

Xingyu Li

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Education

Northeastern University

China

Master in Control Science and Engineering

09/2023 - Present (expected 06/2026)

- College Of Information Science and Engineering (GPA 89.42/100)

Shenyang University of Chemical Technology

China

Bachelor in Process Equipment and Control Engineering

09/2019 - 06/2023

- School of Mechanical and Power Engineering (GPA 89.01/100)

Publications

- **Xingyu Li**, Hongyu Nie, Haoxuan Xu, Xingrui Liu, Zhaotong Tan, Chunyu Jiang, Yang Feng and Sen Mei. GeoSafe: A Unified Unconstrained Multi-DOF Optimization Framework for Multi-UAV Cooperative Hoisting and Obstacle Avoidance. (Accepted by **2025-IROS**) 
- **Xingyu Li**, Haoxuan Xu, Xingrui Liu and Zhaotong Tan. Real-Time Occupancy Grid Mapping Using RMM on Large-scale and Unstructured Environments. (Accepted by **2025-IROS**) 
- Hongyu Nie[†], **Xingyu Li**[†], Xu Liu, Decai Li, Yuqing He. FELP: Fast and Effective Autonomous Flight on Large-scale and Cluttered Environments Based on Unified Linear Parametric Map. (**2025-RAL**) ([†]: **equal contribution**) 
- Hongyu Nie[†], **Xingyu Li**[†], Xu Liu, Zhaotong Tan, Sen Mei, Wenbo Su. Unified Linear Parametric Map Modeling and Perception-aware Trajectory Planning for Mobile Robotics. (**Available on arXiv**, V1) ([†]: **equal contribution**) 

Research Experience

Multi-UAV Cooperative Hoisting and Trajectory Planning in Constrained Environments 2023 - 2024

- Proposed a unified optimization framework (GeoSafe) that introduces a rotational degree of freedom to the standard 4-DOF model, expanding the solution space for navigating narrow passages.
- Utilized the MINCO transformation to reformulate the constrained formation adjustment and obstacle avoidance problem into a single unconstrained optimization, enabling efficient, real-time trajectory generation.
- Validated with scalable formations (2-4 UAVs) in extensive simulations and real-world experiments, demonstrating superior success rates and computational efficiency compared to IF-based and sampling-based methods.

Lightweight and Efficient Occupancy Mapping for UAV Autonomous Exploration 2024 - 2025

- Proposed a linear parametric model using the Random Mapping Method (RMM) to generate complete and coherent world models, overcoming the limitations of traditional probabilistic methods like **Bayesian filtering** that produce fragmented maps due to occlusions.
- Implemented an online learning framework for the model on a resource-constrained UAV platform with Livox Lidar, demonstrating its efficiency for real-time map updates and inference during autonomous flight.
- Validated the method in extensive simulations and real-world tests, demonstrating that it surpasses traditional methods in storage efficiency, access time, and prediction accuracy.

Fast and Efficient Autonomous Flight in Large-Scale Environments 2024 - 2025

- Proposing a novel **knowledge representation** framework using a unified linear parametric model to symbolically represent both occupancy grids and ESDF maps for autonomous flight.
- Enabling efficient **symbolic reasoning** by deriving a closed-form, resolution-invariant ESDF from the parametric model, which allows for direct computation of distance and gradients without traditional interpolation.
- Validating the complete flight system (FELP), demonstrating that the symbolic representation and reasoning approach yields superior performance in mapping and planning efficiency against state-of-the-art methods in diverse, large-scale environments.

Unified Parametric Mapping and Perception-Aware Planning for Mobile Robots

2024 - 2025

- Proposed a unified mapping framework (RMRP) for environmental **knowledge representation** using random mapping and sparse random projection to create a lightweight, continuous linear parametric map, supported by a novel Residual Energy Preservation Theorem for theoretical guarantees.
- Developed a perception-aware planning framework (RPATR) for UAVs that uses the map's analytical gradient to refine initial paths and a closed-form ESDF model for back-end optimization, enabling proactive navigation through **symbolic inference** of unobserved structures from learned geometric priors.
- Extended the framework to UGVs for terrain-aware navigation by modeling terrain and its analytical gradient to avoid hazards, and validated the entire system in diverse scenarios, demonstrating superior performance in mapping and planning.

Work Experience

Woozoom Technology Company Ltd. | *Mapping and Planning*

Shenyang, China

Robotics Software Engineer Intern

Sept 2024 - Aug 2025

- Developed and optimized real-time C++ algorithms for UAV motion planning and lightweight mapping systems, contributing to autonomous flight research publications
- Integrated and deployed autonomous flight systems including FASTLIO2 SLAM, CUAV V5+ flight controller, and Mid360 LiDAR for complete UAV autonomy
- Debugged and optimized system integration workflows, ensuring robust performance across hardware-software interfaces in real-world flight scenarios
- Tech: C++, ROS, Linux, CUDA, CMake, NumPy, Matplotlib, Adobe Illustrator, Adobe After Effects

Research Interest

- Enabling autonomous robots to make common-sense decisions in real, open environments by integrating symbolic planning, probabilistic reasoning, world modeling, and learning-based methods.

Skills

- **Programming:** C/C++ & Python for Linux (ROS), CUDA, ROS, Gazebo, V-REP, Git, CMake, LaTeX
- **Machine Learning & Algorithms:** Machine Learning fundamentals, Algorithm optimization and deployment on embedded platforms(Intel NUC, NVIDIA Orin NX)
- **Mathematics & Modeling:** Linear Algebra, Optimization, Probability Theory, 3D Modeling (SolidWorks)
- **Development Tools:** WSL2, System integration and testing, Adobe Illustrator, Adobe After Effects
- **Soft Skills:** Independent Research, Team Collaboration, Problem-solving, Analytical Thinking, Technical Communication
- **Miscellaneous:** NumPy, Matplotlib, CAD, Markdown, NodeJs, Ansys Fluent

Awards & Honors

- First-Class Academic Scholarship, Northeastern University
(2023-2024, 2024-2025, 2025-2026, University-level)
- National University Mechanical Engineering Innovation and Creativity Competition Zhuoran-Dushun Cup
(2022, National Second Prize, Team Leader)
- 12th MathorCup Mathematical Modeling Challenge
(2022, National Second Prize, Team Leader)
- Wenyu Scholarship for the year 2021
(2021-2022, University-level)

Peer Reviewer

- IEEE International Conference on Robotics and Automation (ICRA) 2026