

# Manav Vora

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## EDUCATION

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### University of Illinois Urbana-Champaign

Champaign, IL

M.Sc. in Aerospace Engineering - Thesis Track, GPA: 3.83/4.0

Aug 2022 - May 2024 (expected)

- Advisor: Prof. Melkior Ornik
- Relevant Coursework : MDPs and Reinforcement Learning, Optimization in Aerospace Systems

### Indian Institute of Technology Bombay (IIT Bombay)

Mumbai, IN

B.Tech (with honors) in Aerospace Engineering, Minor in Systems and Controls

Jul 2018 - Aug 2022

- Ranked 4<sup>th</sup> out of 60 students in the department of aerospace engineering
- Recipient of **Chanakya Research Fellowship** awarded for research on autopilot design for delivery drone

## SELECTED WORK EXPERIENCE

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### Research Assistant | Advisor: Prof. Melkior Ornik | LEADCAT Group, UIUC

Aug 2022 - Present

- Solving the problem of **multi-agent optimization** of large state space factored POMDPs via reinforcement learning
- Implemented a **POMCP** solver in **Julia** to find optimal maintenance and inspection policy for multiple buildings
- Developed a **budget distribution** algorithm to decouple the buildings into independent POMDPs and make the optimal policy computationally feasible and efficient
- Developing a **transfer learning** algorithm to extrapolate the optimal policy of a single building to multiple buildings and aid in computationally efficient solution through faster reinforcement learning in the larger state space

### Reinforcement Learning for Lunar Lander | Course Project

Aug 2022 - Dec 2022

- Compared performance of **DQN, SARSA, Q-Learning and Monte Carlo** algorithms on a spacecraft to aid in optimal landing on the surface of the moon
- Visualised the performance of all algorithms on the spacecraft by creating animations using the **Python Gym Environment**
- Obtained the final trajectory of spacecraft, from the animations, under different algorithms using object tracking in **OpenCV**

### Lie Algebra Based Neural ODE | Advisor: Prof. Pratik Chaudhari | GRASP Lab, UPenn

Apr 2021 - Feb 2022

- Implemented **Hamiltonian-based Neural ODE** on pendulum and quadrotor to understand its structure and working
- Worked on incorporating **Lie Algebra** in Neural ODE architecture to increase dynamics prediction accuracy
- Achieved validation error under **5%** on CIFAR-10 dataset via design and implementation of a **16x4 Wide ResNet**
- Executed **RRT-star** algorithm on Dubins' Car with 2 nearest neighbor search heuristics to understand Lie Algebra

### Control of Agile Tethered Drone Attached to Moving Vehicle | Bachelor's Thesis

Jan 2021 - May 2022

- Developed a **ROS controller package** and merged with PixHawk to achieve trajectory tracking with less than **3%** error
- Created a novel **Gazebo** model of a quadrotor UAV tethered to a fixed support via a flexible tether
- Developed a Gazebo **control force plugin** using C++ to apply external force to the system for dynamics simulation

### Autopilot Design for Delivery Drone | Advisor: Prof. Arnab Maity

Jul 2020 - Jan 2022

- Conceptualised a novel **Hamiltonian Neural ODE** network based adaptive controller to maintain system performance in the presence of dynamic uncertainties like payload imbalance, motor failure and disturbances
- Designed an **e-modification** based adaptive controller and achieved an accuracy of **98%**
- Formulated the dynamics and performed stability analysis of a drone carrying unbalanced grasped payload
- Compared the performance of various flight control techniques like **PID, Dynamic Inversion and Backstepping**

## TECHNICAL SKILLS

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### Languages

Python, Julia, C++, C, MATLAB

### Tools & Frameworks

ROS, Pytorch, Apache MXNet, Numpy, SciPy, sklearn, Gym, OpenCV, Pandas, Compyle, Gazebo, Simulink, L<sup>A</sup>T<sub>E</sub>X, Mayavi, git

## TEACHING EXPERIENCE

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### Teaching Assistant | Guide: Prof. Arnab Maity | Control Theory

Jul 2021 - Dec 2021

- Worked in a **team of 6** students to help the professor in smooth day-to-day conduction of the course
- Responsible for curation of a comprehensive compendium of the course for **80+** students in the department