

Xusheng Luo

Assistant Professor | North Carolina State University

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Academic and Professional Employment

North Carolina State University	Raleigh, NC
• Assistant Professor, Department of Mechanical and Aerospace Engineering (MAE)	2026 – Present
Carnegie Mellon University	Pittsburgh, PA
• Research Scientist at the Robotics Institute, School of Computer Science	2025 – 2026
• Postdoctoral Fellow at the Robotics Institute, School of Computer Science	2023 – 2025
• Advisor: Changliu Liu	
Dajiang Software Technology Co. Ltd	Shenzhen, China
• Autonomous Driving Research Engineer, Decision Making and Planning	2021 – 2023

Education

Duke University	Durham, NC
• Ph.D. in Mechanical Engineering (Robotics)	2017 – 2020
• M.S. in Mechanical Engineering (Robotics)	2017 – 2020
• Advisor: Michael M. Zavlanos	
• Dissertation: Scalable Control Synthesis for Multi-Robot Systems under Temporal Logic Specifications	
Harbin Institute of Technology	Harbin, China
• M.S. in Aerospace Engineering	2015 – 2017
• B.S. in Aerospace Engineering	2011 – 2015

Publications

* indicates equal contribution; ‡ indicates equal advising.

Refereed Journal Publications

- [1] **Xusheng Luo**, Changliu Liu, “Simultaneous Task Allocation and Planning for Multi-Robots under Hierarchical Temporal Logic Specifications”. *IEEE Transactions on Robotics*, 2025. DOI: [10.1109/TRO.2025.3598139](https://doi.org/10.1109/TRO.2025.3598139)
- [2] Shaojun Xu*, **Xusheng Luo***, Yutong Huang, Letian Leng, Ruixuan Liu, Changliu Liu, “NL2HLL2PLAN: Scaling Up Natural Language Understanding for Multi-Robots Through Hierarchical Temporal Logic Task Representation”. *IEEE Robotics and Automation Letters*, 2025. DOI: [10.1109/LRA.2025.3598648](https://doi.org/10.1109/LRA.2025.3598648)
- [3] **Xusheng Luo**, Tianhao Wei, Simin Liu, Ziwei Wang, Luis Mattei-Mendez, Taylor Loper, Joshua Neighbor, Casidhe Hutchison, and Changliu Liu. “Certifying Robustness of Learning-Based Key-point Detection and Pose Estimation Methods”. *ACM Transactions on Cyber-Physical Systems* 9, no. 2 (2025): 1-26. DOI: [10.1145/372836](https://doi.org/10.1145/372836)
- [4] **Xusheng Luo**, Shaojun Xu, Ruixuan Liu and Changliu Liu. “Decomposition-based Hierarchical Task Allocation and Planning for Multi-Robots under Hierarchical Temporal Logic Specifications”. *IEEE Robotics and Automation Letters*, 2024, with presentation at ICRA 2025. DOI: [10.1109/LRA.2024.3412589](https://doi.org/10.1109/LRA.2024.3412589)
- [5] **Xusheng Luo** and Michael M Zavlanos. “Temporal Logic Task Allocation in Heterogeneous Multi-robot Systems”. *IEEE Transactions on Robotics*, 38(6):3602-3621, 2022. DOI: [10.1109/TRO.2022.3181948](https://doi.org/10.1109/TRO.2022.3181948)

- [6] **Xusheng Luo**, Yiannis Kantaros, and Michael M Zavlanos. “An Abstraction-Free Method for Multi-robot Temporal Logic Optimal Control Synthesis”. *IEEE Transactions on Robotics*, 37(5):1487–1507, 2021. DOI: [10.1109/TRO.2021.3061983](https://doi.org/10.1109/TRO.2021.3061983)
- [7] **Xusheng Luo**, Miroslav Pajic, and Michael M. Zavlanos. “An Optimal Graph-Search Method for Secure State Estimation”. *Automatica* 123 (2021): 109323. DOI: [10.1016/j.automatica.2020.109323](https://doi.org/10.1016/j.automatica.2020.109323)

Refereed Conference Proceedings

- [8] **Xusheng Luo** and Changliu Liu. “From Decoupled to Coupled: Robustness Verification for Learning-based Keypoint Detection with Joint Specifications”. *International Conference on Neuro-Symbolic Systems (NeuS)*, 2026. [\[paper\]](#)
- [9] Yiyuan Pan*, **Xusheng Luo***, Hanjiang Hu, Peiqi Yu, Changliu Liu. “Emergent Neural Automaton Policies: Learning Symbolic Structure from Visuomotor Trajectories”. *Robotics: Science and Systems (RSS)*, 2026. [\[paper\]](#)
- [10] Zhongqi Wei*, **Xusheng Luo***, Changliu Liu, “Hierarchical Temporal Logic Task and Motion Planning for Multi-Robot Systems”. *Robotics: Science and Systems (RSS)*, 2025. DOI: [10.15607/RSS.2025.XXI.099](https://doi.org/10.15607/RSS.2025.XXI.099)
- [11] Tianhao Wei, Luca Marzari, Kai Yun, Hanjiang Hu, Peizhi Niu, **Xusheng Luo** and Changliu Liu. “ModelVerification.jl: a Comprehensive Toolbox for Formally Verifying Deep Neural Networks”. *International Conference on Computer Aided Verification*, pp. 395-408. Cham: Springer Nature Switzerland, 2025. DOI: [10.1007/978-3-031-98679-6_18](https://doi.org/10.1007/978-3-031-98679-6_18)
- [12] Shiqi Sun, Yan Zhang, **Xusheng Luo**, Panagiotis Vlantis, Miroslav Pajic, and Michael M. Zavlanos. “Formal Verification of Stochastic Systems with ReLU Neural Network Controller”. *IEEE 39th International Conference on Robotics and Automation (ICRA)*, Philadelphia, USA, 2022. DOI: [10.1109/ICRA46639.2022.9811866](https://doi.org/10.1109/ICRA46639.2022.9811866)
- [13] Yijie Zhou, Yan Zhang, **Xusheng Luo**, and Michael M. Zavlanos. “Human-in-the-loop Robot Planning with Non-Contextual Bandit Feedback”. In *2021 60th IEEE Conference on Decision and Control (CDC)*, pp. 2848-2853. IEEE, 2021. DOI: [10.1109/CDC45484.2021.9683023](https://doi.org/10.1109/CDC45484.2021.9683023)
- [14] **Xusheng Luo***, Yan Zhang*, and Michael M. Zavlanos. “Socially-aware Robot Planning via Bandit Human Feedback”. In *2020 ACM/IEEE 11th International Conference on Cyber-Physical Systems (ICCPS)*, pp. 216-225. IEEE, 2020. DOI: [10.1109/ICCPS48487.2020.00033](https://doi.org/10.1109/ICCPS48487.2020.00033)
- [15] Le, Duc M., **Xusheng Luo**, Leila J. Bridgeman, Michael M. Zavlanos, and Warren E. Dixon. “Single-Agent Indirect Herding of Multiple Targets using Metric Temporal Logic Switching”. In *2020 59th IEEE Conference on Decision and Control (CDC)*, pp. 1398-1403. IEEE, 2020. DOI: [10.1109/CDC42340.2020.9304233](https://doi.org/10.1109/CDC42340.2020.9304233)
- [16] **Xusheng Luo**, and Michael M. Zavlanos. “Transfer Planning for Temporal Logic Tasks”. In *2019 IEEE 58th Conference on Decision and Control (CDC)*, pp. 5306-5311. IEEE, 2019. DOI: [10.1109/CDC40024.2019.9030087](https://doi.org/10.1109/CDC40024.2019.9030087)

Refereed Workshop Publications

- [17] **Xusheng Luo***, Zhongqi Wei*, Changliu Liu, “Integrated Temporal Logic Task and Motion Planning for Multi-Arms”. Workshop on *Frontiers in Dynamic, Intelligent, and Adaptive Multi-Arm Manipulation*, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2025.
- [18] **Xusheng Luo**, Tianhao Wei, Simin Liu, Ziwei Wang, Luis Mattei-Mendez, Taylor Loper, Joshua Neighbor, Casidhe Hutchison, Changliu Liu, “Certifying Robustness of Learning-Based Keypoint Detection and Pose Estimation Methods”. Workshop on *Public Trust in Autonomous Systems*, IEEE International Conference on Robotics and Automation (ICRA), 2025. [\[paper\]](#)

- [19] **Xusheng Luo** and Changliu Liu. “Hierarchical Temporal Logic Specifications for Abstract Safety Tasks”. Workshop on *Robot safety under uncertainty from “intangible” specifications*, IEEE International Conference on Robotics and Automation (ICRA), 2025. [paper]
- [20] **Xusheng Luo***, Shaojun Xu* and Changliu Liu. “Obtaining Hierarchy from Human Instructions: an LLMs-based Approach”. Workshop on *Learning Effective Abstractions for Planning (LEAP)*, Conference on Robot Learning (CoRL), 2023. [paper]
- [21] **Xusheng Luo**, Shaojun Xu, Ruixuan Liu and Changliu Liu. “Robotic Planning under Hierarchical Temporal Logic Specifications”. Workshop on *Formal Methods Techniques in Robotics Systems: Design and Control*, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2023. [paper]

Preprints

- [22] Yiyuan Pan, Hanjiang Hu, Shangtao Li, **Xusheng Luo**[‡], Changliu Liu[‡]. “Inference-Time Robot Behavior Steering through Physically-Aware Reconfiguration of Task-Structure”. *arXiv:2606.26588*, 2026. [paper]
- [23] Hanjiang Hu, Yiyuan Pan, Jiaying Li, **Xusheng Luo**, Alexander Robey, Na Li, Yebin Wang, Changliu Liu. “VLESA: Vision-Language Embodied Safety Agent for Human Activity Monitoring”. *arXiv:2606.03954*, 2026. [paper]
- [24] Ruixuan Liu, Alan Chen, **Xusheng Luo** and Changliu Liu. “Simulation-aided Learning from Demonstration for Robotic LEGO Construction”. *arXiv:2309.11010*, 2023. [paper]

Awards and Honors

- **Dynamic Systems & Control Division (DSCD) Rising Star** ASME, 2025
- **Multi-Robot Systems (MRS) Young Pioneer** (declined due to visa issues) IEEE, 2025
- **Cyber-Physical System (CPS) Rising Star (16.4%=36/220)** NSF, 2024
“36 outstanding PhD students and postdocs in Cyber-Physical Systems (CPS)”.
- **CDC Travel Grant** IEEE Control Systems Society, 2020
- **Outstanding Graduate** Harbin Institute of Technology, 2015, 2017
- **The Samsung Scholarship** Harbin Institute of Technology, 2016
- **Summer School Scholarship** Technion, Israel, 2016
- **National Endeavor Fellowship** Harbin Institute of Technology, 2012, 2014
- **Third Prize in the 9th National Zhou Peiyuan Mechanics Competition** CSTAM, China, 2013

TALKS

Refereed Conference and Workshop Presentations

- Integrated Temporal Logic Task and Motion Planning for Multi-Arms 2025
– Workshop on *Frontiers in Dynamic, Intelligent, and Adaptive Multi-Arm Manipulation (FDIAMM)*, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
- Building Assured Autonomy at Scale 2025
– Special Session on *ASME DSCD Rising Stars*
- Building Assured Autonomy at Scale 2025
– In 2025 *Northeast Robotics Colloquium (NERC)*

- Decomposition-based Hierarchical Task Allocation and Planning for Multi-Robots under Hierarchical Temporal Logic Specifications 2025
– In 2025 *IEEE International Conference on Robotics and Automation (ICRA)*
- Certifying Robustness of Learning-Based Keypoint Detection and Pose Estimation Methods 2025
– Workshop on *Public Trust in Autonomous Systems, IEEE International Conference on Robotics and Automation (ICRA)*
- Hierarchical Temporal Logic Specifications for Abstract Safety Tasks 2025
– Workshop on *Robot safety under uncertainty from “intangible” specifications, IEEE International Conference on Robotics and Automation (ICRA)*
- Integrating Autonomy with Formal Methods 2024
– Workshop on *2024 NSF CPS Rising Stars*
- Obtaining Hierarchy from Human Instructions: an LLMs-based Approach 2023
– Workshop on *Learning Effective Abstractions for Planning, Conference on Robot Learning (CoRL)*
- Robotic Planning under Hierarchical Temporal Logic Specifications 2023
– Workshop on *Formal Methods Techniques in Robotics Systems: Design and Control, IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*
- Socially-aware Robot Planning via Bandit Human Feedback 2020
– In *2020 ACM/IEEE 11th International Conference on Cyber-Physical Systems (ICCPS)*
- Transfer Planning for Temporal Logic Tasks 2019
– In *2019 IEEE 58th Conference on Decision and Control (CDC)*

Invited Talks

- Building Assured Autonomy at Scale: Logical Specification, Provable Control, and Verified Learning
– Department of Mechanical and Aerospace Engineering at NC State University 2026
◦ Host: Professor Jie Yin
- Department of Mechanical Engineering at Rochester Institute of Technology 2026
◦ Host: Professor Qian Xue
- Department of Mechanical and Aerospace Engineering at the University of Tennessee, Knoxville 2026
◦ Host: Professor Subhadeep Chakraborty
- Department of Mechanical Engineering at Colorado State University 2026
◦ Host: Professor Jianguo Zhao
- Department of Intelligent Systems Engineering at Indiana University Bloomington 2026
◦ Host: Professor Lantao Liu
- Department of Mechanical and Aerospace Engineering at the University of Texas at Arlington 2026
◦ Host: Professor Animesh Chakravarthy
- Department of Aerospace and Mechanical Engineering at the University of Texas at El Paso 2026
◦ Host: Professor Angel Flores Abad
- Laboratory for Intelligent Decision and Autonomous Robots (LIDAR) at Georgia Tech 2026
◦ Host: Professor Ye Zhao
- Kantaros Lab at Washington University in St. Louis 2026
◦ Host: Professor Yiannis Kantaros
- Artificial Intelligence for Robot Coordination at Scale (ARCS) Lab at CMU 2025
◦ Host: Professor Jiaoyang Li
- Computational Robotics, AI & Biomedicine (Kavraki) Lab at Rice University 2025
◦ Host: Professor Lydia E. Kavraki
- Center for Autonomy at University of Texas, Austin 2025
◦ Host: Professor Ufuk Topcu
- Resilient Cyber-Physical Systems Lab at University of California, Irvine 2025
◦ Host: Professor Yasser Shoukry

- Riverside Artificial Intelligence Research and Education Institute (RAISE) Seminar at University of California, Riverside 2025
 - Host: Professor Vassilis Tsotras
- Existential Robotics Laboratory (ERL) at University of California, San Diego 2025
 - Host: Professor Nikolay A. Atanasov
- Scalable Control Synthesis for Multi-Robot Systems under Temporal Logic Specifications 2022
 - Intelligent Control Lab (ICL) at CMU
 - Host: Professor Changliu Liu
 - Reliable Autonomous System (REALM) Lab at MIT 2021
 - Host: Professor Chuchu Fan

Professional service

Professional Affiliations

- Institute of Electrical and Electronics Engineers (IEEE), Member

Editorial Roles

- *Associate Editor* for Vision and Sensor-Based Control, IEEE International Conference on Robotics and Automation (ICRA) 2026
- *Associate Editor* for Autonomy and Mobility for Manipulation, IEEE International Conference on Robotics and Automation (ICRA) 2027

Conference & Workshop Organization

- *Organizer*, **Learning and Formal Methods for Robotics (LAFR) Workshop** at IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2026
- *Session Chair*, Verification and Formal Methods, ICRA 2025
- *Lead Organizer*, **Foundation Models for Control (FM4Control): Bridging Language, Vision, and Control Workshop** at Modeling, Estimation and Control Conference (MECC) 2025
- *Volunteer*, Modeling, Estimation, and Control Conference (MECC) 2025
Supported onsite operations and technical sessions to ensure smooth conference execution

Paper Review

• Journals:

- IEEE Transactions on Pattern Analysis and Machine Intelligence (T-PAMI) 2025
- IEEE Transactions on Mechatronics (T-MECH) 2025
- IEEE Journal of Dynamic Systems, Measurement and Control 2025
- IEEE Robotics and Automation Letters (RA-L) 2025 - present
- IEEE Transactions on Robotics (T-RO) 2022 - present
- IEEE Control Systems Letters (L-CSS) 2024, 2025
- IEEE Transactions on Automation Science and Engineering (T-ASE) 2021, 2025, 2026
- IEEE Transactions on Control of Network Systems (T-CNS) 2019, 2021
- The International Journal of Robotics Research (IJRR) 2026

• Conferences:

- Conference on Robot Learning (CoRL) Workshop Learning Effective Abstractions for Planning (LEAP) 2024, 2025

- IEEE Conference on Decision and Control (CDC) 2025
- Robotics: Science and Systems (R:SS) 2024 - present
- IEEE International Conference on Robotics and Automation (ICRA) 2024 - present
- AACC/IFAC Conference on Modeling, Estimation and Control Conference (MECC) 2024, 2025
- IEEE International Conference on Intelligent Robots and Systems (IROS) 2022, 2025 - present
- IEEE American Control Conference (ACC) 2022, 2026
- IEEE International Conference on Ubiquitous Robots (UR) 2021
- ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS) 2019, 2020

Teaching Experience

Teaching Assistant

- MATLAB for Engineering Applications Harbin Institute of Technology, Fall 2016
 - Instructor: Changsheng Gao

Guest Lecturer

- From Temporal Logic Specifications to Control Synthesis in Multi-Robot Systems
 - CSCE 689: Special Topics in Multi-Robot Systems Texas A&M University, Fall 2025
 - Instructor: Yiwei Lyu
- System Properties: Controllability, Observability, and Stability
 - 16-714 Advanced Control for Robotics Carnegie Mellon University, Fall 2025
 - Instructor: Changliu Liu
- Certification of Pose Estimation Models
 - Special Topics: Provably Safe Robotics Carnegie Mellon University, Spring 2025
 - Instructor: Changliu Liu
- Formal Methods in Robotics
 - Special Topics: Provably Safe Robotics Carnegie Mellon University, Spring 2024
 - Instructor: Changliu Liu

Mentoring

- **CMU Paths to AI Research Program (PAIR)** Fall 2025
 - Provide monthly guidance to two undergraduates exploring AI research: helping them identify research topics, connect with labs, and plan for internships/fellowships.
- **PhD students:**
 - RuiXuan Liu (CMU Robotics [2], [4], [24])
 - Zhongqi Wei (CMU ME [10])
 - Tianhao Wei (CMU ECE [3], [11])
 - Hanjiang Hu (CMU ECE [11])
- **Master's students:**
 - Yiyuan Pan (CMU CS [9])
 - Yutong Huang (CMU ME [2])
 - Letian Leng (CMU ME [2])
 - Shiqi Sun (Duke ME → PhD student at Northwestern Polytechnical University [12])
 - Yijie Zhou (Duke ME → PhD student at the Chinese University of Hong Kong [13])
- **Undergraduate students:**
 - Shaojun Xu (visiting student at CMU → PhD student at Tsinghua University [2], [4])

- Shuo Yang (visiting student at Duke → PhD student at University of Pennsylvania)
- Daniel Jiang (CMU CS, PAIR program)
- Sudhir Chebiyyam (CMU CS, PAIR program)
- **High school students:**
 - Alan Chan (visiting student at CMU → undergraduate at the University of Texas at Austin [24])