

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

无人系统的自主定位、建图与导航

组织者

1. 徐阳，助理研究员，浙江大学
2. 李亮，研究员，浙江大学
3. 王恒，教授，北京科技大学
4. 孔贺，研究员，南方科技大学
5. 施琳琳，讲师，华南农业大学

个人简介



徐阳，浙江大学控制学院助理研究员/博士后，浙江大学博士（2023 年），悉尼科技大学 CSC 联合培养博士，入选 2024 年度博士后创新人才支持计划推荐名单（“博新计划”，控制学科）。主要从事机器人定位、建图与规划研究，近年来在机器人领域国际权威刊物 IEEE T-ASE、IEEE RAL、IEEE TIM、RAS、ICRA、IROS 等发表论文十余篇，授权国家发明专利 3 项，主持中国博士后科学基金等科研项目 3 项，作为项目骨干参与科技创新 2030-新一代人工智能重大项目、NSFC 联合重点/面上等多项国家级项目。担任机器人权威会议 IEEE RO-MAN 2024 Associate Editor、ICRA 2024 SLAM 会场共同主席、CAA PRE-ICRA 2024 分会场主席等，现为 IEEE/CAA JAS、TIM、IEEE Sensor Journal、Measurement Science & Technology、ICRA、IROS、AIM 等主流刊物审稿人，曾获浙江大学博士生学术新星和博士生国家奖学金等。



李亮，浙江大学百人计划研究员、博士生导师，入选国家高层次青年人才计划，浙江大学启真优秀青年学者，2013 年本科毕业于哈尔滨工业大学，2018 年获上海交通大学博士学位。2019 年至 2022 年分别在荷兰埃因霍温理工大学、英国伦敦大学学院从事博士后研究工作。主要研究方向为移动机器人、无人驾驶、SLAM 中的特征提取、特征匹配、

位姿图优化、多传感器融合等研究。作为核心成员曾参与 Drive4All、Frontiers in Autonomous Systems Technology (FAST)、GIFT-Surg 等无人车/机器人项目多项，主持国家自然科学基金项目、CCF-腾讯犀牛鸟基金。发表期刊及会议论文二十余篇，其中以第一作者身份在机器人领域权威期刊 IEEE T-RO、RAL、TIP 等发表论文多篇，担任智能车领域旗舰期刊 IEEE Transactions on Intelligent Transportation Systems 编委 (AE, Associate Editor)、IROS 等机器人领域权威会议 AE。



王恒，北京科技大学自动化学院教授、博士生导师。2008 年 7 月毕业于东北大学，2008 年 7 月至 2014 年 3 月在北京工业大学电子信息与控制工程学院工作，期间 2010 年 7 月至 2011 年 7 月在澳大利亚悉尼科技大学从事 Research Fellow 工作。2014 年 4 月至 2015 年 11 月在新加坡科技研究局 (A*STAR) 资讯通信研究院 (I2R) 无人驾驶部任研究科学家。

2015 年 12 月至 2018 年 4 月被聘为东北大学信息科学与工程学院副教授。2018 年 5 月起在北京科技大学工作至今。担任《International Journal of Advanced Robotic Systems》、IROS 国际期刊/会议副主编。主要研究方向为无人车环境感知与控制、同时定位与地图构建 (SLAM) 等。作为课题负责人承担科技创新 2030-重大项目 1 项，主持及参与国家自然科学基金项目共 6 项，在 Automatica、自动化学报等国内外学术期刊发表 SCI 检索论文 40 余篇。



孔贺，南方科技大学研究员，博士生导师，主持国家海外高层次人才（青年项目）、国家自然科学基金委原创探索计划项目；广东省重点实验室、深圳市重点实验室、深圳市孔雀团队计划核心成员。主要致力于机器人的多模态感知及融合（视觉与听觉），最优滤波与参数辨识，先进控制方法在机器人与航天中的应用。本硕博

分别毕业于中国矿大、哈工大（导师：段广仁）、澳大利亚 Newcastle 大学（导师：澳大利亚两院院士 Graham Goodwin）。曾任悉尼大学野外机器人研究中心博士后（合作导师：澳大利亚工程院院士 Salah Sukkarieh），从事野外机器人技术及其农业应用方面的研究。曾获 IFAC 1st Workshop on Robot Control

最佳青年论文提名奖。担任国际机器人与自动化领域主流期刊 IEEE RAL、IEEE RAM、IEEE Sensors Letters、International Journal of Adaptive Control and Signal Processing 副主编、《智慧农业（中英文）》青年编委以及机器人领域多个主流会议副主编，包括 IEEE ICRA、IEEE/RSJ IROS、IEEE CASE 等。



施琳琳，华南农业大学讲师，硕士生导师。2022 年 6 月博士毕业于浙江大学控制理论与控制工程专业，曾获浙江大学优秀博士学位论文。主要研究方向包括多机器人的协同控制与优化、海洋环境感知与处理、以及多无人机在农业上的应用等，以第一作者身份在 Automatica、IEEE Trans.、CDC 等控制领域国际权威期刊与会议发表论文 10 余篇。现主持国家自然科学基金青年基金、广东省自然科学基金面上项目、广州市科技计划项目等多项课题，先后主要参与国自然联合基金项目、国自然面上等科研工作。现为中国自动化学会青年工作委员会委员，中国自动化学会强化学习与自适应动态规划专业委员会委员，中国人工智能学会青年工作委员会委员。

特邀专题简介

随着近年来人工智能技术的快速发展，地面机器人、无人机、无人潜航器等无人系统愈发智能化和自主化，而无人系统面临的场景和作业环境也愈发复杂多变，对无人系统的自主环境感知能力，尤其是对自主定位、环境地图构建和自主导航能力提出了更高要求，这也成为国内外无人系统领域的研究热点和难点。在此背景下，本专题将着重探讨无人系统同步定位与建图（SLAM）等相关理论与技术的最新进展，从无人系统的单体智能到多体协同，从常规环境到未知复杂环境，从传统方法到数据驱动方法，旨在促进无人系统自主定位、建图与导航等新技术、新研究及相关行业应用。

本特邀专题邀请以下主题相关的新思想、新概念、新发现、改进以及新应用的原创学术论文，包括但不限于：

- 无人系统的定位、建图与导航（视觉、激光、声学等）
- 无人系统的环境自主探索
- 无人系统的多机协同 SLAM
- 大尺度复杂环境 SLAM

- SLAM 中的环境表征方法
- SLAM 数据集与评测基准

IEEE ICUS 2024

Invited Session Summary

Title of Session

Autonomous Localization, Mapping, and Navigation of Unmanned Systems

Organizers

1. Dr. Yang Xu

Zhejiang University, China

2. Prof. Liang Li

Zhejiang University, China

3. Prof. Heng Wang

University of Science and Technology Beijing, China

4. Prof. He Kong

Southern University of Science and Technology, China

5. Dr. Linlin Shi

Southern China Agricultural University, China

Biosketches of Organizers



Dr. Yang Xu has been an assistant researcher and postdoctoral fellow at the College of Control Science and Engineering, Zhejiang University, since 2023. He obtained his Ph.D. from Zhejiang University in 2023 and was a joint Ph.D. student at the University of Technology Sydney, Australia. His primary research focuses on robotic SLAM, exploration, and path planning. He has published over ten papers in leading robotics journals such as IEEE Transactions on Automation Science and Engineering (T-ASE), IEEE Robotics and Automation Letters (RAL), IEEE Transactions on Instrumentation and Measurement (TIM), and Robotics and Autonomous Systems (RAS). He holds three national invention patents and has led three research projects. As a key member, he has participated in several major national projects, including the Science and Technology Innovation 2030 Major Project and NSFC joint key/general projects. He has presented orally multiple times at top robotics conferences such as ICRA and IROS. He has served as the Associate Editor for IEEE RO-MAN 2024, SLAM session co-chair for ICRA 2024 and session chair for CAA- Hybrid Intelligence Committee PRE-ICRA 2024. He is also a reviewer for over 10 mainstream journals, including IEEE/CAA Journal of

Automatica Sinica (JAS), IEEE TIM, IEEE Sensor Journal, Measurement Science and Technology, ICRA, IROS, and AIM. He was suggested for the 2024 China Postdoctoral Innovation Talents Support Program and a recipient of Zhejiang University Academic Rising Star Program for Ph.D. students.



Prof. Liang Li is a Hundred Talents Program researcher and Ph.D. supervisor at Zhejiang University. He is a recipient of the National High-Level Young Talent Program and the Qi Zhen Outstanding Young Scholar at Zhejiang University. He received his bachelor's degree from Harbin Institute of Technology in 2013 and his Ph.D. from Shanghai Jiao Tong University in 2018. From 2019 to 2022, he conducted postdoctoral research at Eindhoven University of Technology in the Netherlands and University College London in the UK. His primary research areas include mobile robotics, autonomous driving, feature extraction and matching in SLAM, pose graph optimization, and multi-sensor fusion. As a core member, he has participated in several unmanned vehicle/robot projects, including Drive4All, Frontiers in Autonomous Systems Technology (FAST), and GIFT-Surg. He has led projects funded by the National Natural Science Foundation and the CCF-Tencent Rhino-Bird Fund. He has published over twenty journal and conference papers, with several first-author papers in leading robotics journals such as IEEE Transactions on Robotics (T-RO), IEEE Robotics and Automation Letters (RAL), and IEEE Transactions on Image Processing (TIP). He serves as an Associate Editor for the flagship journal in the intelligent vehicle field, IEEE Transactions on Intelligent Transportation Systems, and as an Associate Editor for major robotics conferences such as IROS.



Dr. Heng Wang is a professor and Ph.D. supervisor at the School of Automation, University of Science and Technology Beijing. He graduated from Northeastern University in July 2008 and worked at the School of Electronic Information and Control Engineering, Beijing University of Technology, from July 2008 to March 2014. During this period, he also worked as a Research Fellow at the University of Technology Sydney, Australia, from July 2010 to July 2011. From April 2014 to November 2015, he served as a Research Scientist in the Autonomous Driving Division at the Institute for Infocomm Research (I2R), Agency for Science, Technology and Research (A*STAR), Singapore. He was appointed as an associate

professor at the School of Information Science and Engineering, Northeastern University, from December 2015 to April 2018. Since May 2018, he has been with the University of Science and Technology Beijing. He serves as associate editors for international journal/conference such as International Journal of Advanced Robotic Systems and IROS. His primary research areas include environmental perception and control for unmanned vehicles and Simultaneous Localization and Mapping (SLAM). As a project leader, he has undertaken one major project under the Science and Technology Innovation 2030 Program and has led or participated in six projects funded by the National Natural Science Foundation. He has published over 40 SCI-indexed papers in domestic and international academic journals, including Automatica and Acta Automatica Sinica.



Dr. He Kong is currently a Research Professor (Ph.D. supervisor) with Southern University of Science and Technology, Shenzhen, China, since 2022. He received the Bachelor's degree in Electrical Engineering from China University of Mining and Technology, Xuzhou, China, Master's degree in Control Science and Engineering from Harbin Institute of Technology, Harbin, China, and the Ph.D. degree in Electrical Engineering from the University of Newcastle, Australia, respectively. He was a Research Fellow at the Australian Centre for Field Robotics, the University of Sydney, Australia, during 2016–2021. His research interests include active multi-modal perception, robot audition, state estimation, control applications. He is currently serving on the editorial board of IEEE Robotics and Automation Letters, IEEE Robotics and Automation Magazine, IEEE Sensor Letters, International Journal of Adaptive Control and Signal Processing, the Journal of Smart Agriculture. He has also served as an Associate Editor for several international conferences in robotics and automation, including the IEEE ICRA (2023, 2024), IEEE/RSJ IROS (2023, 2024), the IEEE CASE (2024). He was a co-recipient of Finalist for Youth Author Prize at the IFAC 1st Workshop on Robot Control in 2019.



Dr. Linlin Shi received the B.E. degree in electrical engineering and automation from Zhejiang University of Technology, Hangzhou, China, in 2016, and the Ph.D. degree in control theory and control engineering at Zhejiang University, Hangzhou, China, in 2022. She is currently a Lecturer (Master supervisor) with the College of Engineering, South China Agricultural University, Guangzhou, China. Her research interests include cooperative control and optimization of multiple robots, marine environment perception and processing, and the application of multiple UAVs in agriculture, etc. She has published over 10 papers in major international journals and conferences such as *Automatica*, *IEEE Transactions*, *CDC*, etc. She has led 3 projects including the Youth Program of National Natural Science Foundation of China, and the General Program of the Natural Science Foundation of Guangdong Province.

Details of Session

In recent years, with the rapid development of artificial intelligence technologies, unmanned systems such as ground robots, drones, and unmanned underwater vehicles have become increasingly intelligent and autonomous. The task scenarios and operational environments faced by these unmanned systems have also become more complex and dynamic. This has imposed higher requirements on the autonomous environmental perception capabilities of unmanned systems, particularly in terms of autonomous localization, environmental mapping, and autonomous navigation. These challenges have emerged as prominent research hotspots and difficulties within the field of unmanned systems, both domestically and internationally. Against this backdrop, this invited session will focus on the latest advancements in theories and technologies related to Simultaneous Localization and Mapping (SLAM) for unmanned systems. Topics will span from the intelligence of individual unmanned systems to multi-agent coordination, from conventional environments to unknown complex environments, and from traditional methods to data-driven approaches. The aim of this invited session is to promote new technologies, research, and applications in autonomous localization, mapping, and navigation of unmanned systems.

We invite original academic papers presenting new ideas, concepts, discoveries, improvements, and applications related to the following topics, including but not limited to:

- Localization, mapping, and navigation of unmanned systems (using vision, laser, acoustic, etc.)
- Autonomous environmental exploration of unmanned systems
- Multi-agent collaborative SLAM of unmanned systems
- SLAM in large-scale complex environments
- Environmental representation methods in SLAM
- SLAM datasets and benchmarks