Aditya Parameshwaran

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Professional Summary

PhD candidate specializing in Embodied AI with expertise in controls, reinforcement learning and formal theory. Experienced in multi-agent systems and verification for robotic manipulators and autonomous vehicles in dynamic environments.

Education

Clemson University — Jan 2022 - Present
Ph.D. Candidate in Mechanical Engineering — *Expected Graduation: August 2026*
Relevant Courses: Advanced Linear Programming, Robust Control, Optimal Control, Data-Driven Learning

Purdue University — Aug 2019 - Dec 2021
Master of Science in Mechanical Engineering — *GPA: 3.9/4.0*
Relevant Courses: Autonomous Systems, Modern Robotics, Engineering Mathematics

Experience

Department of Mechanical Engineering — Clemson University, SC
Graduate Research Assistant — *Jan 2022 - Present*

Multi-Agent Reinforcement Learning for Mobile Robots: Architected MAPPO-based coordination system for mobile robot systems utilizing 16 parallel training environments and centralized Vision-Language Critic model for natural language goals, paired with decentralized policy execution for deployment, achieving 90% success rate in multi-robot navigation with 12x faster training convergence. (`Python, ROS 2, Isaac Sim, Qwen-2.5 VL`)

Reinforcement Learning for Robotic Manipulators: Engineered PPO and SAC networks that achieve an 85% success rate in object manipulation tasks using RGBD sensors on a UR5 arm. (`C++, ROS 2, Isaac Sim, skrl`)

Semantic Mapping with Autonomous Vehicles: Collaborated to integrate stereo cameras and LiDAR sensors on a ground vehicle and improved off-road path planning using 3D semantic terrain maps (`C++, ROS 2, Octomap`).

Runtime Safety Monitoring using Generative AI models: Pioneered a novel verification framework using VAE networks, reducing formal safety verification time by 70% for image-based neural network controllers in both robotic manipulation and autonomous driving scenarios. (`PyTorch, ROS 2, Isaac Sim`)

Ground Robot Navigation with Verified Safety: Developed a mobile robot navigation system constrained by formal methods combining temporal logic and optimal controls, achieving complete collision avoidance in complex dynamic environments. (`MATLAB, Gurobi`).

WABTEC Corporation — West Lafayette, IN
Autonomy Intern — *May 2021 - Dec 2021*

Robotic Train for Railway Monitoring: Spearheaded a cross-functional team to design a sensor-integrated robotic train using `Solidworks` and `Nvidia Jetson`, improving track monitoring efficiency by 30% and reducing inspection costs by $45K annually.

Sensor Fusion for GPS-Denied Navigation: Architected an Extended Kalman Filter for multi-sensor fusion, reducing position error by 65% in GPS-denied environments and enabling robust autonomous navigation in tunnels and urban canyons.

Technical Skills

Programming Languages: C/C++, Python, MATLAB
Robotics & Simulation: ROS 2, Gazebo, Isaac Sim, Isaac Lab, MuJoCo, CARLA, MoveIt
Tools: Git, Docker, Gurobi, SolidWorks, CasADI
Machine Learning & AI: VLM, PyTorch, TensorFlow, OpenCV, scipy, pandas, gym, skrl

Selected Projects

Pick and Place Tasks for Robotic Manipulators: Designed hierarchical task-based planning approach for picking and placing objects using a UR5 robot arm and gripper in `C++`, `MoveIt` and `IsaacSim`.
Imitation Learning for Autonomous Driving: Developed a Deep CNN model on `PyTorch` achieving expert policy emulation for autonomous vehicle navigation in `CARLA`, with robust performance across varied urban scenarios and weather conditions.
Robust Control for Lane Changing: Engineered a robust MPC controller using `CasADI` and `Gurobi`, achieving successful lane changes under tested noise conditions while maintaining passenger comfort metrics within human preference thresholds.

Selected Publications

Parameshwaran, A., Wang, Y., "Scalable and Interpretable Verification of Image-Based Neural Network Controllers for Autonomous Vehicles", *ICCPS,* 2025. *(25% Acceptance Rate)*

Parameshwaran, A., Wang, Y., "Temporal Logic Guided Safe Navigation for Autonomous Vehicles", *IFAC-PapersOnLine*, 2024.