

Education

- 2025 **Ph.D., Automotive Engineering**, *Clemson University ICAR*, Greenville, **GPA**: 3.93/4.0.
Research topics: robotics controls and planning, reinforcement learning, off-road driving controls, optimal control, connected autonomous vehicles, optimization, sim2real
Research Question: "How can we leverage the individual strengths of model-based and learning-based methods for safe driving controls and planning?"
- 2022 **MS, Automotive Engineering**, *Clemson University ICAR*, Greenville, **GPA**: 3.97/4.0.
TATA Fellow; Capstone Project: Deep Orange 13 (Full scaled high speed autonomous off-road vehicle)

Skills

- Coding Python, C++, PyTorch, Git
- Robotics ROS, ROS2, Autoware software stack, Gazebo, Gym
- Simulation MATLAB, Simulink, CarSim, Project Chrono, Altair MotionSolve, Hyperworks, ANSA, Solidworks, Carla
- Solvers Acados, Gurobi, NASTRAN
- RT Control Arduino, New Eagle Raptor and other Real-Time control modules
- OS Windows, Linux, Raspberry Pi
- Certificates Nanodegree: Intro to Self-Driving Cars, Udacity ([view](#)), DC201x: Dynamics and Control, Universidad Politecnica de Valencia ([view](#)), Machine Learning, Stanford University ([view](#))

Research & Development Experience

Graduate Research Assistant, Clemson University

- 2022-2025 **Learning Augmented Model-based Optimization Controls.**
- Formulated and investigated a hybrid reinforcement learning architecture to handle modeling mismatches and unmodeled system dynamics to improve driving performance
 - Research aims to reduce data dependency by leveraging nominal models and increase generalization of controller across different driving conditions
 - Online learning to enable life-long adaptation on vehicle
 - Validating simulation results on a drive-by-wire vehicle on off-road terrains ([Off-road Autonomous Video](#))
- 2022-2024 **Energy efficient Cooperative Autonomous Driving.**
- Controls and planning research to improve energy efficiency through V2V, V2I connectivity using optimal control and planning algorithms like Model Predictive Control (MPC) and Pontryagin's minimum principle.
 - Experimental results up on an in-house drive-by-wire Mazda CX7 showed up to 36% improvements with state-of-the-art lane switching and acceleration strategy on connected traffic corridors
 - Expert skills for on-vehicle control deployment using MPC and other state-of-the-art controllers
- 2021-2022 **Deep Orange 13: High Speed Off-road Autonomous Vehicle.**
- Implemented fully autonomous navigation for offroad driving using cameras, lidars, GNSS over ROS (Robot Operating Software) on physical small and full scaled platforms
 - Designed and developed vehicle controls systems and safety architecture using model based engineering for embedded platform
 - Utilized systems engineering principles and requirements analysis to accomplish missions
 - H-i-L and S-i-L testing for vehicle autonomy
 - Autonomous Driving: [Unmanned Autonomous Deep Orange 13-14](#), [Manned Autonomous](#)
- [CAE and Multibody Dynamics Engineer, Mercedes Benz R&D India](#)
- 2017-2020 **Freightliner Chassis Engineering Simulation.**
- Designed and set up a new simulation processes to evaluate and analyze K&C characteristics of vehicle suspensions using multi-body approach.
 - Simulated entire vehicle on a digitalized rough road for dynamics and durability evaluations to reduce physical testing costs. This lowered simulation times by 80% as compared to existing FEA processes.

Selected Projects

- 2024 **Physics Informed Future Video Frame Prediction.**
- Surveyed and analyzed existing physics informed video prediction methods in computer vision
 - Conditional Generative Adversarial Network (GAN) approach with kinematic constraints was developed.
 - Project webpage: [conditional-GAN for video prediction](#)
- 2021 **Stability of Tractor-Trailer Systems.**
- Analysis of dynamics of tractor-trailer combinations, their stability issues and control solutions
 - LQR based yaw control of vehicle system
 - Report Link: [Stability Analysis Report](#), [Control Design Report](#)
- 2021 **Autonomous Driving Robot.**
- Developed and implemented ROS python and C++ nodes to enable, on a Turtlebot3 robot: Obstacle avoidance, Navigation, Line following, Traffic sign detection, Object tracking
 - Utilized pre-trained deep learning models for object recognition
 - GitHub: [ProjectCode](#)
- 2021 **Parallel Robots: Hexapod Inverse Kinematics.**
- Implemented a planar cable robot and designed controller using Quanser's Hexapod hardware in HiL simulation
 - Formulated inverse and forward kinematics for the cable robot
- 2021 **Edge Detection and Image Segmentation.**
- Implemented convolution kernels for letter recognition and edge detections in images using C
 - Explored methods like template matching, contouring, filtering, region growth to interpret images

Selected Publications

Journal Articles

- 2025 **Prakhar Gupta**, Jonathon M Smereka, and Yunyi Jia. Reinforcement learning compensated model predictive control for off-road driving on unknown deformable terrain. *arXiv preprint [arXiv:2408.09253](#), Under Review at IEEE Transactions on Intelligent Vehicles*, 2025.
- 2025 Tyler Ard, Jihun Han, **Prakhar Gupta**, Dominik Karbowski, Yunyi Jia, and Ardan Vahidi. Energy-efficient automated driving for everyday maneuvers: Fundamentals to experimentation. *IEEE Control Systems Letters*. IEEE, 2025.

In Conference Proceedings

- 2025 **Prakhar Gupta**, Jonathon M Smereka, and Yunyi Jia. Actor-critic cooperative compensation to model predictive control for off-road autonomous vehicles under unknown dynamics. In *IEEE ICRA*, 2025. [Arxiv preprint](#).
- 2024 Jihun Han, Tyler Ard, **Prakhar Gupta**, Rongyao Wang, Ardan Vahidi, Yunyi Jia, and Dominik Karbowski. Human driver interaction with an eco-speed advisory system in connected vehicles: Simulation and experimental results. In *Proceeding of Transportation Research Board*, 2024. [Winner, Best Paper Award](#).
- 2023 **Prakhar Gupta**, Rongyao Wang, Tyler Ard, Jihun Han, Dominik Karbowski, Ardan Vahidi, and Yunyi Jia. An x-in-the-loop (xil) testing framework for validation of connected and autonomous vehicles. In *2023 IEEE International Automated Vehicle Validation Conference (IAVVC)*, pages 1–6. IEEE, 2023. [2nd Place, Best Paper Award](#).

Fellowships & Awards

- 2024 [Best Paper Award](#), TRB Road User Measurement and Evaluation Committee, in the 103rd TRB Annual Meeting
- 2023 [2nd Place, Best Paper Award](#) at IEEE IAVVC 2023 conference
- 2021 [First prize](#) for [research poster](#) in Centre for Connected Multimodal Mobility Annual Conference 2021
- 2020 Received TATA Fellowship (100% tuition grant) to pursue MS Automotive Engg. at CU-ICAR
- 2019 Won [Team Impact Award](#) at Daimler for rapid and efficient development projects in CAE.
- 2016 Overall 2nd place, Formula Bharat 2015 (national student competition) – winners in 7 categories.
- 2016 National record for best acceleration timing of an FSAE race-car in 2015.