

2024 第七届 IEEE 国际无人系统大会

特邀专题简介表

特邀专题名称

面向智能无人系统的感知、规划、控制和通信关键技术

组织者

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个人简介



胡满江，湖南大学教授。长期致力于智能网联技术及装备在城市出行、工程机械领域的产业应用。主持国家重点研发计划、国家自然科学基金、国防基础科研项目、国家重点实验室自主重点项目、重大校企合作项目 20 余项。发表高水平学术论文 70 余篇，参编行业报告 2 部，授权发明专利 20 余项、软件著作权 8 项；获国际会议最佳论文奖、全国高校科技论文奖等 4 项。



李洋，湖南大学机械与运载工程学院，助理教授。主要研究方向为智能网联汽车环境感知、交通参与者行为预测、风险评估、决策规划和运动控制等。近年来，在 IEEE TITS、TIV、AAP 等国内外著名期刊上发表高水平期刊论文 20 余篇，以核心骨干身份参与国家自然科学基金 2 项，横向项目 3 项。



边有刚，湖南大学机械与运载工程学院，副教授。主要研究方向为智能控制、协同控制及其在道路/水下运载装备运动控制中的应用。先后主持国家自然科学基金项目、整车先进设计制造技术国家重点实验室自主研究项目等 8 项、横向合作项目 4 项；发表学术论文 80 余篇，授权发明专利 30 余项；获

国际/国内学术奖 7 项、省级/校级教学奖 3 项。



高铭，湖南大学机械与运载工程学院，副研究员。主要研究领域为车路协同感知与预测、多型载运工具数字孪生系统。先后主持/核心参与了国家自然科学基金青年基金 1 项（课题负责人）、国家重点研发计划项目（子任务负责人）、全国重点实验室开放基金（课题负责人）、军委科技委重大项目（项目骨干）。

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刘巧斌，华南理工大学机械与汽车工程学院，副教授。主要研究方向为智能汽车决策、汽车 NVH 及可靠性。先后主持/参与国家自然科学基金项目、中央高校基本科研业务费、广州市基础与应用基础研究项目等 8 项；发表学术论文 20 余篇，授权发明专利 20 余项，获吉林省优秀博士学位论文奖励。



杨路，北京理工大学机械与车辆学院，助理教授。主要研究方向为智能汽车人机协同控制、车辆动力学等。主持及参与国家自然科学基金、国防基础科研项目等 3 项；在 IEEE Trans. , ASME Trans. , Nonlinear Dynamics, 汽车工程等国内外著名期刊上发表高水平学术论文 20 余篇；授权中国发明专利 11

项；获国际/国内学术奖励 2 项。



王力，北京理工大学助理教授。主持国家科技部重点研发计划子课题等 3 项，参与国家重点研发计划、国家自然科学基金等 12 个纵横向项目。主要研究自动驾驶及多栖运载平台复杂场景下融合感知算法，在 TITS、TIV、TVT、TMM、TCSVT、CVPR、ICCV 等中科院 TOP 刊和领域顶会发表论文 33 篇，授权国内专利 27 项，授权美国专利 5 项，出版自动驾驶感知相关书籍 1 部（Springer 出版）。

获得德国纽伦堡发明展览会金奖及中国（沈阳）智能网联汽车大赛金奖（排名 1）。所提出基于“外观-运动”组合优化的融合多目标跟踪算法 CAMO-MOT 在自动驾驶领域大规模数据集 nuScenes 三维跟踪评测榜单上排名第一，并建立首个面向中国城市复杂气候环境的自动驾驶 4D 成像毫米波数据集 Dual

Radar。

特邀专题简介

随着人工智能技术不断取得突破，智能无人系统在各个领域和行业都得到了成功应用，例如运输、农业、采矿、电网、应急救援等。凭借环境感知、决策规划、运动控制、集群编队、通信与人机交互、先进材料等不同技术的综合运用，无人系统能够具有更强的性能、更低的成本以及更出色的高危环境作业能力。按照其活动的物理空间，无人系统可以划分为无人机(UAVs)、无人车(UGVs)、无人潜航器(UUVs)和无人水面艇(USVs)等无人平台及相关的配套设备。近年来，知识驱动的方法、强化学习、大语言模型、世界模型、边缘计算、区块链等先进技术的涌现，进一步掀起了工业界和学术界对于智能无人系统的研究浪潮。然而，随着智能无人系统的应用逐渐拓展到更加广阔、更加严苛的领域时，如外太空、地下空间、人体等，智能无人系统的技术挑战将不断升级，对于相关技术革新也将更为迫切。

为了充分展示智能无人系统关键技术的最新进展和成果，推动关键理论突破和技术创新，本特邀专题邀请以下与“面向智能无人系统的感知、规划、控制和通信关键技术”主题相关的包含创新思想、概念、新发现、改进以及新应用的原创论文

投稿论文的主题包括但不限于：

- 智能无人机、无人车、无人潜航器、无人水面艇
- 智能无人系统环境感知
- 智能无人系统决策规划
- 智能无人系统运动控制
- 智能无人系统集群与协同
- 智能无人系统设计与应用
- 智能无人系统通信与人机交互

IEEE ICUS 2024
Invited Session Summary

Title of Session

Key Technologies of Perception, Planning, Control and Communication for
Intelligent Unmanned Systems

Organizers

1. Prof. Manjiang Hu

Hunan University, China

2. Prof. Yang Li

Hunan University, China

3. Prof. Yougang Bian

Hunan University, China

4. Prof. Ming Gao

Hunan University, China

5. Prof. Qiaobin Liu

South China University of Technology, China

6. Prof. Lu Yang

Beijing Institute of Technology, China

7. Prof. Li Wang

Beijing Institute of Technology, China

Biosketches of Organizers



Manjiang Hu is currently a Professor at Hunan University. He has been working on the industrial application of intelligent and connected vehicle technology and equipment in urban transportation and engineering machinery. He has led over 20 projects, including the National Key Research and Development Program, National Natural Science Foundation projects, National Defense Basic Scientific Research projects, National Key Laboratory Independent Key Projects, and major university-industry cooperation projects. He has published more than 70 high-level academic papers, co-authored two industry reports, obtained over 20 invention patents, and received eight software copyrights.



Yang Li is currently working as an Assistant Professor with Hunan University, Changsha, China. She worked as a postdoc at Algorithmics group of Delft University of Technology, the Netherlands. Her current research interests focus on intelligent and connects vehicles, including environmental perception, motion prediction, situational analysis, safe reinforcement learning-based decision making, and motion planning. In recent years, she has participated more than 5 projects and has published over 20 papers.



Yougang Bian (Member, IEEE) is currently an Associate Professor of Hunan University, Changsha, China. His research interests include distributed control, cooperative control, and their applications to connected and automated vehicles. Dr. Bian is a recipient of the Best Paper Award from 2017 IEEE Intelligent Vehicles Symposium. He has led eight projects funded by the National Natural Science Foundation of China and four collaborative projects. Over the years, he has published over 80 academic papers and more than 30 granted invention patents.



Ming Gao, Associate Researcher at the School of Mechanical and Vehicle Engineering, Hunan University. His primary research areas include vehicle-road cooperative perception and prediction, as well as digital twin systems for multi-modal transportation vehicles. He has successfully led or actively participated in various research projects, including one funded by the National Natural Science Foundation of China (as principal investigator), a sub-task of the National Key Research and Development Program project (as task leader), a project funded by the National Key Laboratory Open Fund (as principal investigator), and a major project supported by the Military Commission's Science and Technology Committee (as a key member). Gao has published over 10 papers in SCI/EI journals and holds more than 10 patents and copyrights for intellectual property, both domestically and internationally.



Qiaobin Liu is currently an Associate Professor of School of South China University of Technology, Guangzhou, China. His research interests include intelligent vehicles decision-making, automotive NVH, and reliability. He has led/participated 8 projects, including the National Natural Science Foundation of China, basic research business fees for central universities, and basic and applied basic research projects in Guangzhou. Over the years, he has published over 20 academic papers and more than 20 granted invention patents, and received the Excellent Doctoral Dissertation Award of Jilin Province.



Lu Yang is currently an Assistant Professor at the School of Mechanical and Vehicle Engineering, Beijing Institute of Technology. His primary research focuses on intelligent human-machine collaborative control in smart vehicles and vehicle dynamics. He has led and participated in three projects funded by the National Natural Science Foundation and the Defense Basic Research Program. Yang has published over 20 high-level academic papers in renowned domestic and international journals such as IEEE Transactions, ASME Transactions, Nonlinear Dynamics, and Automotive Engineering. He holds 11 granted patents in China for his inventions. Additionally, he has received two academic awards, one at the international level and another at the national level.



Li Wang, Assistant Professor at Beijing Institute of Technology. He has hosted three sub projects of the National Key Research and Development Program of the Ministry of Science and Technology, and participated in 12 projects such as the National Key Research and Development Program and the National Natural Science Foundation. His main research focuses on the fusion perception algorithm for autonomous driving and multi-amphibious transport platforms in complex scenarios. 33 papers have been published in the top journals and field conferences, such as TITS, TIV, TVT, TMM, TCSVT, CVPR, ICCV, etc. 27 patents have been granted, 5 US patents have been granted, and 1 book related to autonomous driving perception has been published (published by Springer). He has received the gold medal at the Nuremberg Invention Exhibition in Germany and the gold medal at the China (Shenyang) Intelligent Connected Vehicle Competition (ranked first). The proposed fusion multi-object tracking algorithm CAMO-MOT based on "appearance-motion" combination

optimization ranks first on the large-scale dataset nuScenes 3D tracking evaluation list in the field of autonomous driving, and establishes the first 4D Radar dataset “Dual Radar” for autonomous driving under complex climate environments in Chinese cities.

Details of Session

With continuous breakthroughs in artificial intelligence technology, intelligent unmanned systems (IUSs) have found successful applications in various fields and industries, such as transportation, agriculture, mining, power grids, and rescue operations. By integrating diverse technologies including environment perception, decision planning, motion control, cluster and collaboration, communication and human-machine interaction, advanced materials, etc., unmanned systems can achieve enhanced performance, reduced costs, and exceptional capabilities for operating in high-risk environments. Based on their physical space of operation, unmanned systems can be classified into unmanned aerial vehicles (UAVs), unmanned ground vehicles (UGVs), unmanned underwater vehicles (UUVs), and unmanned surface vessels (USVs), along with their associated equipment. In recent years, the emergence of knowledge-driven approaches, reinforcement learning, large language model, world model, blockchain, edge computing, and other advanced technologies has sparked a new wave of research in the industrial and academic communities focused on IUSs. However, as IUSs gradually extend their applications to broader and more demanding domains, such as underground space, deep space, and even human body, the technological challenges of IUSs will continue to escalate, calling for more urgent advancements in relevant technologies.

This special issue solicits original research papers with innovative ideas, concepts, new findings, improvements, and novel applications that are relevant to the topic of “Key Technologies of Perception, Planning, Control and Communication for Intelligent Unmanned Systems”.

Some topics of interest include (but are not limited to) the following:

- Intelligent unmanned aerial vehicles (UAVs), unmanned ground vehicles (UGVs), unmanned underwater vehicles (UUVs), and unmanned surface vessels (USVs).
- Environment perception for intelligent unmanned systems.
- Decision-making and planning for intelligent unmanned systems.
- Motion control of intelligent unmanned systems.

- Cluster and cooperative control of intelligent unmanned systems.
- Design and applications of intelligent unmanned systems.
- Communication and human-machine interaction for intelligent unmanned systems.