Yuanjie Lu

+1 (703)-622-0533 | yakouhelo96@outlook.com | Vienna, VA, 22182 | yuanjielu-64.github.io | github.com/yuanjielu-64

Education

George Mason University *Aug. 2021 - Present*
Ph.D. in Computer Science Fairfax, VA
- GPA: 3.85/4
- Research Focus: Deep Learning & Reinforcement Learning for Autonomous Robot Navigation; AI-driven Decision-Making for Motion Planning and Control

George Mason University *Aug. 2019 - May 2021*
M.S. in Computer Science Fairfax, VA

Research Experience

Research Assistant, George Mason University & University of South Florida *Oct. 2025 - Present*
Advisors: Prof. Xuesu Xiao (GMU), Prof. Xiaomin Lin (USF) Fairfax, VA
Project: Adaptive Planner Parameter Learning from Large Language Model (LLM)
- Developing an LLM-guided adaptive planner that uses reasoning to tune parameters in real-time, addressing limitations of traditional and RL-based methods.
- Leveraging **ChatGPT-4o** and locally deployed **Llama 3** to learn ROS navigation stack structure (global planner, local planner, costmap, and recovery behaviors), enabling reasoning-driven parameter tuning and adaptive module selection.
- Optimizing LLM inference latency to achieve **1–10 Hz** real-time performance for onboard robot navigation.

Project: Reasoning and Planning for Underwater Monitoring from Vision Language Model (VLM)
- Designing a VLM-guided autonomy framework for underwater navigation, addressing perception noise, semantic ambiguity, and planning inconsistency.
- Integrating VLM with chain-of-thought reasoning for global planning and optimizing local planners (DWA, TEB, E-Band) for obstacle avoidance.
- Achieving **1–5 Hz** VLM reasoning and at least **20 Hz** control frequency for real-time underwater navigation.

Research Assistant, George Mason University *Aug. 2025 – Oct. 2025*
Advisors: Prof. Xuesu Xiao Fairfax, VA
Project: Adaptive Dynamics Planning (ADP) for Robot Navigation
- Enabled collision-free navigation in narrow corridors and warehouse environments for **delivery robots** under tight spatial constraints.
- Designed dual-system architecture combining classical planning with **TD3-based RL** for real-time dynamics adaptation.
- Developed distributed training pipeline (Gazebo + Slurm HPC + Condor), achieving **89% reduction** in training time across hundreds of environments.
- Achieved **99% success rate** and **1st place** on BARN Challenge with **30% faster** traversal; submitted to **ICRA 2026**. [paper]

Research Engineer Intern, Johns Hopkins University *May 2025 – Aug. 2025*
Advisors: Prof. Tinoosh Mohsenin Baltimore, MD
Project: Autonomous Navigation for Legged Robots in Complex Environments
- Led team to develop full autonomy stack for **Unitree Go2 platform**, implementing 2D/3D adaptive navigation with autonomous exploration and terrain traversal analysis in unknown environments.
- Designed a hierarchical two-tier control architecture: DDP-based navigation framework for high-level planning and RL-trained locomotion policies in **NVIDIA Isaac Sim/Lab** for low-level motion control with designed observation space and reward structure.
- Implemented multi-sensor suite (LiDAR, IMU, RGB camera) matching physical robot specifications; enabled stable wireless ROS2 communication for untethered real-time control and telemetry over Wi-Fi. [video]

Research Assistant, George Mason University & Oxford Robotics Institute *Nov. 2025 – May 2025*
Advisors: Prof. Xuesu Xiao (GMU), Prof. Nick Hawes (ORI) Fairfax, VA
Project: Decremental Dynamics Planning (DDP) for Robot Navigation
- Enabled **high-speed** autonomous navigation for ground robots in **unknown** and **unstructured** environments, including off-road fields, urban alleys, and indoor obstacle-rich areas.
- Re-architected **ROS move_base** in C++ with hierarchical dynamics modeling (DWA, MPPI, Log-MPPI) and custom recovery behaviors for stalling/deadlock handling.
- Achieved **2nd place** in 2025 BARN Challenge; published at **IROS 2025**. [paper] [video]

Digital Innovation Research Fellow, Institute for Digital Innovation (IDIA) *May 2024 - Aug. 2024*
Advisors: Tong Yang (Unitree Robotics) and Kamaljeet Sanghera (IDIA) Fairfax, VA
Project: Vision-Driven Obstacle Avoidance for Quadruped Robot Navigation
- Focused on improving **visual–LiDAR fusion for obstacle avoidance** on the **Unitree Go1** quadruped robot, enhancing navigation reliability in complex 3D environments.
- Engineered **YOLO-based real-time obstacle detection** module integrated with **ROS1 move_base** framework, dynamically updating costmaps for reactive avoidance in dense environments.
- Developed RL-based velocity command policy for **non-planar terrain** locomotion and **stair climbing** in **Isaac Gym**, training adaptive behaviors over uneven surfaces [video].

Research Assistant, George Mason University *Jan. 2024 – Apr. 2024*
Advisors: Prof. Xuesu Xiao Fairfax, VA
Project: Multi-goal Motion Memory for Robot Navigation

- Implemented **task-level navigation** for **warehouse and hospital robots** performing delivery missions in dynamic environments without prior maps.
- Integrated CNN-based trajectory predictor (PyTorch) into a memory-augmented planning framework (C++) that reuses prior experiences, enabling rapid generation of dynamics-feasible paths from **camera/LiDAR maps**.
- Achieved **90% faster planning speed** while maintaining path quality; accepted by **ICRA 2025**. [paper] [video]

Research Assistant, George Mason University *Aug. 2021 – Apr. 2023*
Advisors: Prof. Erion Plaku Fairfax, VA
Project: Machine learning-based Motion Planning & Multi-Goal Motion Planning

- Addressed computational inefficiency of traditional motion planning algorithms to balance **planning accuracy and onboard computation** for real-time navigation.
- Engineered modular 2D/3D planning simulator in C++ with sampling-based algorithms (**PRM, RRT, DROMOS**); redesigned Roadmap representation and **Dijkstra** for improved scalability.
- Designed ML models (**MLP, XGBoost, LightGBM**) trained on planner data for predictive cost estimation; implemented distributed training on **Slurm HPC cluster** and integrated models into planning pipeline.
- Achieved **10× computational efficiency** with negligible optimality loss, enabling deployment on resource-constrained systems; published at **IROS 2022/2023** and **ICRA 2024**. [paper] [paper] [paper]

Research Assistant, George Mason University *Aug. 2019 – Jan. 2021*
Advisors: Prof. David Lattanzi & Prof. Amarda Shehu Fairfax, VA
Project: Data-Driven Modeling and Anomaly Forecasting for Autonomous Systems

- Improved traffic flow forecasting under **dynamic disruptions** (road work, lane closures), addressing instability of conventional models in irregular conditions.
- Engineered Graph Convolutional Network to capture spatiotemporal correlations across heterogeneous traffic networks, integrating flow dynamics, topology, and disruption indicators.
- Designed multi-head attention fusion mechanism to enhance robustness against sparse/noisy data, achieving **25% RMSE reduction** compared to baselines.
- Developed transferable graph-based modeling techniques for dynamic environments, contributing to robotic perception and navigation control. [paper]

Publications

C=Conference, J=Journal, S=Submission

[S.1] Y. Lu, L. Wang, T. Xu, and X. Xiao, **"Adaptive Dynamics Planning for Robot Navigation,"** under review at *IEEE International Conference on Robotics and Automation (ICRA)*, 2026.

[C.9] Y. Lu et al., **"Autonomous Ground Navigation in Highly Constrained Spaces: Lessons Learned from the Fourth BARN Challenge at ICRA 2025,"** *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA 2025)*, Competition Track (BARN Challenge), IEEE Robotics and Automation Society, 2025.

[C.1] Y. Lu, T. Xu, L. Wang, N. Hawes, and X. Xiao, **"Decremental Dynamics Planning for Robot Navigation,"** *2025 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, accepted, 2025.

[C.1] Y. Lu, D. Das, E. Plaku, and X. Xiao, **"Multi-goal Motion Memory for Robot Navigation,"** *2025 IEEE International Conference on Robotics and Automation (ICRA)*, pp. 8864–8871, 2025.

[J.6] T. Xu, C. Pan, M. B. Rao, A. Datar, A. Pokhrel, Y. Lu, and X. Xiao, **"Verti-bench: A General and Scalable Off-road Mobility Benchmark for Vertically Challenging Terrain,"** *IEEE Robotics and Automation Letters (RA-L)*, 2025.

[C.3] L. Wang, T. Xu, Y. Lu, and X. Xiao, **"Reward Training Wheels: Adaptive Auxiliary Rewards for Robotics Reinforcement Learning,"** *2025 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, accepted, 2025.

[C.2] D. Das, Y. Lu, E. Plaku, and X. Xiao, **"Motion Memory: Leveraging Past Experiences to Accelerate Future Motion Planning,"** *2024 IEEE International Conference on Robotics and Automation (ICRA)*, pp. 16467–16474, 2024.

[C.1] Y. Lu and E. Plaku, **"Leveraging Single-goal Predictions to Improve the Efficiency of Multi-goal Motion Planning with Dynamics,"** *2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 850–857, 2023.

[C.2] H. D. Bui, Y. Lu, and E. Plaku, **"Improving the Efficiency of Sampling-based Motion Planners via Runtime Predictions for Motion-planning Problems with Dynamics,"** *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pp. 4486–4491, 2022.

[C.4] Y. Du, Y. Wang, F. Alam, Y. Lu, X. Guo, L. Zhao, and A. Shehu, **"Deep Latent-variable Models for Controllable Molecule Generation,"** *2021 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*, pp. 1303–1310, 2021.

Professional Service

Journal/Conference Reviewer: IEEE Robotics and Automation Letters (**RA-L**), IEEE International Conference on Robotics and Automation (**ICRA**), and IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**), 2024–2025.
Leadership: Team Lead, GMU BARN Challenge 2025 Team

Technical Skills

Programming Languages: C++, Python, Java
AI Frameworks: PyTorch, TensorFlow, Keras, Scikit-Learn
Cloud Computing: AWS, Google Colab
Robotic tools: ROS, Gazebo, Nvidia-Isaac Gym/Sim, OpenAI Gym
Other: Linux, Git, Mac OS, Windows