# Aditya Parameshwaran

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## INTERESTS

My areas of interests lie in **Formal Methods**, **Machine Learning** and **Autonomous Controls**. I particularly focus on verification of Deep Learning models to quantitatively analyse and ensure safety for autonomous applications such as mobile robots and vehicles.

## PUBLICATIONS

- Parameshwaran, Aditya, and Yue Wang. Safety Verification of Autonomous Vehicles based on Signal Temporal Logic (STL) constraints. No. 2023-01-0113. SAE Technical Paper, 2023.

## EXPERIENCE

**US Army - VIPR Centre**  Clemson University, SC
*Graduate Research Assistant*  *Jan 2022 - Present*

- **Safety Verification in Perception Models**: Developing tools for verification and validation of Deep Neural Network based image segmentation models with extensive use of *PyTorch* and *Tensorflow* with *Keras*. Experienced in operating Linux based High-Performance Cluster computing resources for training networks
- **Outdoor Terrain Mapping and Navigation**: Integrated US Army's native robotics stack onto a Clearpath Jackal robot equipped with LIDAR for off-road navigation using *ROS* and *C++*. Compiled the OctoMap library for developing 3D maps of outdoor terrains
- **Formal Rules based Navigation for Mobile Robots**: Developed a Temporal Logic based path planner that guarantees safety for navigation of mobile robots in known environments using *MATLAB* and Mixed Integer solvers like *Gurobi*

**WABTEC Corporation**  Purdue University, IN
*Industry Project*  *Aug 2020 - Dec 2021*

- **Autonomous Rail-Bot for Data collection on Railway tracks**: Constructed an autonomous railway bot that runs on railway tracks and collects processable perception and odometry data from LIDAR, stereo cameras, GPS and IMU

## PROJECTS

**Behavioral Cloning for Autonomous Vehicles**: Trained a Deep CNN model on *Tensorflow* to predict steering angle values from a race car based on an expert driver's recorded data

**Robust Control for uncertain Lane Changing scenario**: Used the *CasADI* tools and *Gurobi* solver to develop a robust controller that could successfully automate changing lanes of an AV under measurement noise and input disturbances

**Optimal Control for Landing Reusable Rockets**: Deployed a path-tracking model predictive controller to land a non-linear rocket safely for different landing scenarios. Employed an Extended Kalman Filter to estimate the rocket's location under environmental disturbances and noise

**Autonomous Navigation of a vehicle in Unity environment**: Created a software stack capable of navigating a vehicle using lane tracking, obstacle avoidance, and road sign detection using *ROS, OpenCV*, and *Python*

## EDUCATION

**Clemson University**  Jan 2022 - Present
*PhD. in Mechanical Engineering (GPA - 4.0)*
Research Topic: Formal Rules based Verification and Controls in Autonomous Vehicles
Advisor: Yue Wang

**Purdue University**  Aug 2019 - Dec 2021
*Master of Science in Mechanical Engineering (GPA - 3.94)*
Relevant Courses: Autonomous Systems, Robot Kinematics, Deep Reinforcement Learning

**University of Pune**  Aug 2014 - June 2018
*Bachelor of Engineering in Mechanical Engineering*

## Conferences

- Oral Presentation at the *SAE World Congress Experience (WCX) 2023*, Detroit, Michigan; "Safety Verification and Navigation of Autonomous Vehicles based on Signal Temporal Logic Constraints"

## Skills

- Python
- C++
- TensorFlow
- PyTorch
- ROS
- MATLAB
- Simulink
- StateFlow

## Co-Curricular

- **M.E. Graduate Student Council**: Head of Charter and Bylaws, with the responsibility of updating and ratifying the student council handbook, and organizing social and academic events for the ME graduate students