

# SAMBHU H. KARUMANCHI

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## PERSONAL INFORMATION

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## 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

- [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

**Optimal Control using Physics-Informed Neural Networks (PINNs) :**

*Supervisor : Prof. Matthew West and Prof. Luke Olson*

- Trained PINNs to solve the Hamilton-Jacobi-Bellman (HJB) PDE for trajectory optimization in non-linear systems
- Compared the performance of the framework with constrained numerical optimization techniques such as shooting methods and direct transcription

**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

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

- Worked on Multi-agent collaborative active SLAM

**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.