RUIYANG WANG

Durham, NC, 27701 • (984)-259-5539 • ruiyang.wang@duke.edu

Research interests:

Multi-Robot Systems (MRS), Learning based planning and control, and Neural-Symbolic/LLM integration for robotic autonomy.

Education

Duke University - Durham, NC *August 2024 - April 2028 (Expected)*
Doctor of Philosophy (Ph.D.): Electrical and Computer Engineering

University of Michigan, Ann Arbor - Ann Arbor, MI *August 2022 - December 2023*
Master of Science: Robotics

University of Michigan, Ann Arbor - Ann Arbor, MI *August 2018 - April 2022*
Bachelor of Science: Mechanical Engineering

Skills

Programming & Tools: Python, C++, Julia, MATLAB, ROS2, Linux/Unix, Git, CMake
ML/AI Frameworks: PyTorch, TensorFlow, scikit-learn
Robotics & Simulation: ROS2, PyBullet, OpenAI Gym, LCM

Research Experiences

Large Language Model Multi-robot Coordinated Exploration and Search *January 2025 - September 2025*
Prof. Miroslav Pajic, Cyper-Physical Systems Lab

- Developed **LLM-MCoX**, a framework that fuses LiDAR based **frontier clustering** and **doorway detection** with multimodal LLM reasoning to coordinate robot teams. The system uniquely incorporates **natural language key initial information** (e.g., "object likely in northeast corridor") to semantically guide search and reduce redundant exploration.
- Demonstrated strong scalability and adaptability: achieved **22.7%** faster exploration and **50%** more efficient search than frontier and Voronoi based baselines in structured and unstructured environments, generalized across homogeneous and heterogeneous teams, and validated in real-world tests with a **Unitree Go2** quadruped and **X500** drone. **[P1]**

Neural-Symbolic Deadlock Resolution in Multi-robot Systems *August 2024 - December 2024*
Prof. Miroslav Pajic, Cyper-Physical Systems Lab

- Proposed **NSDR (Neuro-Symbolic Deadlock Resolution)**, combining an **Active-Passive paradigm** with **Neural Logic Machines (NLMs)** to resolve deadlocks *after* they occur, guaranteeing feasibility and preventing future deadlocks even in cluttered environments.
- Trained NLMs on **simple 2–5 robot deadlocks**, leveraging symbolic reasoning to **generalize to larger and more complex scenarios** (8–10+ robots, asymmetric layouts, multiple target regions). Across extensive simulations, NSDR outperformed adaptive repulsive force and greedy methods, enabling **concurrent robot progress** and reducing total arrival times. **[P2]**

* both authors have equal contribution

Compatible Constraint Selection in Receding-Horizon Control *December 2022 - Current*
Prof. Dimitra Panagou, The Distributed Aerospace and Control Lab

- Developed heuristics for the **maximal feasible subset selection problem** in receding-horizon control of nonlinear systems, using **Lagrange multipliers** to identify incompatible soft constraints before infeasibility occurs.
- In waypoint tracking under disturbances and obstacles, showed that the method preserves safety critical constraints, completes more tasks than slack-variable relaxations, and achieves near optimal performance at **orders-of-magnitude lower computation cost** than exhaustive or reachability-based methods. **[P3]**

Selected Publications

- **[P1] Ruiyang Wang**, Hao-lun Hsu, David Hunt, Shaocheng Luo, Jiwoo Kim and Miroslav Pajic, "LLM-MCoX: Large Language Model Multi-robot Coordinated Exploration and Search", Submitted to *International Conference on Robotics & Automation (ICRA)* 2026.
Available from
- **[P2] Ruiyang Wang**, Bowen He, Miroslav Pajic, "Neural Symbolic Deadlock Resolution in Multi-robot Sytems:", Accepted to *Learning for Dynamics & Control (L4DC)* 2025.
Available from https://proceedings.mlr.press/v283/wang25f.html
- **[P3] Ruiyang Wang***, Hardik Parwana*, Dimitra Panagou, "Algorithms for Finding Compatible Constraints in Receding-Horizon Control of Dynamical Systems", Accepted to *American Control Conference (ACC)* 2024.
Available from https://ieeexplore.ieee.org/abstract/document/10644243

Course Projects

ROB 498 Robot Learning for Planning and Control *January 2023 - April 2023*

- Designed a latent space controller in **Python** for a PANDA robotic arm with 7 DOF using a Variational AutoEncoder (VAE) and Sparse Identification of Nonlinear Dynamics (SINDy) based on latent states extracted from image inputs.
- Evaluated the performance on a planar pushing task in OpenAI Gym environment with Pybullet, and it outperforms the controller using Globally Linear Latent Dynamics model in terms of moving a block to the desired position and orientation with **20% less number of actions**.

ROB 599 Deep Learning for Robot Perception *January 2023 - April 2023*

- Reimplemented the PoseCNN network for 6D object pose estimation in **Pytorch**. Trained and evaluated the network on PROPS Pose Estimation Dataset and achieved a **5°5cm Accuracy** of **53.62%**.
- Investigated the effect of feed-forward layers in the network and improved the 5°5cm Accuracy to **64.14%** by adding one more feed-forward layer in the base-line network.

ROB 550 BotLab *September 2022 - December 2022*

- Built a fully autonomous driving robot that can explore and navigate in an unforeseen maze with a team of 4 students. Mainly worked on a triple-layered PID controller for low-level wheel speed control, particle filter for localization, and path planning using A* in **C++**.