

# Raghav Sood

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## EDUCATION

### Carnegie Mellon University (CMU)

Master of Science in Mechanical Engineering - Research

Pittsburgh, PA

May 2020

**GPA: 4.0/4.0**

Courses: Adaptive Control and RL, Planning in Robotics, Computer Vision, SLAM, Deep Learning, Multivariable Control

### Delhi Technological University (DTU)

Bachelor of Technology in Mechanical Engineering (First Class with Distinction)

New Delhi, India

May 2018

## WORK EXPERIENCE

### Search Based Planning Laboratory, Robotics Institute, CMU

Pittsburgh, PA

Research Associate

May 2020 – Present

- Developing a motion planning framework for real-time planning of long soft robots with high degrees of freedom.
- Created a homotopy guidance algorithm to accelerate higher dimensional search by 4x compared to baseline.

## RESEARCH PROJECTS

### Intelligently Activating Adaptive Motion Primitives using Deep Learning

Pittsburgh, PA

Search Based Planning Laboratory, CMU

May 2019 – Feb 2020

- Crafted a Deep Learning based algorithm to efficiently employ adaptive motion primitives during a heuristic search.
- Built a unified domain independent planning framework on ROS and tested it on navigation and manipulation tasks.
- Attained an average speedup of 2.5 times compared to baseline planner.

### Motion Planning for an Autonomous Blimp Drone for Inspection Tasks

Pittsburgh, PA

CERLAB, CMU

Sep 2018 – May 2019

- Designed and manufactured a blimp drone in a team of 4 to inspect cargo containers for cracks.
- Employed and tuned Model Predictive Controller for autonomous operation of drone using ROS platform.
- Developed a lattice-based multi-goal weighted A\* planner achieving real-time performance on inspection tasks.

## ACADEMIC PROJECTS (CMU)

### Model Based Reinforcement Learning in Handful of Trials

April 2020 – May 2020

- Implemented MBRL algorithm to improve sample efficiency using probabilistic ensembles with trajectory sampling.
- Achieved better performance than soft actor critic (SAC) method with high sample efficiency (50% of SAC).

### Motion Planning for Global Localization in Multi-Modal Belief Spaces

Oct 2019 – Nov 2019

- Lead a team of 3 to design a motion planning algorithm to disambiguate a multi-modal robot state during localization.
- Demonstrated algorithm working on a non-holonomic ground robot in symmetric maze-like environment.

### Navigation Framework for an Autonomous Vehicle in Unstructured Environment

April 2019 – May 2019

- Developed a motion planning framework to navigate an autonomous vehicle in a dynamic environment.
- Combined a lattice-based ARA\* motion planner with trajectory prediction to handle dynamic obstacles in real time.

### LQR Controller Design for an Autonomous Ground Vehicle

Nov 2018

- Applied Linear Quadratic Regulator controller to control an autonomous ground robot based on bicycle model.
- Achieved best lap time (61s) in robot buggy racing competition.

## SKILLS

**CS Framework and Tools:** ROS, PyTorch, Linux, Gazebo, OpenAI Gym, Git

**Programming Languages:** Advanced: C, C++, Python, MATLAB | Intermediate: Markdown, HTML/CSS

## PUBLICATIONS

Raghav Sood, Shivam Vats, Maxim Likhachev, “**Learning to Use Adaptive Motion Primitives in Search-Based Planning for Navigation**”, IEEE/RSJ International Conference on Intelligent Robots and Systems, 2020.