Prakhar Gupta

Curriculum Vitae

Department of Automotive Engg.
Clemson University
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🏠 *Prakhar's Website*
 Github in *Linkedin*

Education

2025 **Ph.D., Automotive Engineering**, *Clemson University ICAR*, Greenville.
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 to improve off-road driving controls and planning algorithms under unknown dynamics?"

2022 **MS, Automotive Engineering**, *Clemson University ICAR*, Greenville.
Capstone Project: Deep Orange 13 (Full scaled high speed autonomous off-road vehicle)
GPA: 3.97/4.0

2017 **B.Tech., Mechanical Engineering**, *Manipal Univeristy*, India.
Thesis topic: Vehicle dynamics simulation model and validation

Publications

Journal Articles

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.

2025 Hannah Musau, Denis Ruganuza, Debbie Indah, Arthur Mukwaya, Nana Kankam Gyimah, Ashish Patil, Mayuresh Bhosale, **Gupta, Prakhar**, Judith Mwakalonge, Yunyi Jia, Dariusz Mikulski, David Grabowsky, Jae Dong Hong, and Saidi Siuhi. A review of off-road datasets, sensor technologies and terrain traversability analysis. Technical Report 2025-01-8339, SAE Technical Paper, 2025.

2024 **Prakhar Gupta** and Yunyi Jia. Safety-regulated reinforcement learning compensated model predictive control for ground vehicles with unknown disturbances. Technical report, SAE Technical Paper, GVSETS, 2024.

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.

2024 Mayuresh Bhosale, **Prakhar Gupta**, Rahul Prasanna Kumar, and Yunyi Jia. Ai-enhanced proactive model predictive control for off-road autonomous vehicles. Technical report, SAE Technical Paper, GVSETS, 2024.

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.

Research & Development Experience

Graduate Research Assistant, Clemson University

2022-2024 **Learning augmented model based optimization controls**.

Advisor: Dr. Yunyi Jia, Associate Professor, Clemson University

Funding: Department of Defense through VIPR-GS.

1. Formulated and investigated a hybrid reinforcement learning architecture to handle modeling mismatches and unmodeled system dynamics
2. Research aims to reduce data dependency by leveraging nominal models and increased generalization of controller across different driving conditions
3. Validating simulation results on a drive-by-wire Polaris RZR vehicle on off-road terrains (Off-road Autonomous Video)

2022-2024 **Energy Efficient cooperative driving**.

Advisors: Dr. Yunyi Jia, Dr. Ardalan Vahidi, Clemson University

Funding: Department of Energy through Argonne National Laboratory.

1. Research aims to improve energy efficiency through V2V, V2I connectivity by informing lane switching and acceleration strategy on connected traffic corridors
2. Experimental results up on an in-house drive-by-wire Mazda CX7 showed up to 36% improvements
3. Expert skills for on-vehicle control deployment using MPC and other state-of-the-art controllers

2021-2022 **Collaborative monitoring of road conditions**.

Advisors: Dr. Yunyi Jia, Clemson University

Funding: Department of Transportation

1. Research aims to utilize deep learning and cloud architecture to augment road condition monitoring
2. Object detection neural networks were trained to identify road defects that need attention using just smartphone sensors like IMU and camera. Research Poster, Award

2021 **Hexapod Inverse Kinematics**.

Advisor: Dr. Venkat Krovi, Professor, Clemson University

1. Implemented a planar cable robot and designed controller using Quanser's Hexapod hardware in HiL simulation
2. Formulated inverse and forward kinematics for the cable robot

2021-2022 **Deep Orange 13**.

Advisor: Dr. Chris Paredis, Professor Emeritus, Clemson University

Funding: Department of Defense through VIPR-GS.

1. Implemented fully autonomous navigation for offroad driving using cameras, lidars, GNSS over ROS (Robot Operating Software) on small and full scaled platforms
2. Designed and developed in-house Drive-by-Wire vehicle controls architecture using New Eagle Raptor controller and ROS using C++ and Python
3. H-i-L and S-i-L testing for vehicle controls
4. Communications and vehicle networking using CAN, Ethernet, wireless short range communications
5. 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**.

1. Designed and set up a new simulation process to evaluate K&C characteristics of Freightliner custom chassis suspensions using multi-body approach. Facilitated vehicle evaluation for FMVSS136 regulation by analyzing sensitivity to K&C data.
2. Simulated entire vehicle on a digitalized rough road in Altair MotionSolve (multi-body) for dynamics and durability evaluations to reduce physical testing costs. This lowered simulation times by 80% as compared to existing FEA processes.
3. Used FEA solvers (NASTRAN, Abaqus) to analyze and quantify durability performance of Freightliner motorhome chassis.

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 (full tuition grant $36,000$) 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.

Skills

Programming	Python, PyTorch, C++
Robotics	Gazebo, ROS, ROS2, Autoware software stack
Simulation & Modeling	MATLAB, Simulink, CarSim, Project Chrono, Altair MotionSolve, Hyperworks, ANSA, Solidworks, Carla
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)

Leadership Positions

| 2021-2022 | **Lead Autonomy and Controls Engineer**, Deep Orange 13, Clemson University. |
| 2014-2016 | **Lead Vehicle Dynamics Engineer**, FSAE Team, Manipal University. |

Teaching Assistantship

| 2022-2024 | **AuE8350: Automotive Electronics Integration**, *Dr. Yunyi Jia*, Clemson University. |

Dynamics and Robotics Projects

2021 Stability of Tractor-Trailer Systems.
Course Instructor: Dr. Beshah Ayalew, Professor, Clemson University
1. Analysis of dynamics of tractor-trailer combinations, their stability issues and control solutions
2. LQR based yaw control of vehicle system
3. Report Link: Stability Analysis Report, Control Design Report

2021 Autonomous Driving Robot.
Course Instructor: Dr. Venkat Krovi, Professor, Clemson University
1. Developed and implemented ROS python and C++ nodes to enable, on a Turtlebot3 robot: Obstacle avoidance, Navigation, Line following, Traffic sign detection, Object tracking
2. Utilized pre-trained deep learning models for object recognition
3. GitHub: ProjectCode

Community Engagement

2023	**Robotics for kids**, *Taught kids the basics of robotics using visual block programming and drawing robots as a STEAM initiative at Artishpere Greenville festival.*
2019	**Formula Student**, *Design Judged undergraduate students' engineering skills and race-cars; conducted feedback sessions to mentor them.*
2019	**Habitat for Humanity**, *Volunteered to paint homes in underprivileged neighborhoods. Initiative was to recondition their homes for the festive season. Cleaning drive for the city lake.*
2018	**Mobile Kids, a Daimler Initiative**, *Worked in a team of 20 members to impart traffic education events to over 100 school children. Identified traffic hazards and missing traffic management infrastructure in school vicinity and fulfilled them with the help of an NGO called 'Pothole Raja'.*