Prakhar Gupta

Resume

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Prakhar's Website
Github *Linkedin*

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
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)

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 MPC
- 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 and safety architecture using New Eagle Raptor platform
- 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

Skills

Coding Python, C++, PyTorch

Robotics Gazebo, ROS, ROS2, Autoware software stack

Simulation MATLAB, Simulink, CarSim, Project Chrono, Altair MotionSolve, Hyperworks, ANSA, Solidworks, Carla

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)

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 Ardalan 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, Ardalan 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, Ardalan 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.