacturing, this study proposes an automated vision-based detection system. The system architecture integrates binocular cameras, and industrial computing units as hardware core components, coupled with real-time positional detection and adhesive recognition modules to achieve comprehensive process monitoring. Through binocular calibration, intrinsic and extrinsic camera parameters were systematically acquired, enabling depth calculation via triangulation principles. Screw positioning was indirectly achieved through hand key point detection, with geometric modeling subsequently analyzing screw-cabin contact states to trigger photographic verification at critical engagement moments. The adhesive inspection module employs predefined regions of interest (ROI) to narrow processing scope, implementing color feature analysis to quantify adhesive coverage condition while ensuring real-time performance and measurement accuracy.

**CC060**

17:05-17:12

Title: Application of genetic algorithm to optimize fuzzy PID-Smith in coal mine ventilation power plant control
Authors: Xiangxin Shao, Tao Yu, Tao Cui, Sen Yang, Ruiyao Wang
Presenter: Xiangxin Shao, Changchun University of Technology, China

Abstract: The stable ventilation under the coal mine is an important part of underground safety production, which greatly affects the production efficiency. At present, the control of wind speed and air volume under coal mine safety ventilation generally adopts fuzzy PID control combined with fuzzy control algorithm and PID algorithm, but the effect of fuzzy control greatly depends on expert experience, among which the scale factor 、、 and quantization factor 、in fuzzy controller can not be dynamically changed with the change of error after setting, and the lack of dynamic adaptability. In this paper, genetic algorithm is used to optimize the above factors, and smith predictive control algorithm is incorporated to eliminate the effect of time delay, and MATLAB is applied to simulation. The simulation results show that the fuzzy PID control optimized by genetic algorithm is more excellent in response speed, overshoot control, steady-state time and so on.

**CC043**

17:12-17:19

Title: Indoor motion trajectory prediction based on CPO-LSTM-Self-Attention
Authors: Yu Wang, Honbin Chang
Presenter: Yu Wang, Shenyang University of Technology, China

Abstract: With the widespread use of mobile devices and the development of indoor positioning technology, predicting user movement trajectories within indoor settings have emerged as a research focus over the past few years. Although most prediction methods based on kinematic or statistical models demonstrate satisfactory performance in outdoor scenarios, their effectiveness is notably diminished in indoor settings. In response to this challenge, the paper presents a hybrid approach integrating crested porcupine optimization (CPO) and long short-term memory (LSTM), and self-attention mechanism. The process begins with the model optimizing the LSTM network's hyperparameters through CPO, ensuring that the LSTM processes the input data with the optimal configuration. The LSTM network is then leveraged to extract temporal features from the input data, identifying dependencies across short and long timeframes. Subsequently, the self-attention mechanism is introduced, which adaptively assigns different weights to different time steps, enhancing the model's focus on key time points and effectively capturing important information in the time series. Finally, the predicted results of the indoor trajectory are output through the fully connected layer. Comparative experiments and ablation studies are conducted on a real indoor dataset to evaluate the predictive performance of the model. The experimental results show that the prediction performance and evaluation indicators of the model are better than those of the benchmark model and other optimization algorithm combination models, which verifies that the combined model has good prediction performance and generalization ability and can be applied in practical scenarios.

**CC034**

17:19-17:26

Title: An Improved Subspace-Aided Fault Detection Method for Traction Drive Systems
Authors: Chao Cheng, Zhiwei Wan, Bokai Han, Ruijie Liu, Bing Wang, and Hongtian Chen
Presenter: Zhiwei Wan, Changchun University of Technology, China

Abstract: This paper addresses the incipient fault detection (FD) problem for traction drive systems under uncertain distributions of stochastic noises. Incipient faults are easily masked by stochastic noises from process and sensors, making effective detection challenging. To tackle this issue, a performance index is incorporated into the design of the residual generator, enhancing the fault features and improving the sensitivity to incipient faults. Furthermore, a residual evaluation unit based on the Mahalanobis distance is introduced into the subspace-aided FD framework. This enhances the sensitivity to incipient faults while maintaining the robustness against the negative effect caused by stochastic noises. The effectiveness of the proposed method is validated on a real traction drive system.

**CC031**

17:26-17:33

Title: Temperature Gradient-Driven Adaptive Sampling for Efficient Prediction of Boiler Temperature
Authors: Banglong Yu, Zhenhao Tang
Presenter: Yu Banglong, Northeast Electric Power University, China

Abstract: Accurate and efficient real-time monitoring of combustion temperature fields in coal-fired boilers is hampered by challenges of low spatial resolution and insufficient computational efficiency. To overcome these hurdles, this study presents a framework that combines physicsinformed hierarchical hybrid sampling with a dynamically weighted loss function. This framework is developed through the thorough integration of multi-operational computational fluid dynamics (CFD) simulation data and operational parameters from the distributed control system (DCS) of a 350 MW supercritical once-through boiler.Initially, the flame core is pinpointed by computing the absolute temperature gradient at each grid point within the simulation data. Following this, a global coarse sampling approach is adopted to capture the boiler's geometric structure and overall temperature distribution characteristics. This is further refined by local sampling in regions exhibiting the top 10% temperature gradients, effectively optimizing the total data points to 420,000. Ultimately, a deep neural network-based model is established for predicting the 3D temperature distribution within the boiler. This model incorporates error weights for highgradient regions through the application of a dynamically weighted loss function. Experimental results validate the efficacy of this collaborative modeling approach, which merges physicsbased constraints with data-driven techniques, offering a highprecision and streamlined solution for real-time combustion field optimization and safety regulation in coal-fired power units.

**CC039**

17:33-17:40

Title: MedMM:Multi-level Semantic-guided Multi-branch Medical Image Classification Network
Authors: Wei Xiao, Yinlan Shen, He Zhu, Lei Jiang, Jie Chen, Chao Pan, Tao Wang
Presenter: Yinlan Shen, Changchun University of Technology, China

Abstract: The integration of deep learning techniques into computer-aided diagnosis (CAD) has significantly enhanced the accuracy and effectiveness of medical diagnoses. However, these advancements are often hindered by limitations when faced with ambiguous or complex morphological features, which complicate the identification of small lesions and increase the risk of misdiagnosis. MedMM is an innovative medical image classification network that combines deep learning with an attention mechanism to improve diagnostic accuracy. It comprises three components: a local feature extraction network, a global feature extraction network, and a feature fusion classification network. The global branch employs moving window and relative position coding to enhance data assimilation, while the local branch utilizes differential convolution to construct the Detail Feature Enhancement (DFE) module, which captures fine details and mitigates the risk of misdiagnosis. The feature fusion branch is based on multi-scale adaptive fusion feature blocks(MSFF) that create stage transition guide module (STG) and feature Surveillance module (FSM) for efficient feature fusion. To validate its efficacy, MedMM has been tested on several well-known medical image datasets (COVID-19 and Kvasir) and has demonstrated excellent performance. Our code is open-source and available from https://github.com/faacai/MedMM.

**CC038**

17:40-17:47

Title: Research on target detection algorithm in complex road background
Authors: Xiao Wang, Li Chen
Presenter: Xiao Wang, Shenyang University of Technology, China

Abstract: An improved DF-YOLOv8 algorithm was proposed to solve the problem of decreasing target detection accuracy under the influence of occlusion, small target and other factors during target detection on complex road background. FIoU calculated the diagonal distance of the overlap area of the IoU of the real box and the predicted box. Compared with the center point distance of CIoU, the diagonal distance is more suitable for the calculation of the IoU Loss function of the occluded target. The CIoU in the algorithm was replaced by FIoU to improve the regression accuracy of the algorithm for the occluded target. A multi-scale convolution module DCD is proposed for small target problem. The module uses convolution of different scales to extract features of different scales, and fuses channel features of four convolution channels to exchange channel information. To obtain a more comprehensive and rich feature representation. A multi-scale convolutional network is constructed by replacing common convolution in C2f with DCD module to improve the effect of small target detection. The experimental results were compared and verified on the KITTI target detection dataset, and finally the ablation experiment was conducted and compared with the current mainstream detection algorithms, which fully proved the effectiveness of DF-YOLOv8.

## *Session 2: Image-Based Intelligent Control and Detection System*

**Time:** 13:00-15:30, April 27, 2025, Sunday, Beijing Time, GMT+8

**Onsite Room:** 会议室 3, Meeting Room 3, B1

**Session Chair: Dr. Tianjiao An, Changchun University of Technology, China**

### CC049

13:00-13:15

Title: Optimizing spatio-temporal action detection in figure skating via temporal rearrangement and dual-path delay Learning
Authors: Alin Hou, Mengxue Yan, Wen Cao, Minjun Xu, Jiayu Sun, Junpeng Zhang
Presenter: Mengxue Yan, Changchun University of Technology, China

Abstract: Figure skating involves performing skating, turning, jumping and other movements on the ice. Existing motion recognition methods struggle to effectively detect the actions in figure skating. To address this problem, we propose a method for Optimizing spatio-temporal action detection in figure skating using temporal rearrangement and dual-path delay learning. Firstly, to enhance the model's sensitivity to time dynamics, temporal rearrangement module is introduced, this module can better capture the temporal information and improve network performance. Secondly, to reduce the complexity of the model and the computational burden, a dual-path delay lightening module is designed, so that the combination not only improves the modeling ability of the spatio-temporal features and the temporal information, but also maintains a low computational load, which is particularly suitable for dealing with long timeseries data. Finally, the experimental results show that the proposed outperforms YOWO by 1.4% on the FineFS dataset and 1.73% on the UCF101-24 dataset, with a parameter reduction of approximately 27.69%.

### CC1013

13:15-13:30

Title: Segmentation of lung nodules based on an improved U-Net network model
Authors: Kaikai Zhang, Xiaowen Lan, Yanhui Wang, Shaofeng Wang, Wenjing Liu and Zhiying Zhao
Presenter: Kaikai Zhang, Inner Mongolia University Of Science & Technology, China

Abstract: In the domain of medical imaging, accurate segmentation of lung nodules is imperative for the timely diagnosis and treatment of lung diseases. Due to the intricate nature of feature information present in lung CT images, the conventional U-Net network exhibits suboptimal performance in the lung nodule segmentation task. To address this limitation, this study proposes an enhanced U-Net network capable of achieving higher segmentation accuracy for lung nodules. The proposed model incorporates a wavelet fusion downsampler (WFD) module within the downsampling pathway of the traditional U-Net network. This module employs wavelet transform to decompose the image, downsamples each subband independently, and then inverts and fuses them. This approach effectively preserves the texture and edge details of the lung nodule image, enhancing the model's capacity to capture the features of the lung nodule. Secondly, the Channel-Transformer-Assembler (CTA) module is incorporated into the hopping section, leveraging an attention mechanism to adaptively assign weights to different levels of nodule feature maps based on feature importance and subsequently fuse them. This approach mitigates the loss of information due to resolution differences, enhances feature expression, improves lung nodule segmentation accuracy and model adaptability, and provides substantial support for accurate lung nodule segmentation. The efficacy of the proposed methodology is empirically investigated and validated on two distinct datasets: luna16 and a private dataset annotated by experts from the Second Affiliated Hospital of Baotou City, Inner Mongolia. The results showed that with the improved U-Net network, the dice similarity coefficient increased by 1.376% to reach 83.589% compared with the original model, segmentation precision was 88.41% and sensitivity was 86.879%, which proved that the model has some application value in terms of lung nodule segmentation accuracy and precision.

**CC018**

13:30-13:45

Title: Inverse Optimal Pitch Control for Power Regulation and Load Mitigation in Wind Turbines
Authors: Shaodong Wang, Qinmin Yang, Shuzong Xie, Wenchao Meng, Ge Song
Presenter: Shaodong Wang, Zhejiang University, China

Abstract: In this paper, an inverse optimal adaptive neural pitch control method is proposed to comprehensively consider power generation and mechanical load reduction of the wind turbine (WT). Firstly, to facilitate the design of controller, the nonlinear affine WT system is constructed based on WT model operating in the high-speed region. Then the inverse optimal adaptive neural pitch controller is designed by using neural network (NN) technology. In addition, the stability and practical inverse optimality of the system are proved by Lyapunov function. Finally, to validate the feasibility of the proposed control method, an NREL 5-MW WT has been tested using the OpenFAST platform.

**CC048**

13:45-14:00

Title: Spatio-Temporal Action Recognition Enabled by an Enhanced YOWO Network
Authors: Alin Hou, Wen Cao, Mengxue Yan, Minjun Xu, Jiayu Sun, Junpeng Zhang
Presenter: Wen Cao, Changchun University of Technology, China

Abstract: This paper proposes an enhanced spatio-temporal action recognition model by integrating the Biformer network structure into the 2D convolutional module of the YOWO network, significantly improving the spatial feature extraction of key frames. Additionally, the GIoU loss function is replaced with the DIoU loss function, which better meets the requirements of the model for detection accuracy and convergence speed in complex scenarios in this study. Experiments conducted on both a custom AVA basketball dataset and the UCF101-24 dataset demonstrate that the proposed method significantly improves action recognition accuracy compared to the original YOWO network. On the custom AVA basketball dataset, the Frame-mAP increased by 2.27% when both the Biformer network and the DIoU were added. For the UCF101-24 dataset, with the addition of both the Biformer and the DIoU, the Frame-mAP improved by 1.11%, and the Video-mAP improved by 1.31% at an IoU threshold of 0.2 and 0.24% at 0.5. These results indicate the model's generalizability and potential for various computer vision tasks.

**CC022**

14:00-14:15

Title: Energy-harvesting-based fusion filtering for multi-rate nonlinear systems with random sensor saturations: A center difference approach
Authors: Shuting Fan, Hang Xu, Yuxin Guo, Yixin Xia, Jun Hu
Presenter: Shuting Fan, Harbin University of Science and Technology, China

Abstract: This paper investigates the inverse covariance intersection (ICI) fusion filtering issue for multi-rate nonlinear systems under the influence of random sensor saturations, in which the sensor is considered to have the ability to harvest energy and the Poisson process is applied to characterize the behavior of the sensor to collect energy. The primary objective is to construct a local filtering algorithm in accordance with the acquired information to derive an upper bound on the local filtering error covariance and design filter gains to optimize the obtained upper bound. Moreover, the fusion filter is obtained according to ICI fusion rules. The monotonicity is analyzed between the trace of the upper bound and the saturation probability. Finally, the effectiveness of the algorithm is demonstrated through a simulation example.

**CC020**

14:15-14:30

Title: Adaptive Optimization Scheduling of Wind-Solar-Thermal Storage Multi-Energy Complementary Based on Dynamic Programming
Authors: Yi An, Jiale Zhang, Chunhui Liang, Hui Zhang
Presenter: Jiale Zhang, Changchun Institute of Technology, China

Abstract: This work proposes an adaptive, dynamic programming-based optimization method for power system multi-variable optimal scheduling with coupled-interconnected uncertainties. The mathematical models for photovoltaic, wind, concentrated solar power, and energy storage systems are constructed. The HJB equation is established, which considers both system power output and user-side load performance metrics. The strategy-iteration algorithm is adopted to solve the optimal dispatching strategies and the Lyapunov theory is employed for stability analysis. By comparing the simulation results of other optimization control methods, the efficiency of the proposed dynamic planning algorithm is verified, and it shows that the control strategy based on dynamic planning has a good development prospect in the comprehensive energy control based on renewable energy.

**CC027**

14:30-14:45

Title: Lag consensus and lag $\mathcal H_{\infty}$ consensus for multiagent systems subject to topology attacks based on PD control
Authors: Yi-Ming Zhai, Xin-Yu Zhao, Jian-Qiao Wang, Jin-Liang Wang
Presenter: Jian-Qiao Wang, Tiangong University, China

Abstract: In this paper, the PD control approaches are utilized to tackle the lag and lag $\mathcal H_{\infty}$ consensus for multi-agent systems (MASs) suffering topology attacks. A lag consensus condition of the MAS is presented with the help of the devised PD control scheme. In addition, a lag $\mathcal{H}_{\infty}$ consensus condition is acquired of the MAS under external disturbances by using PD control approach. Finally, two numerical examples are afforded to validate the devised control schemes.

**CC046**

14:45-15:00

Title: An End-to-End High-Resolution Model for TFT Chip Pattern Segmentation: Leveraging an Enhanced DeepLabV3+ Architecture
Authors: Alin Hou, Junpeng Zhang, Hai Gong, Junxiu Chen, Jiayu Sun, Minjun Xu, Mengxue Yan, Wen Cao
Presenter: Junpeng Zhang, Changchun University of Technology, China

Abstract: This paper presents a comprehensive study on the application and optimization of the DeepLabV3+ model for pixel-level semantic segmentation in ultra-high resolution Thin-Film Transistor (TFT) Liquid Crystal Display (LCD) images. The research addresses two critical challenges: the inability of conventional models to directly process ultra-high-resolution TFT images and the excessive memory and GPU resource consumption associated with such images. The goal is to demonstrate the feasibility and efficiency of the DeepLabV3+ model in accurately segmenting large-scale TFT images, thereby improving the automated optical inspection process in TFT manufacturing and ensuring product quality. The proposed model enables direct training and inference on ultra-high-resolution images, seamlessly integrating into the automated optical inspection (AOI) of TFT panels. This optimization significantly reduces inspection time, improves efficiency, and ultimately enhances production throughput.

**CC1001**

15:00-15:15

Title: Nonzero-sum Game-based Approximate Optimal control of Reconfigurable Manipulator system Identified by RNN
Authors: Bo Dong, Rui Sun, Chen Li, Hongbo Dong, Tianjiao An, Bing Ma
Presenter: Tianjiao An, Changchun University of Technology, China

Abstract: This paper explores the issue of an approximate optimal control problem within a nonzero-sum differential game context for reconfigurable manipulator systems. Utilizing the input-output data from these systems, we introduce an effective identifier via recurrent neural network (RNN) to recognize dynamics of the system. We consider all joints as players and establish an n-player nonzero-sum differential game optimal control problem. We utilize adaptive dynamic programming (ADP) in conjunction with a critic neural network to approximate the optimal control policy. This approach effectively circumvents the curse of dimensionality typically encountered when dealing the Hamilton-Jacobi (HJ) equation. We then establish the convergence properties of ADP and the identifier, demonstrating that the system state, along with the weights of the RNN and critic neural network, will converge to a finite neighborhood of equilibrium. Finally, simulation results validate the effectiveness of the ADP methods.

**CC026**

15:15-15:30

Title: Joint Torque Feedback-based Standing Balance Control for Biped Rconfigurable Robots
Authors: Yuanchun Li, Yuan Yao, Hangwei Zhang, Tianjiao An, Qiang Pan, Bing Ma
Presenter: Yuan Yao, Changchun University of Technology, China

Abstract: This paper proposes the standing balance control for the biped reconfigurable robots. Firstly, based on the NewtonEuler algorithm, the dynamic model of biped reconfigurable robots is established. For simplifying model structure, a single robot dynamic model based on joint torque feedback technique is established in free space. Then, the fusion error function is established to reflect the tracking performance of the trunk, the support force and the contact force between the sole and the environment. In addition, a radial basis function neural network (RBFNN) identifier is constructed to approximate the dynamic uncertainties. Then, the standing balance control method is designed for the biped reconfigurable robots. Finally, the tracking error is proved to be asymptotically stable based on Lyapunov stability theory. Finally, the effectiveness of the control method is verified by experiments.

## *Session 3: Machine Learning and Computational Models in Intelligent Image Processing*

**Time:** 14:00-16:35, April 27, 2025, Sunday, Beijing Time, GMT+8
**Zoom ID:** 821 1241 9629 **Password:** 042527
**Session Chair: Prof. Anand Nayyar, Duy Tan University, Viet Nam**

### CC1002

14:00-14:15

Title: Machine learning-based web application for early detection of Autism Spectrum Disorder
Authors: Dario Joaquin Diaz, Valeria Ariana Vilela, Pedro Segundo Castañeda
Presenter: Dario Joaquin Diaz, Universidad Peruana de Ciencias Aplicadas, Peru

Abstract: This study outlines the development of a web application leveraging machine learning for the early diagnosis of Autism Spectrum Disorder (ASD). The proposed system focuses on creating a predictive model using data from the Q-CHAT-10 questionnaire to identify patterns associated with ASD. Multiple classification algorithms were evaluated, including Logistic Regression, Support Vector Machines (SVM), Decision Trees, Random Forest, XGBoost, K-Nearest Neighbors, and Gaussian Naive Bayes. To enhance system performance, techniques such as hyperparameter tuning with Grid Search and class imbalance management using SMOTE were employed, resulting in improved model accuracy and generalization. The outcomes surpassed the established benchmark of 85% across key metrics, including precision, accuracy, recall, F1 score, and AUC-ROC. Notably, the optimized SVM model demonstrated superior performance, achieving an accuracy of 98.80%, precision of 93.27%, recall of 90.11%, F1 score of 94.25%, and an AUC-ROC of 97.93%. This technological solution shows significant potential for integration into clinical settings, facilitating early diagnoses and providing effective decision-making support for healthcare professionals. Furthermore, the results emphasize the application's effectiveness in resource-limited environments, representing a meaningful advancement in ASD care within clinical contexts.

### CC1003

14:15-14:30

Title: Wear-leveling impact and solution of an embedded real-time operating system booting
Authors: Haoshang Zhou, Zhaoling Gao, Feng Wang, Tianqi Yang
Presenter: Haoshang Zhou, State Key Laboratory for Traction and Control System of EMU and Locomotive, China

Abstract: Generally, when an embedded real-time operating system starts, it needs to start Microsoft DOS first, and then it is regarded as general software to start. In this paper, based on the customer service feedback of each locomotive subway company that an embedded operating system failed to start and the six lights on the front panel were always on. The problem of electronic disk loss balance and the impact of DOS reading and writing on the electronic disk on its starting process will be explored, and the OBR(OS Boot Record) recompiled by assembly language to directly load bootrom.sys into memory and take over system control. That can be directly started on the FAT32 format electronic disk will be proposed and verified, and tested in the laboratory, each subway company. It is proved that this method can completely avoid the problem of system startup failure.

### CC1009

14:30-14:45

Title: Air quality prediction system in Lima using Long Short Term Memory
Authors: Michell Alvarez, Gonzalo Cadenas, Roberto Montero
Presenter: Gonzalo Cadenas, Universidad Peruana de Ciencias Aplicadas, Peru

Abstract: The city of Lima has a high level of air pollution due to the increase in the number of vehicles using fossil fuels and the lack of natural aspects that can mitigate it. This is detrimental to people's quality of life. Authorities lack tools that allow them to make decisions on environmental aspects. This research has aimed to create a system that allows measuring air quality in different environments of the city in order to provide quantitative aspects that facilitate taking actions in favor of decontamination. The proposed system is based on LSTM neural networks to model a real-time prediction of air quality that allows the metropolitan municipality of Lima to take action on environmental policies. The results have shown that LSTM outperforms other models such as DTR and SVR by better capturing temporal dependencies, so the validations of the system have been very satisfactory and based on them it has been possible to generate policies on vehicle access in places with a high degree of pollution, which benefits citizens.Index Terms-Air quality, air quality index, AQI, predictive model, machine learning, LSTM.

**CC062**

14:45-15:00

Title: Research on Multi - scale Attention Network Integrating Brain Functional Connectivity Features in Resting - state fMRI of Alzheimer's Disease
Authors: Changzhi Song, Ruofan Wang, Xu Wang and Haojie Xu
Presenter: Changzhi Song, Tianjin University of Technology and Education, China

Abstract: Alzheimer's disease (AD), a neurodegenerative disorder, poses a significant threat to the health of an aging society. To address the challenge of its early diagnosis, this study, based on functional magnetic resonance imaging (f)MRI technology, proposes a deep - learning framework that combines multi - scale dynamic functional connectivity (dFC) and an attention mechanism.Data was obtained from the Alzheimer's Disease Neuroimaging Initiative (ADNI) database. Multi - scale sliding windows were used to construct dFC matrices. A multi - scale convolutional neural network (CNN) was designed to extract spatial features, which was combined with a bidirectional long - short - term memory network (BiLSTM) and a scaled dot - product attention mechanism to capture temporal dependencies, enabling the classification of AD patients and normal controls (NC).Experimental results demonstrate that the model achieved remarkable classification performance in five - fold cross - validation (accuracy of 89.2% and an F1 - score of 0.87). This validates the effectiveness of multi - scale dynamic functional connectivity and the attention mechanism in mining the features of AD brain networks, providing new methodological support for the early diagnosis of AD.

**CC1008**

15:00-15:15

Title: Predictive system to avoid passenger saturation on the Lima BRT using neural networks
Authors: Guillermo Aguilar, Aymin Roman, Roberto Montero
Presenter: Guillermo Aguilar, Universidad Peruana de Ciencias Aplicadas, Peru

Abstract: The main cities in the world have a transport service that allows citizens to move around them. Lima has a public service called Bus Rapid Transit (Lima's BRT), which allows the transportation of citizens. This service presents situations of passenger accumulation in all its stations caused by the poor determination of supply and demand of buses; this results in delays in departures and journeys, overloading of buses and the annoyance of people, so the quality of the service is diminished without fulfilling the objective of rapid transport. In this research, a predictive model has been developed using neural networks that allows estimating the flow of passengers in the stations, providing the competent authority with an important resource for determining the demand and supply of buses with the objective of speeding up the flow of passengers. The model allows a precision of 92% compared to other models and it has been proven that the estimation of the use of buses allows speeding up the flow of passengers, satisfactorily speeding up the service.

**CC033**

15:15-15:30

Title: MSA-Net: A lightweight multi-scale feature refinement network for optic cup and optic disc segmentation
Authors: Weiwei Song, Ming Xu, Haixing Li, Xiaosheng Yu, Hongyu Wang
Presenter: Weiwei Song, Shenyang University of Technology, China

Abstract: Optic disc and optic cup segmentation plays a key role in early diagnosis of glaucoma which is a serious eye disease that can cause damage to the optic nerve, retina, and may cause permanent blindness. To make the segmentation model more applicable to actual medical scenarios. We propose a multi-scale adaptive spatial attention network, which balances the high performance and computational efficiency of the model. A lightweight adaptive multi-branch convolution block is designed to balance accuracy and complexity, and the feature extraction ability of the network is enhanced without excessively increasing network parameters and ensuring lightweight. A spatial attention module that can dynamically adjust the obtained structural feature weights is designed, which not only improves the accuracy of the cup-disc segmentation task, but also significantly reduces the amount of parameters and reduces the computational burden. The Dice coefficients on the test set are 0.9676, 0.8563 for the optic cup region and 0.9632, 0.8871 for the optic disc region, respectively. The proposed method achieves competitive results compared to other state-of-the-art methods.

**CC1005**

15:30-15:45

Title: A Random Forest Classification Model to improve credit evaluation in Credit Unions – Perú
Authors: ANDRÉ MARTÍN COQUIS, CARLOS DANIEL SONAN, YENY ALEJANDRA VARGAS, DAVID ARMANDO RODRIGUEZ
Presenter: ANDRÉ MARTÍN COQUIS, Universidad Peruana de Ciencias Aplicadas, Peru

Abstract: Credit Unions are non-profit financial institutions that operate in a comparable way to a bank. These organizations currently have problems being able to accurately assess the creditworthiness of their members. Therefore, it is proposed to develop a Random Forest Classification model that qualifies the eligibility and payment capacity of the member to receive a loan using the information collected in their application and thus increase the quality loans that the Credit Unit deliver while freeing up the burden on the credit unit. To choose the Machine Learning model, an evaluation of the most used algorithms in similar applications was carried out. The model was trained and tested with the data of the financial institution. The implementation and its correct operation were validated through an experiment in which fifty evaluations were carried out through expert judgment and compared with the same cases evaluated through Random Forest, reaching an accuracy of 95.56% and saving them twenty hours of work for every fifty evaluations.

**CC019**

15:45-16:00

Title: Research on Rice Seed Image Identification Using Dual Attention Mechanism Based on ResNet-50
Authors: Hui Zhang, Lin Sun, ShuChang Chen, Yi An
Presenter: Hui Zhang, CHANGCHUN TECHNICAL UNIVERSITY OF AUTOMOBILE, China

Abstract: Precise single-grain identification technology for rice seed images is of great significance for ensuring the purity and quality of rice seeds, safeguarding germplasm security, and ensuring stable and high-yield grain production. In recent years, although traditional convolutional neural network models can identify rice seed images to a certain extent, in practical applications, problems such as the inability to efficiently extract global effective features still need to be urgently solved. To address these issues, this paper proposes a rice seed classification and recognition algorithm based on the addition of dual-attention mechanism in the residual network. Using the ResNet-50 residual neural network as the backbone network, a Convolutional Block Attention Module(CBAM) is added to the input layer to enhance the ability to extract the channel and spatial detail characteristics of seed features. At the same time, an Efficient Channel Attention (ECA)module is introduced to enhance the extraction of key seed features while removing redundant and ineffective features. The experimental results show that when the CBAM is embedded in the conv1 of the backbone network and the ECA module is embedded in the conv2 of the backbone network, the seed identification effect is the best, and the recognition accuracy can reach 90.2%.

**CC1007**

16:00-16:15

Title: Vehicle recognition model based on their characteristics applying YOLO-v5
Authors: Elgar Cruz, Miguel Izquierdo, Roberto Montero
Presenter: Elgar Puma-Cruz, Universidad Peruana de Ciencias Aplicadas S.A.C., Peru

Abstract: Due to the deficiency in locating vehicles involved in incidents such as theft or accidents, we propose to use V-Localize, an artificial intelligence framework for continuous vehicle search and localization captured from live traffic videos based on inputted textual descriptions and rely on the YOLO-v5 deep learning model, thus overcoming the license plate dependency of vehicles, which could be altered, damaged, or missing. The methodology includes: (i) data collection, (ii) processing, (iii) training, and (iv) data evaluation. We use the VCoR dataset with 15 color classes and VRiV to evaluate the performance on live videos. The results show that YOLO-v5 has 9% higher accuracy than other algorithms, reaching a confidence level of 0.946. Experimental results show that one of the main advantages of the proposed continuous vehicle search and location framework is that it could be integrated into the ITS software solution to assist law enforcement, especially in critical cases, such as amber alerts or hit-and-run incidents.

**CC035**

16:15-16:30

Title: Research on Epileptic EEG Signal Feature Optimization and Classification via Improved Kingfisher Optimization Algorithm

Authors: Xinpeng Liu, Qiudong Yu
Presenter: Xinpeng Liu, Tianjin University of Technology and Education, China

Abstract: Epilepsy is a chronic neurological disorder caused by abnormal discharges of brain neurons, and its diagnosis relies on the precise analysis of electroencephalogram (EEG) signals. In this study, an improved kingfisher optimization algorithm (IPKO) was proposed for the feature optimization and classification of epileptic EEG signals. Firstly, the three - dimensional EEG signals were reduced to a two - dimensional space through principal component analysis (PCA). Secondly, the IPKO algorithm was used to extract 12 types of features, including mean value, standard deviation, peak - to - peak value, etc. Subsequently, a classification model was constructed based on XGBoost, achieving an accuracy of 89%. Key features (such as standard deviation, average power spectrum, etc.) were screened out through SHAP analysis. Further classification was carried out using the optimized feature subset, with the accuracy remaining at 87%, while the calculation time was significantly shortened. The experimental results indicate that the improved IPKO algorithm can effectively enhance the feature discrimination, and the optimized feature set reduces the computational complexity while ensuring the classification performance. This research provides a new approach for the rapid diagnosis of epilepsy.


CityWalk
TRAVEL RECORD
漫游城市
长春20个网红打卡地
多种路线
深度漫游城市
微信扫描二维码即可获取

# 值得N吃的！

## 长春 美食

## 长春旅游美食地图

微信扫描二维码即可获取

长春市商务局联合吉林省饮食

文化研究会以及美团联合打造

# Memo

# Memo