Sambhu H. Karumanchi

Personal Information

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website

Research Interests

Machine Learning, Robotics, and Vision-based Control

Education

University of Illinois Urbana-Champaign, Urbana, IL, USA

Doctor of Philosophy in Mechanical Engineering, 08/2023 - Present
Advisor : Prof. Naira Hovakimyan GPA : **4.0/4**

Master of Science in Aerospace Engineering, 08/2021 - 08/2023
Advisor : Prof. Naira Hovakimyan GPA : **4.0/4**

National Institute of Technology Karnataka, Surathkal, India

Bachelor of Technology in Mechanical Engineering, 08/2016 - 06/2020
Advisor : Prof. Prasad Krishna & Prof. Patricio Vela GPA : **9.35/10**

Publications

[9] Energy-constrained multi-robot exploration for autonomous map building
Sambhu H. Karumanchi, Bhagawan R., Alexander Schperberg, and Abraham P. Vinod
IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS**), 2025

[8] Wasserstein Distributionally Robust Adaptive Covariance Steering
Aditya Gahlawat, Duo W., **Sambhu H. Karumanchi**, Vivek K., Petros V., Naira Hovakimyan
IEEE Conference on Decision and Control (**CDC**), 2025

[7] Robust Model Based Reinforcement Learning using $\mathcal{L}_1$ Adaptive control
Minjun Sung*, **Sambhu H. Karumanchi***, Aditya Gahlawat, Naira Hovakimyan
International Conference on Learning Representations (**ICLR**), 2024

[6] Empirical Dynamic Programming for Controlled Diffusion Processes
Sambhu H. Karumanchi, Mohamed A. Belabbas, Naira Hovakimyan
IFAC World Congress (**WC**), 2023

[5] Autonomous UAV Navigation in Complex Environments using Human Feedback
Sambhu H. Karumanchi, R. Diddigi, KJ Prabuchandran, Shalabh Bhatnagar
IEEE International Conference on Robot and Human Interactive Communication (**RO-MAN**), 2023

[4] Real-time Autonomous Vehicle Navigation under Unknown Dynamics
Shubham Kedia and **Sambhu H. Karumanchi**
IEEE Intelligent Transportation Systems Conference (**ITSC**), 2023

[3] Tackling Airspace Congestion : A Scalable and Robust Framework for End-to-End UAS Traffic Management
Minjun Sung, **Sambhu H. Karumanchi**, Christophe H.M., H. Kim and Naira Hovakimyan
IEEE Intelligent Transportation Systems Conference (**ITSC**), 2023

[2] Integrated Perception and Planning for Autonomous Vehicle Navigation : An Optimization-Based Approach
S. Kedia, Yu Zhao, **Sambhu H. Karumanchi**
IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (**CVPRW**), 2023

[1] Closed-loop benchmarking of stereo visual-inertial SLAM systems : Understanding the impact of drift and latency on tracking accuracy
Y. Zhao, J.S. Smith, **Sambhu H. Karumanchi** and Patricio Vela
IEEE International Conference on Robotics and Automation (**ICRA**), 2020

Awards

- **TechnipFMC Fellowship**, University of Illinois Urbana-Champaign, 2024
- **MechSE Outstanding Scholar Fellowship**, University of Illinois Urbana-Champaign, 2023
- **University Student Research Challenge (USRC)**, NASA, 2022
- **Summer Research Fellowship**, IIT Madras, 2019

Selected Projects

Approximate Dynamic Programming for Dynamic Resource Allocation
Supervisor : Prof. Cedric Langbort

- Considered cost-effective allocation of freights to two different modes of transport - a high capacity long-haul followed by last-mile transport or direct last-minute transport to the destination - when orders randomly arrive at a single origin with shipping requests to different destinations.
- An approximate dynamic program was formulated and solved using the linear programming approach

Physics-Informed Neural Networks for Aerodynamic Design Optimization
Supervisor : Prof. Elle Wroblewski

- Developed a physics-informed neural network model to determine the optimal aerodynamic shape design for the flows modeled using the Navier-Stokes equation.
- The system was modeled as a controlled Partial Differential Equation with the boundary shape of the aerofoil acting as the control.
- The optimization model accommodates generic performance functions such as achieving a target surface pressure distribution or a desired lift-to-drag ratio

Research Experiences

Machine Learning Research Intern PNNL, Richland, WA, USA *06/2025 - 08/2025*

- Worked on optimal control for Turtlebot4 differential drive robots using physics-informed neural networks

Robotics Research Intern Mitsubishi Electric (MERL), MA, USA *05/2024 - 08/2024*

- Worked on Multi-agent collaborative active SLAM (**IROS 2025**)

Machine Learning Intern Indian Institute of Science, Bangalore, India *07/2020 - 08/2021*

- Worked on preference-based reinforcement learning for UAV obstacle avoidance and autonomous navigation (**RO-MAN 2023**)

Robotics Research Intern Georgia Tech, GA, USA *08/2019 - 12/2019*

- Performed closed-loop benchmarking study of various stereo visual-inertial SLAM systems (**ICRA 2020**)

Skills

Programming languages : C, C++, Python, Julia
Libraries : Robot Operating System(ROS 2), TensorFlow, Pytorch, OpenCV
Softwares : MATLAB, CATIA, LabVIEW.