Aditya Parameshwaran

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Professional Summary

PhD candidate specializing in the intersection of Robotics, Controls, and Machine Learning with expertise in developing autonomous systems enhanced by Generative AI. Experienced in runtime safety verification, robotic manipulation, and autonomous vehicles in complex environments.

Education

Clemson University — Jan 2022 - Present
Ph.D. Candidate in Mechanical Engineering — *Expected Graduation: May 2026*
Research Focus: Robotics, Generative Models, Controls
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 (PhD.) — *Jan 2022 - Present*

Reinforcement Learning (RL) for Robotic Manipulator: Engineered a DDPG-based Soft Actor-Critic network achieving 85% success rate in object manipulation tasks using RGBD sensors on a UR5 arm. (`C++, ROS 2, Isaac Sim`)

Runtime Monitoring with Generative AI: Pioneered a novel verification framework using attention-enhanced GAN networks, reducing formal safety verification time by 70% for image-based neural network controllers in both robotic manipulation and autonomous driving scenarios.

Drone Navigation with Guaranteed Safety: Developed a formal methods-based navigation system combining temporal logic and optimal controls, achieving complete collision avoidance in complex environments while optimizing flight paths. (`MATLAB, Gurobi`).

WABTEC Corporation — West Lafayette, IN
Robotics 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, CARLA, MoveIt
Engineering Tools: Git, Docker, Gurobi, SolidWorks, CasADI
Machine Learning & AI: PyTorch, TensorFlow, OpenCV, AutoML, scipy, pandas

Selected Projects

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.

Physics-Informed Neural Network Controller: Enhanced neural path planner performance by 2x using physics-based loss functions, resulting in smoother trajectories and faster convergence, implemented in `PyTorch` and `OpenCV` on L5Kit dataset.

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 Explainable 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.