2025 第八届 IEEE 国际无人系统大会
特邀专题简介表

特邀专题名称

无人系统智能决策与学习控制

组织者

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3.赵涛，教授，四川大学

4.高洪波，研究员，中国科学技术大学

5. 魏冲锋，副教授，英国格拉斯哥大学

个人简介

丁飞，湖南大学机械与运载工程学院、整车先进设计制造技术全国重点实验室，副教授、博士生导师。本硕博就读于湖南大学车辆工程专业，2014-2018 年在中国汽车工程研究院从事汽车底盘技术开发，高级工程师。现就职于湖南大学机械与运载工程学院车辆工程系，一直从事于网联车辆行驶安全控制与动力学设计研究，主持和参与国家自科基金等国家级科研项目 6 项，参与编写教材 1 部，建设国家精品课程 1 门，在 IEEE Transactions 汇刊、Nonlinear Dynamics、Information Sciences、Vehicle System Dynamics 等国内外权威学术期刊发表论文近 40 篇，授权专利 10 余项。兼任《湖南大学学报（自然科学版）》、《重庆理工大学学报（自然科学版）》、《汽车工程学报》青年编委、中国汽车工程学会青年工作委员会委员、秘书处副秘书长等。

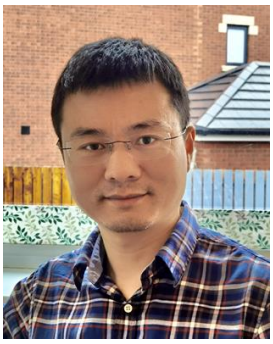
王亚飞，上海交通大学机械与动力工程学院教授，博士生导师，国家万人计划青年拔尖人才、交通运输部青年拔尖人才。现任上海交通大学机械与动力工程学院智能汽车研究所书记。研究方向为特种车辆自动驾驶、车路协同，发表中英文论文 100 余篇，授权发明专利 30 余项，主持国

家级和企业项目 30 余项，参与制定国家标准 5 项、我国无人矿山领域第一个系列团体标准。现任《IEEE Vehicular Technology Magazine》副主编、《ASME Journal of Dynamic Systems, Measurement, and Control》副主编、《汽车工程学报》青年编委、《汽车工程》青年编委、《中国公路学报》青年编委、中国汽车工程学会青委会副秘书长、中国指挥与控制学会无人系统专委会委员、中国自动化学会车辆控制与智能化专委会委员、中国人工智能学会智能驾驶专委会委员等职。获国际学术会议最佳论文奖/提名奖 4 项。

赵涛，教授，博士生导师，四川大学自动化系主任，研究领域涉及可解释人工智能、智能控制、智能机器人等。四川大学双百人才 B 计划入选者，四川大学好未来优秀学者奖获得者。四川省自动化与仪器仪表学会常务理事，中国电工技术学会青工委委员。担任《工程科学与技术》期刊青年编委和《Processes》期刊编委。主持国家自然科学基金面上项目、国家自然科学基金青年基金、国家重点研发计划子课题等省部级及以上项目 8 项，以第一作者或通讯作者发表 SCI 论文 60 余篇，其中 ESI 高被引论文 5 篇。著作/参编学术著作 2 部，以第一发明人授权中国发明专利 13 项，相关研究成果在在国家电网、中广核等单位得到应用。

高洪波，博士，中国科学技术大学信息科学与技术学院研究员、博士生导师。他于 2016 年 11 月在北航师从李德毅院士指导下获得博士学位，并曾在清华大学工作。主持了包括国家自然科学基金重点项目、科技部重点研发计划总体课题、子课题以及教育部人工智能专项在内的十余项项目，总资助超过 1200 万元人民币。作为第一作者/通讯作者，发表了 22 篇 JCR 一区/二区 SCI 论文（其中 16 篇发表在 JCR 一区顶级期刊），单篇 SCI 引用最高达 171 次，1 篇 ESI 高被引论文，Google Scholar 引用次数 1721 次，H 因子为 22，SCI 因子超过 5.0 的论文超过 20 篇，获得 5 项国际期刊会议论文奖。获得了 22 项发明专利，1 项美国专利和 1 项 PCT 专利。曾获安徽省杰青、安徽省“特支计划”创新领军人才、中国指挥与控制学会科技进步奖一等奖（排名第一）、中国通信学会科技创新青年奖、中国指挥与控

制学会优秀青年科学家奖、安徽省人工智能技术奖杰出奖（排名第三）等奖项。目前担任中国指挥与控制学会理事长、青年工作委员会副主任，安徽省机器人学会监事长、青年工作委员会主任，安徽省院士专家协会、安徽省科技人才企业家协会执行理事，中国指挥与控制学会青年工作委员会副主任。他还担任 IEEE TNNLS 和 TASE 两大人工智能领域顶级 SCI 期刊的副主编，《国际先进机器人系统》知名 SCI 期刊的副主编，两次 EI 期刊编委，九次领域主席和客座主编。曾多次受邀参加国际和国内会议发表演讲，次数超过 5 次。



魏冲锋，英国 EPSRC 机器人与智能系统青年委员会委员，英国高等教育协会会士，博士毕业于英国伯明翰大学，现任英国格拉斯哥大学副教授以及交互式智能系统课题组(IVA)负责人。作为 PI 和 Co-I 主持包括英国 EPSRC、欧盟 Horizon Europe、英国交通部、欧盟发展基金等项目在内的多项科研项目，总计经费超过£1200k。魏博士在智能驾驶、智能交通、动力学及其控制、人机交互等领域发表学术及会议论文 100 余篇，包括 ESI 热点论文一篇、高被引论文 6 篇，获得人机交互顶级会议 IEEE-ICHMS 大会最佳论文奖、机器人设计领域国际会议 MEDER 大会最佳论文奖、英国皇家学会 Robotics and AI 最佳学术研究奖 Finalist（青年组）、以及车辆动力学顶级会议 IAVSD 最佳学术海报奖。魏博士目前兼任 IEEE TITS, IEEE TVT, IEEE TIV, IEEE Open Journal ITS, Frontiers on Robotics and AI 等期刊副主编。

特邀专题简介

近年来，以移动机器人、自动驾驶汽车、港口和矿用车辆等为代表的无人系统自主化与智能化水平逐渐提升，在提高生产效率、保障人类安全等方面发挥了重要作用。这一进步的核心驱动力源于应用自然生物的学习机制赋予无人系统智能决策控制能力。目前，涉及多模态感知与融合方法、鲁棒智能控制算法、多智能体协作与博弈决策等的智能决策与学习控制技术已成为当前的研究热点，如协同编队及位姿控制、协同决策和数据驱动控制等。该类技术主要将人工智能、机器学习、强化学习等先进算法与无人系统相结合，使系统能够自主感知环境、规划任务、实时决策并优化控制策略，具备感知、决策、执行等“类人”行为属性，实现系统的高效、稳定、可靠运行。然而，由于无人系统

工作过程不可避免的遭遇动态变化、不可预测的非结构环境，装备参数及模型的不确定性，复杂的多目标优化任务，多智能体协作中的通信延迟、计算资源限制等问题，亟需突破无人系统智能决策与学习控制技术中高实时性要求下的感知与建模、多目标规划与不确定性推理、自适应控制与鲁棒性优化、多智能体协作的通信优化等挑战，以进一步提升无人系统适应性和泛化能力，以此有效推动无人系统产业升级和发展。

本特邀专题旨在汇聚移动机器人、自动驾驶汽车、港口和矿用车辆等无人系统智能决策与学习控制领域的最新研究成果、技术进展、概念创新及应用。我们诚挚邀请研究人员提交与这些前沿课题相关的原创性论文，特别是结合理论创新与实际应用的高质量论文，包括但不限于以下议题：

- 智能决策算法及其在无人系统中的应用
- 基于学习的控制方法（如强化学习、模仿学习、元学习等）
- 复杂环境下的路径规划与避障控制
- 多智能体协作与决策
- 高动态环境下的自适应控制
- 位姿估计与精准控制技术
- 不确定性环境下的鲁棒决策方法

IEEE ICUS 2025
Invited Session Summary

Title of Session

Intelligent Decision-Making and Learning Control for Unmanned Systems

Organizers

1. Assoc. Prof. Fei Ding

Hunan University, China

2. Prof. Yafei Wang

Shanghai Jiao Tong University, China

3. Prof. Tao Zhao

Sichuan University, China

4. Prof. Hongbo Gao

University of Science and Technology of China

5. Assoc. Prof. Chongfeng Wei

University of Glasgow, United Kingdom

Biosketches of Organizers

Fei Ding, Associate Professor and Doctoral Supervisor, School of Mechanical and Transportation Engineering, Hunan University, and the National Key Laboratory of Advanced Vehicle Design and Manufacturing Technology. He completed his Bachelor's, Master's, and Ph.D. studies in Vehicle Engineering at Hunan University. From 2014 to 2018, he worked as a Senior Engineer at the China Automotive Engineering Research Institute, specializing in automotive chassis technology development. Currently, he is a faculty member at the Department of Vehicle Engineering, School of Mechanical and Transportation Engineering, Hunan University, where his research focuses on connected vehicle safety control and dynamic design. He has led and participated in six national-level research projects, including those funded by the National Natural Science Foundation of China. He has also contributed to the development of one textbook and the establishment of a national excellent course. He has published nearly 40 papers in prestigious academic journals such as IEEE Transactions, Nonlinear Dynamics, Information Sciences, and Vehicle System Dynamics. Additionally, he holds more than 10 authorized patents. He serves as a Youth

Editorial Board Member for the Journal of Hunan University (Natural Sciences Edition), the Journal of Chongqing University of Technology (Natural Sciences Edition) and Journal of Automotive Engineering. He is also a member of the Youth Working Committee of the Society of Automotive Engineers of China (SAE-China) and serves as the Deputy Secretary-General of its Secretariat.

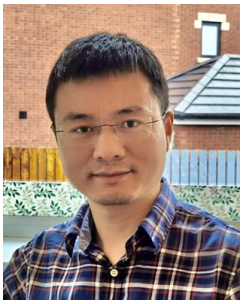
Yafei Wang, Professor, School of Mechanical and Power Engineering, Shanghai Jiao Tong University, National High-level Young Talent, Ministry of Transportation and Communications Young Top Talent. His research interests include unmanned mining vehicles, vehicle-road cooperative sensing and localization. Currently, he is the deputy director of the Intelligent Networked Electric Vehicle Innovation Center and the secretary of Intelligent Vehicle Research Institute in School of Mechanical and Power Engineering of Shanghai Jiao Tong University. He has presided over more than 40 key R&D projects of the Ministry of Science and Technology, the National Natural Science Foundation of China, and cooperative projects with enterprises and institutions, published more than 100 papers, and applied for/authorized more than 50 invention patents at home and abroad. Currently, he is the deputy editor-in-chief of IEEE Vehicular Technology Magazine, the youth editorial board member of Journal of Automotive Engineering, the youth editorial board member of Automotive Engineering, and the deputy secretary of the Youth Committee of the Chinese Society of Automotive Engineering, etc. He is also the deputy secretary of the Youth Committee of the Chinese Society of Automotive Engineering.

Tao Zhao, professor, doctoral supervisor, head of the Department of Automation at Sichuan University, his research area involves interpretable artificial intelligence, intelligent control, intelligent robotics and so on. He is a selected candidate of Sichuan University's Double Hundred Talents B Program, and a recipient of Sichuan University's Good Future Outstanding Scholar Award. He is the executive director of Sichuan Society of Automation and Instrumentation, and a member of the Youth Work Committee of the Chinese Society of Electrotechnology. He serves as a member of the Youth Editorial Board of the Journal of Engineering Science and Technology and the Editorial Board of the Journal of Processes. He has presided over 8 provincial and ministerial level projects, such as National Natural

Science Foundation of China (NSFC) top project, NSFC Youth Fund, National Key R&D Program sub-projects, etc. He has published more than 60 SCI papers as the first author or corresponding author, including 5 ESI highly cited papers. He has authored or co-authored 2 academic books, and has been authorized 13 Chinese invention patents as the first inventor, and the related research results have been applied in State Grid, CGN and other units.

Hongbo Gao, Ph.D., is a researcher and doctoral supervisor at the School of Information Science and Technology, University of Science and Technology of China. He received his Ph.D. in November 2016 from Beihang University under the guidance of Academician Deyi Li, and has worked at Tsinghua University. He has presided over more than ten projects including the key projects of the National Natural Science Foundation of China, the overall topics and sub-topics of the Key R&D Program of the Ministry of Science and Technology, as well as the Artificial Intelligence Special Project of the Ministry of Education, with a total funding of more than 12 million RMB. As the first author/corresponding author, he has published 22 JCR I/II SCI papers (16 of which were published in the top JCR I journals), with the highest single SCI citation of 171 times, 1 ESI highly cited paper, 1721 Google Scholar citations, an H-factor of 22, and more than 20 papers with an SCI factor of more than 5.0, and has won 5 International Journal Conference Paper Awards. Obtained 22 invention patents, 1 US patent and 1 PCT patent. He has been awarded the Anhui Jieqing, Anhui “Special Support Program” Innovation Leaders, the First Prize of Science and Technology Progress Award of China Command and Control Society (ranked first), the Youth Award of Scientific and Technological Innovation of China Communication Society, the Outstanding Young Scientist Award of China Command and Control Society, and the Outstanding Award of Artificial Intelligence Technology Award of Anhui Province (ranked third), among other prizes. Currently, he serves as the chairman of the board of directors and deputy director of the youth working committee of the Chinese Command and Control Society, the supervisor and director of the youth working committee of the Anhui Robotics Society, the executive director of the Anhui Academician and Expert Association and the Anhui Science and Technology Talent and Entrepreneur Association, and the deputy director of the youth working committee of the Chinese Command and Control Society. He also serves as Associate Editor of IEEE TNNLS and TASE, two

top SCI journals in the field of Artificial Intelligence, Associate Editor of International Advanced Robotic Systems, a well-known SCI journal, Editorial Board member of EI journals for two times, and Field Chair and Guest Editor-in-Chief for nine times. He has been invited to give speeches at international and national conferences more than five times.



Chongfeng Wei is a member of the UK EPSRC Early Career Forum in Robotics and Intelligent Systems and a Fellow of the UK Higher Education Academy (HEA). He obtained his PhD from the University of Birmingham, UK, and is currently an Associate Professor at the University of Glasgow, where he leads the Interactive Versatile Automation research group. As a Principal Investigator (PI) and Co-Investigator (Co-I), Dr. Wei has led multiple research projects funded by UK EPSRC, EU Horizon Europe, the UK Department for Transport, and the European Regional Development Fund, with total funding exceeding £1.2 million. Dr. Wei has published over 100 academic and conference papers in the fields of autonomous driving, intelligent transportation, dynamics and control, and human-machine interaction, including one ESI hot paper and six highly cited papers. He has received several prestigious awards, including: Best Paper Award at IEEE-ICHMS, Best Paper Award at MEDER, Royal Society Research Award Finalist in Robotics and AI (Early Career Category), Best Academic Poster Award at IAVSD. Dr. Wei currently serves as an Associate Editor for multiple journals, including IEEE TITS, IEEE TVT, IEEE TIV, IEEE Open Journal of ITS, and Frontiers in Robotics and AI.

Details of Session

In recent years, the autonomy and intelligence of unmanned systems, represented by mobile robots, autonomous vehicles, port vehicles, and mining trucks, have gradually advanced, playing a pivotal role in improving production efficiency and ensuring human safety. The driving force behind this progress is the application of learning mechanisms inspired by natural biological systems, which provide unmanned systems with intelligent decision-making and control capabilities. Currently, intelligent decision-making and learning control technologies involving multi-modal perception and fusion methods, robust intelligent control algorithms, multi-agent cooperation, and game-theoretic decision-making, have become hot topics of research. These include technologies such as cooperative formation and

pose control, collaborative decision-making, and data-driven control. These technologies mainly combine advanced algorithms such as artificial intelligence, machine learning, and reinforcement learning with unmanned systems, enabling them to autonomously perceive the environment, plan tasks, make real-time decisions, and optimize control strategies. They possess “human-like” behavioral attributes such as perception, decision-making, and execution, enabling efficient, stable, and reliable system operation. However, unmanned systems inevitably encounter dynamic and unpredictable unstructured environments during operation, along with uncertainties in equipment parameters and models, complex multi-objective optimization tasks, communication delays and computational resource constraints in multi-agent cooperation, among other issues. There is an urgent need to overcome challenges in perception and modeling under high real-time requirements, multi-objective planning and uncertainty reasoning, adaptive control and robustness optimization, and communication optimization in multi-agent cooperation within intelligent decision-making and learning control technologies for unmanned systems. Addressing these challenges is crucial for enhancing the adaptability and generalization capabilities of unmanned systems, effectively promoting the upgrade and development of the unmanned systems industry.

This special issue aims to bring together the latest research findings, technological advancements, conceptual innovations, and applications in the field of intelligent decision-making and learning control for unmanned systems, including mobile robots, autonomous vehicles, port vehicles, and mining trucks. We sincerely invite researchers to submit original papers related to these cutting-edge topics, especially high-quality papers combining theoretical innovations with practical applications, Topics include but are not limited to the following:

- Intelligent Decision-Making Algorithms and Their Applications in Unmanned Systems
- Learning-Based Control Methods (e.g., Reinforcement Learning, Imitation Learning, Meta-Learning, etc.)
- Path Planning and Obstacle Avoidance Control in Complex Environments
- Multi-Agent Cooperation and Decision-Making
- Adaptive Control in High-Dynamic Environments
- Pose Estimation and Precision Control Technologies
- Robust Decision-Making Methods in Uncertain Environments