

# Ruiji Liu

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## EDUCATION

- **Carnegie Mellon University** Aug. 2022 - May 2024  
*Master of Science in Mechanical Engineering, Robotic and Control Systems* *Pittsburgh, PA*
  - **GPA:** 4.0/4.0 **Advisor:** [George A. Kantor](#)
  - **Core Modules:** Robot Learning, AI Safety, Linear Control, SLAM, Computer Vision, Path Planning
- **The Pennsylvania State University** Aug. 2018 - May 2022  
*Bachelor of Science in Mechanical Engineering* *State College, PA*
  - **GPA:** 3.98/4.0
  - **Core Modules:** Intro Robotics, Modeling Dynamics System, Dynamics

## PUBLICATIONS & TECHNICAL REPORTS

- [1] **Ruiji Liu**, Francisco Yandun, George Kantor, “Towards Over-Canopy Autonomous Navigation: Crop-Agnostic LiDAR-Based Crop-Row Detection in Arable Fields”, in *IEEE International Conference on Robotics and Automation (ICRA)*, 2025. (Under review) [\[Project page\]](#), [\[Paper\]](#), [\[Code\]](#), [\[Video\]](#)
- [2] Saira Hussain, Yuqi Zhou, **Ruiji Liu**, Eric Pauli, Randy Haluck, Barry Fell, Jason Moore, “Evaluation of Endoscope Control Assessment System for Measuring”, in *Design of Medical Devices Conference*, 2022. [\[Paper\]](#)
- [3] **Ruiji Liu**, Francisco Yandun, David Wettergreen, George Kantor, etc., “AIIRA Autonomous Robot Control for Spotted Lanternflies”, Technical report (Research). [\[Paper\]](#), [\[Video\]](#), [\[PPT\]](#), [\[Poster\]](#), [\[News\]](#)
- [4] **Ruiji Liu**, Xiaoyang Zhan, Yumeng Xiu, Yufeng Ren, Hanjiang Hu, Zixuan Zhang. “3D Reconstruction for Tunnel Inspection Based on RGB-D Data”, Technical report (CMU-16833). [\[Paper\]](#), [\[Code\]](#), [\[PPT\]](#)
- [5] **Ruiji Liu**, Morgan Mayborne, Vina Wei. “Push-T Experiment with Diffusion Policy and DQN”, Technical report (CMU-16831). [\[Paper\]](#), [\[Code\]](#), [\[Data\]](#), [\[PPT\]](#)
- [6] **Ruiji Liu**, Letian Leng, Yutong Huang. “Defend Like-a-Lion: Defensive Racing Maneuvers Utilizing Visual Localization”, Technical report (CMU-16663). [\[Paper\]](#), [\[Code\]](#), [\[PPT\]](#)
- [7] **Ruiji Liu**, Yu Qiu, Runpu Meng, Zongyuan Wu. “Finding Optimal Machine Learning Regression Model for House Prices Prediction”, Technical report (CMU-24787). [\[Paper\]](#), [\[Code\]](#)
- [8] A. Anand, C. Frantz, ..., **Ruiji Liu**, etc., “The Pennsylvania State University Advanced Vehicle Team’s Concept Design for the SAE AutoDrive Challenge II Competition’s Perception Cart”, Technical report, 2022. [\[Paper\]](#)
- [9] **Ruiji Liu**, Ryan Maziarz, Alex Nellis. “Autonomous Etch-A-Sketch”, Technical report, 2021. [\[Paper\]](#), [\[Video\]](#), [\[Code\]](#)
- [10] **Ruiji Liu**, Alan Wagner. “Automatic Path-Planning and Map Drawing by Husky Robot and the Realization of Robot Simulation in Unity”, Technical report (MC-REU Scholarship), 2021. [\[Paper\]](#), [\[Talk\]](#), [\[Video\]](#)

## ACADEMIC EXPERIENCE

- **Enhancing Robotic Manipulation via Advanced Data Collection Methods** Oct. 2024 – Present  
*Research Assistant @ CMU [KantorLab](#), supervised by [Dr. George A. Kantor](#)* *Pittsburgh, PA*
  - **SAM2 Key Object Extraction:** Leveraged SAM2 to train object detection models for identifying and extracting key objects from video data, integrating outputs to optimize diffusion policy training
  - **Human-hand-based Data Collection:** Exploring human-hand-based data collection for robotic manipulation training, employing HAMER for hand motion tracking and 3D Gaussian Splatting for environment reconstruction to generate multi-angle camera views and enhance policy training
- **AIIRA Crop-Agnostic Autonomous Navigation on Amiga Robot Platform** May 2023 – Present  
*Research Assistant @ CMU [KantorLab](#), supervised by [Dr. George A. Kantor](#)* *Pittsburgh, PA*
  - **High-Precision Robot Localization:** Integrated the ROS robot localization package on the Amiga robot, fusing sensors’ outputs from IMU, RTK-GPS, and wheel encoder to enhance robot localization accuracy
  - **Drone Map:** Generated multiple drone maps with position accuracy within 3cm using RGB-D images from the drone across various crop fields
  - **MPC Controller:** Designed and implemented a custom Model Predictive Control (MPC) controller, enabling the robot to follow predefined navigation paths (from the drone maps) autonomously and significantly reducing the need for human intervention (tested in fields)
  - **General Crop Detection Algorithm:** Developed a novel LiDAR-based, crop-agnostic detection algorithm to address crop row detection challenges across various crop types and growth stages, demonstrating the effectiveness in crop row detection through testing in both the Gazebo simulation environments and real fields
  - **Autonomous Navigation without RTK-GPS:** Combined the LiDAR-based crop row detection algorithm with a modified local MPC controller to achieve autonomous navigation in crop fields without RTK-GPS. Tested in corn and soybean fields at different growth stages, both in Gazebo simulations and real field conditions. Presented the project at the AIIRA USDA-NIFA/NSF Annual Review poster session

## Jan. 2024 – May 2024

*Pittsburgh, PA*

- AIIRA Autonomous Robot Control for Spotted Lanternflies

Feb. 2023 – May 2023

*Pittsburgh, PA*

- # Endoscope Control Assessment Using Video and Magnetic Tracking

Sep. 2021 - May 2022

State College, PA

- ## Automatic Path-Planning and Map Drawing

Jun. 2021 - Aug. 2021

State College, PA (Remote)

- ACADEMIC SERVICE

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2024-

- ## OTHER PROJECTS

## Jun. 2022 - Aug. 2022

- ## SKILLS

- **Tools:** ROS, PyTorch, OpenCV, Linux, Docker, Git

- **Languages:** English (fluent), Mandarin (native)

- **2<sup>nd</sup> prize**, AUTODRIVE CHALLENGE II Detection competition

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Jun. 2022

- **Dean's List**, Mechanical Engineering, PSU Aug. 2018 - May. 2022

- **Multi-Campus Research Experience Scholarship for Undergraduates, PSU** Jun. 2021 - Aug. 2021

- 1<sup>st</sup> prize in 1v1, 3<sup>st</sup> prize in 3v3 confrontation, RoboMaster University League 2021 Jun. 2021