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

自主系统认知导航

组织者

1. 杨毅，教授，北京理工大学

2. 岳裕丰，教授，北京理工大学

3. 王元哲，教授，山东大学

4. 王越，教授，浙江大学

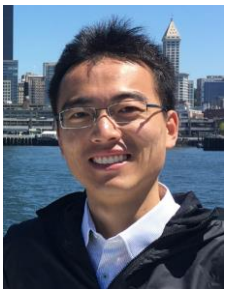
5. 邢伯阳，副研究员，国家地方共建人形机器人创新中心

个人简介

杨毅，北京理工大学自动化学院教授、博士生导师，国家级领军人才，长期从事陆上无人系统自主导航方向的教学与科研工作，现担任北京理工大学“特立笃行”（IN2Bot）陆上无人系统研究方向负责人；北京理工大学 ININ 与普林斯顿大学 PAVE“汽车主动安全技术”联合实验室副主任；全国大学生机器人大赛（ROBOCON）专家委员会委员兼裁判长等。承担国家自然科学基金和某领域预研等重要科研项目多项，发表学术论文 50 余篇，授权发明专利 40 余项，参与出版专著、教材 3 部，2020 年以第二完成人获得国家科技进步一等奖，2017 年以第一完成人获得某领域科技进步一等奖 1 项，获得“跨越险阻 2018”陆上无人系统挑战赛地空协同搜索第一名。

岳裕丰，北京理工大学自动化学院教授、博士生导师，入选国家级青年人才计划和中国科协青年人才托举工程，长期从事自主移动机器人感知与导航研究，具体研究方向包括：具身智能与机器人学习、多模态感知与空间智能、开放环境自主导航等，承担重点研发课题、面上项目等科研项目，在 IEEE TNNLS、IEEE TMech、IEEE RAL、NeurIPS、ICRA 等 SCI 期刊和 EI 会议发表论文 60 余篇，获 2021 IEEE ICUS 最佳论文奖、2020 IEEE ICARCV 最佳论文奖，

指导学生获第七届中国国际“互联网＋”大学生创新创业大赛金奖，担任 IEEE RAS 自主地面车辆技术委员会共同主席；IEEE RAL、ICRA、IROS 等期刊和会议副主编；ICRA、IROS、ICUS 等多个国际会议程序委员会委员、分论坛主席。



王元哲，山东大学控制科学与工程学院教授，博士生导师，国家级青年人才，山东大学杰出中青年学者。长期从事智能机器人技术研究，具体研究方向包括：多模态融合感知、多机器人协同导航、人机交互等，承担国家自然科学基金、新加坡国家机器人计划等项目。出版 Springer 英文专著 1 部，发表论文 30 余篇，获 2020 ICARCV 最佳论文奖。担任国际期刊 JFR、TIV、L-CSS 和国际会议 IROS、IV 编委。

王越，教授，浙江大学控制科学与工程学院。近五年来以通讯作者发表 Nature Communication、IJRR、TPAMI、TRO、IJCV 等期刊论文 30 多篇，发表 RSS、ICRA、IROS 等领域顶会 30 多篇，论文入选 ESI 高被引，获 ICRA 最佳视觉论文，IROS 最佳设计论文提名等论文奖 5 次，入选年度全球前 2%顶尖科学家榜单。担任期刊 IEEE Robotics and Automation Letters 编委、ICRA/IROS 编委等。获中国发明协会创业创新奖二等奖（排名 1）等。主持科技部重点研发计划课题、国家自然科学基金、浙江省自然科学基金重大项目等。

邢伯阳，国家地方共建人形机器人创新中心、硕士生导师，副研究员。2019 年博士毕业于北京理工大学，主要研究方向为仿生机器人运动控制、组合行为规划以及类人智能控制技术，近年来研制了幽灵蛛、Tinymal-B 等系列轻小型仿生四足机器人，在现有分层控制理论与模型控制理论基础上融合动觉智能控制机理，提出了以力觉感知驱动下的组合行为重规划以及事件触发方法。作为负责人承担军委科技委项目 1 项，省级重点项目 1 项；作为主要参与人员牵头国防科工局重点项目 1 项，参与国家自然基金面上项目 1 项；累计发表 SCI/EI 检索论文 6 篇，申请国家发明专利 6 项。

特邀专题简介

目前，大模型、具身智能等新一代人工智能技术发展迅速，导航技术的内涵和外延也被极大拓展。认知导航通过与环境交互实现学习、发育和演进，是认知科学、惯性技术、人工智能等学科与应用场景深度交叉融合的全新导航范式。面向“适应环境-适应任务-适应平台”的导航技术发展趋势，亟需深入研究具有“会、懂、博、学”能力的认知导航技术，为自主系统提供信息源和决策力。本次专题会议将重点讨论自主系统的最新进展，包括感知、定位、建图、导航、控制、机器学习、多机器人系统及相关应用案例。

本次专题会议将为全球科学家，工程师和相关从业人员搭建交流平台，介绍各自在自主系统认知导航领域取得的最新理论和技术进展。本次专题会议的主题包括但不限于以下领域：

- 生物导航认知机制；
- 认知导航数理基础；
- 认知导航计算模型；
- 自主系统空间认知；
- 自主系统行为学习；
- 自主系统世界模型；
- 开放环境认知导航；
- 异构具身智能协作；
- 自主系统认知导航在建筑，农业，救援或侦察等场景的应用。

IEEE ICUS 2025
Invited Session Summary

Title of Session

Cognitive Navigation for Autonomous Systems

Organizers

1. Prof. Yi Yang

Beijing Institute of Technology, China

2. Prof. Yufeng Yue

Beijing Institute of Technology, China

3. Prof. Yuanzhe Wang

Shandong University, China

4. Prof. Yue Wang

Zhejiang University, China

5. Prof. Boyang Xing

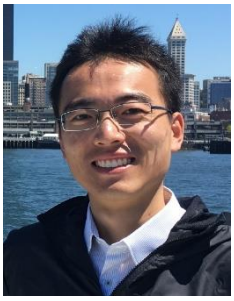
National and Local Co-built Humanoid Robot Innovation Center, China

Biosketches of Organizers

Yi Yang, professor and doctoral supervisor of School of Automation, Beijing Institute of Technology, national-level leading talent. He has been engaged in teaching and research of autonomous navigation of land unmanned systems for a long time. Currently, he serves as the head of research in the field of land-based unmanned systems under the 'IN2Bot' project at Beijing Institute of Technology. He is also the deputy director of the joint laboratory for active automotive safety technology between Beijing Institute of Technology (ININ) and Princeton University (PAVE). Additionally, he serves as a member and chief referee of the Expert Committee for the National University Robot Contest (ROBOCON), hosted by the Communist Youth League Central Committee. He has undertaken multiple important research projects funded by the National Natural Science Foundation and pre-research in certain fields, published over 50 academic papers, obtained over 40 authorized invention patents, co-authored 3 monographs and textbooks, won the first prize in National Science and Technology Progress Award as the second contributor in 2020, won one first prize in the field of science and technology progress as the first contributor in 2017, and achieved first

place in the 'Overcoming Obstacles 2018' Land-based Unmanned Systems Challenge for Ground-Air Cooperative Search.

Yufeng Yue, a professor and doctoral supervisor at the School of Automation, Beijing Institute of Technology, was selected for the national youth talent program in 2021 and was included in the China Association for Science and Technology's youth talent nurturing program in 2020. He has been engaged in research on autonomous mobile robot perception and navigation for an extended period. His specific research directions include multimodal deep learning and cognition, real-time localization and 3D scene reconstruction, and multi-robot collaborative navigation and control. He has undertaken projects funded by the National Natural Science Foundation and others. He has published one English monograph with Springer and over 40 papers in SCI journals such as IEEE TIE, IEEE TMech, NeurIPS, ICRA, and conferences indexed by EI. He has received the Best Paper Award at the 2021 IEEE ICUS and the 2020 IEEE ICARCV. He has guided students to win the gold prize at the Seventh China International "Internet Plus" University Students Innovation and Entrepreneurship Competition. He serves as the Young Chair of the IEEE RAS Autonomous Ground Vehicles Technical Committee, Vice Editor-in-Chief of IROS (2020-2024), and member of the program committee and sub-forum chair for multiple international conferences such as ICRA, IROS, and ICUS.



Yuanzhe Wang, is a Professor at the School of Control Science and Engineering, Shandong University. His research interests include multimodal fusion perception, multi-robot collaborative navigation, and human-robot interaction. He has led projects funded by National Natural Science Foundation of China, Singapore National Robotics Programme, etc. He has published a monograph in Springer and over 30 academic papers, and he received the Best Paper Award at ICARCV 2020. He serves as an Associate Editor for international journals such as the Journal of Field Robotics, IEEE Transactions on Intelligent Vehicles, and IEEE Control Systems Letters, and he is also a member of the editorial boards for international conferences including IROS and IV.

Yue Wang, Professor at the College of Control Science and Engineering, Zhejiang University. Over the past five years, he has published more than 30 journal papers as the corresponding author in top journals such as Nature Communications, IJRR, TPAMI, TRO, and IJCV, and more than 30 papers in leading conferences like RSS, ICRA, and IROS. His papers have been selected as ESI highly cited, and he has received five awards, including the ICRA Best Vision Paper, IROS Best Design Paper nomination, and others. He has been ranked among the top 2% of global scientists. He serves as an editorial board member for the journal IEEE Robotics and Automation Letters and for conferences like ICRA/IROS. He has won the second prize of the Entrepreneurship and Innovation Award from the China Association of Invention (Ranked 1st) and other accolades. He is the principal investigator for key projects under the Ministry of Science and Technology's Major Research and Development Program, the National Natural Science Foundation of China, and the Zhejiang Provincial Natural Science Foundation.

Boyang Xing, National and Local Co-built Humanoid Robot Innovation Center, Master's Supervisor, and Associate Researcher. He graduated with a PhD from Beijing Institute of Technology in 2019. His main research areas include motion control, combinatorial behavior planning, and humanoid intelligent control technology for biomimetic robots. In recent years, He has developed a series of light and small biomimetic quadruped robots such as Phantom Spider and Tinymal-B. Based on existing hierarchical control theory and model control theory, he has integrated motion sensing intelligent control mechanisms and proposed a combination behavior reprogramming and event triggering method driven by force sensing. As the person in charge, he's responsible for 1 project of the Military Commission Science and Technology Committee and 1 provincial key project; As a key participant, he led one key project of the National Defense Science and Industry Bureau and participated in one general project of the National Natural Science Foundation of China; he has published 6 SCI/EI search papers and applied for 6 national invention patents.

Details of Session

Currently, new-generation AI technologies such as large language models and embodied intelligence are developing rapidly, significantly expanding the connotation and extension of navigation technologies. Cognitive navigation, which achieves learning, development, and evolution through environmental interaction, represents a novel navigation paradigm deeply integrating cognitive science, inertial technology, artificial intelligence, and application scenarios. In response to the trend of navigation technologies evolving towards "environmental adaptation-task adaptation-platform adaptation," we aim to thoroughly investigate cognitive navigation capabilities characterized by "competence, comprehension, versatility, and learning," thereby providing information sources and decision-making power for autonomous system cognitive navigation. This special session will focus on the latest advancements in autonomous systems, including perception, localization, mapping, navigation, control, machine learning, multi-robot systems, and related application cases.

This session will establish an exchange platform for global scientists, engineers, and practitioners to present cutting-edge theoretical and technological progress in autonomous system cognitive navigation. Topics include but are not limited to:

- Biological navigation cognitive mechanisms
- Mathematical foundations of cognitive navigation
- Computational models for cognitive navigation
- Spatial cognition in autonomous systems
- Behavioural learning in autonomous systems
- World models for autonomous systems
- Cognitive navigation in open environments
- Collaboration of heterogeneous embodied intelligence
- Applications of autonomous system cognitive navigation in scenarios such as construction, agriculture, rescue, and reconnaissance.