

Muhan Lin

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Education

Purdue University

Expected: May 2029

Ph.D. in Computer Science

Carnegie Mellon University

Aug 2023 – May 2025

M.S. in Robotics

GPA: 4.05/4.0

- **Courses:** Intro to RL (A), Multi-robot Planning (A), Mobile Manipulation (A), Advanced Computer Vision (A).

The Chinese University of Hong Kong (Shenzhen)

Sep 2019 – May 2023

B.Eng. in Electronic Info Engineering (Computer Engineering), First-Class Honors

GPA: 3.6/4.0

- **Core courses:** ML (A), Algorithm Design (A), C++ (A), Python (A), Linear Algebra (A), Mechanics (A).
- **Graduate course:** Programming for Robotics (A-).

Publications

Online Transfer Learning in Continuous Control

Zeyun Deng, Yuzhe Lu, **Muhan Lin**, Fiona Xie, Yanan Niu, Chan Kit Shan Vanessa, Joseph Campbell
In submission

Speaking the Language of Teamwork: LLM-Guided Credit Assignment in Multi-Agent Reinforcement Learning

Muhan Lin, Shuyang Shi, Vinitha Marupeddi, Yue Guo, Vaishnav Tadiparthi, Behdad Chalaki, Ehsan Moradi Pari, Simon Stepputtis, Woojun Kim, Joseph Campbell, Katia Sycara
In submission

Navigating Noisy Feedback: Enhancing Reinforcement Learning with Error-Prone Language Models

Muhan Lin, Shuyang Shi, Yue Guo, Behdad Chalaki, Vaishnav Tadiparthi, Ehsan Moradi Pari, Simon Stepputtis, Joseph Campbell, Katia Sycara
Published - Conference on Empirical Methods in Natural Language Processing (EMNLP) 2024

Speed up Search for Switchable Temporal Planning Graph Optimization

He Jiang, **Muhan Lin**, Jiaoyang Li
Accepted (Oral presentation) - Association for the Advancement of Artificial Intelligence (AAAI) 2025

A Reward Analysis of Reinforcement Learning from Large Language Model Feedback

Muhan Lin, Shuyang Shi, Yue Guo, Behdad Chalaki, Vaishnav Tadiparthi, Simon Stepputtis, Joseph Campbell, Katia Sycara
Published - RLBrew Workshop, Reinforcement Learning Conference (RLC) 2024

Asymptotically Efficient Estimators for Range-based Robot Relative Localization

Yue Wang, **Muhan Lin**, Xinyi Xie, Yuan Gao, Fuqin Deng, Tin Lun Lam
Published - IEEE/ASME Transactions on Mechatronics (TMECH) 2023

Less Is More: A Robust Visual Inertial Odometry with Active Feature Selection

Muhan Lin, Shibo Zhao, Sebastian Scherer
Published - CMU RISS Working Papers Journal 2022

Research Experience

Student Researcher, Robotics Institute (RI), CMU – Pittsburgh, US

Project 1: Enhancing Reinforcement Learning with Error-Prone Language Models

Advisor: Prof. Katia Sycara, Dr. Joseph Campbell | RI, CMU

Sept 2023 – Present

RLBrew Workshop, EMNLP Paper

- Extended *RL from LLM Feedback* to handle small language models prone to incorrect rankings: proposed a potential-based reward specification method to scale down rewards based on LLM feedback uncertainty.
- Theoretically and empirically showed that uncertain LLM feedback leads to uninformative potential-based rewards, avoiding misleading rewards and enabling efficient training even with small error-prone LLMs.
- Extended the proposed method to multiagent collaboration tasks for credit assignment, decomposing team rewards into individual ones with LLM feedback.

Project 2: Enhancing Multi-Agent Teaming Efficiency by Experience-Based Action Advising

Advisor: Prof. Katia Sycara | RI, CMU

Aug – Oct 2024

- Accelerated multi-agent reinforcement learning by enabling agents with different levels of prior competency to cooperate effectively in solving a shared task.
- With a multi-armed bandit algorithm, the most-experienced agent evaluated teammates' skills, assigned suitable sub-tasks and adapted agents to tasks via an action-advising algorithm, improving learning and task efficiency.

Project 3: Plan-Graph Optimization Acceleration for Unexpected Delays in Execution of Multi-agent Path Plans

Advisor: Prof. Jiaoyang Li | RI, CMU

Feb – Aug 2024

AAAI Paper, Course Research Project

- Proposed an accelerated optimization algorithm for the Switchable Temporal Plan Graph (STPG) to address unexpected delays when executing a multiagent path plan with techniques like incremental searching.
- Achieved over 100% improvement in STPG reconstruction success rates within 0.5 seconds across maps with diverse agent densities, outperforming *Mixed-Integer Linear Programming* and *naive graph-based methods*.
- Developed a C++-based real-time visualization tool to display updated STPGs during the replanning process.

Project 4: RL-based Mobile Robot Painting on Large Vertical Canvas

Advisor: Prof. Zackory Erickson | RI, CMU

Feb – Apr 2024

Course Research Project

- Extended FRIDA—an algorithm controlling a robot with a fixed base to paint on a desktop small canvas—for a large canvas and a mobile manipulator based on efficient RL-driven stroke planning in real robot experiments.
- Coordinated the motion of the base and arm to move the end effector to a given stroke position by decomposing end-effector motion in horizontal and vertical directions.
- Utilized AR tags to realize coordinate system transformation between the robot and canvas.

Project 5: Active Feature Selection for Pose Estimation of Multi-spectral Odometry

Advisor: Prof. Sebastian Scherer | RI, CMU

May - Nov 2022

RISS Paper

- Developed a quality measurement metric to actively select visual feature points for the visual odometry.
- Improved the accuracy and efficiency of visual odometry pose estimation (13.036% of the original residuals, 58.832% of the original CPU usage) with filtered visual feature points in dark environments.
- Studied the multi-camera data fusion scheme for visual odometry.
- Integrated the active feature selection method into a multi-camera multi-spectral odometry system with C++ to assist multi-sensor data fusion and pose estimation in challenging environments with fewer features.

Research Assistant, CUHK-Shenzhen & Shenzhen Institute of Artificial Intelligence and Robotics for Society (AIRS) – China

Project 1: Initial Relative Pose Estimation with the Two-stage Extended Kalman Filter

Advisor: Prof. Tin Lun Lam | School of Science and Engineering, CUHK-Shenzhen

Jan - May 2022

Bachelor Thesis

- Developed a Two-stage Extended Kalman Filter for improved *robot-to-robot* initial relative pose estimation using multi-sensor data fusion, improving LIDAR map merging accuracy.
- Validated the method in simulated environments using ROS and Gazebo.

Project 2: Multi-robot Relative Pose Estimation with UWB and Odometry Information

Advisor: Prof. *Tin Lun Lam* | Director of Center for Intelligent Robots, AIRS

Feb 2021 – Jan 2022

TMECH Paper

- Enhanced localization accuracy in multiagent systems, where robots communicated their odometry trajectories and relative distance with each other and then estimated their initial relative poses.
- Developed a real-time relative-pose estimation system structure compatible with multiple offline initial pose estimation algorithms, which adopt the particle filter and the Kalman filter to track subsequent poses.
- Led the design, assigned tasks to younger teammates, and performed the physical experiments of a novel relative localization algorithm with ROS, MATLAB, and a motion-capturing system.

Competition

The Smart Car and Real-time OS Application Development

Mar – Aug 2020

The RISC-V Challenge of China College IC Smart-car Competition

Shenzhen & Nanjing, China

Advisor: Prof. *Simon Pun* | CUHKSZ-Stanford Maker Lab

3rd National Prize (Top 10%)

- Programmed registers on a bare MCU and read and processed raw sensor signals to control a smart car with a linear CCD in C/C++.
- Applied a real-time operating system to the smart car to support multi-threading work to improve real-time performance and resource utilization efficiency.
- Designed a novel path-tracking algorithm in C for the paths bounded by dashed lines with infrared sensors. Increased the success rate of the original algorithm from approximately 50% to above 95%.

Selected Course Projects

Warehouse Robot Challenge

May 2022

- Automated the robot arm to pick randomly placed objects and put them into buckets with consistent colors.
- Realized object localization and classification with diverse colors, utilizing *OpenCV* and *Python*.
- Realized path planning and collision & obstacle avoidance with *Python*, *Moveit*, and *Rviz*.

Service Robot Delivery Challenge

Apr - May 2022

- Automated robot delivery to locations labeled by AR tags in a *Gazebo* environment with *ROS* and *OpenCV*.
- Searched AR tags and navigated to various delivery locations with SLAM algorithms.

Academic Activities

Reviewer: ICRA 2024 2025, IEEE Transactions on Games 2024

Conference Participation: EMNLP 2024, RLC 2024, IROS 2023

Awards

2025 **Herbold Scholarship (Top 1.5%)**, Department of Computer Science, Purdue University

2019-2022 **Dean's List**, School of Science and Engineering, CUHK-Shenzhen

2019-2022 **Bowen Scholarship**, CUHK-Shenzhen

2020 **3rd National Prize (Top 10%)**, The RISC-V Challenge of China College IC Smart-car Competition

Skills

Programming: Python, C/C++, MATLAB, Verilog, VHDL, Mysql, Go, HTML, CSS

Software & Tools: ROS, PyTorch, RLlib, TorchRL, OpenAI Gym, Moveit, OpenCV, Django, FreeRTOS