

Abhinav Kumar

Robotics Ph.D. student applying learning and planning to challenging dexterous and deformable manipulation problems

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WORK EXPERIENCE

Graduate Student Research Assistant University of Michigan Ann Arbor: ARM Lab

08/2022 - Present

Working in Professor Dmitry Berenson's Autonomous Robotic Manipulation Lab

Achievements/Tasks

- Working on generative models for dexterous manipulation, combining learning and trajectory optimization
- Previously worked on deformable object manipulation and online adaptation of model predictive control to novel environments
- 1 paper accepted to IEEE RA-L, 1 in submission to ICRA

Graduate Student Instructor: Intro to Algorithmic Robotics University of Michigan Ann Arbor

08/2023 - 12/2023

Achievements/Tasks

- Assisted in instruction of 50 students in topics related to perception, motion planning, machine learning, optimization, and mathematical foundations of robotics
- Helped create homework assignments and managing grading staff
- Held office hours and answering online questions regarding course material

Undergraduate Research Assistant Georgia Tech Laboratory for Intelligent Decision and Autonomous Robots

08/2020 - 12/2021

Achievements/Tasks

- Conducted research using deep reinforcement learning techniques to improve trajectory optimization for robots in situations with intermittent contact
- Investigated intersection between learning and model based techniques
- Received Georgia Tech President's Undergraduate Research Award

Undergraduate Research Assistant Georgia Tech Machine Learning and Perception Lab

08/2019 - 08/2020

Achievements/Tasks

- Worked on research project combining symbolic representations and deep learning for automating solving of math problems
- Continued work with former members of the lab, leading to publication and oral presentation at EMNLP 2021

SKILLS

Robot Learning



Trajectory Optimization



PyTorch



ROS



C/C++



OTHER PROJECTS

Diffusion Informed Probabilistic Contact Search (DIPS)

- Enable contact mode planning using a combination of diffusion and graph search
- Use planned contact modes to define trajectory optimization problems
- Submitted to ICRA 2025 (<https://arxiv.org/abs/2410.00841>)

Constraint Obeying Gaussian Implicit Surfaces (COGIS)

- Uses a Gaussian Process Implicit Surface to learn an implicit representation of obstacle geometries during task execution through contact interactions
- Ensure satisfaction of arbitrary constraints by refining set of estimated contacts
- Accepted to IEEE RA-L (<https://arxiv.org/abs/2410.00157>)

MBot Autonomy Stack

- Autonomous differential drive wheeled robot that performs LIDAR SLAM, plans paths with A*, and executes trajectories using PID
- Includes functionality for autonomous frontier exploration, allowing for efficient mapping of unknown environments

EDUCATION

Ph.D. Robotics

University of Michigan Ann Arbor

08/2024 - Present

M.S. Robotics

University of Michigan Ann Arbor

08/2022 - Present

3.98

B.S. Computer Science

Georgia Institute of Technology

08/2017 - 12/2021

4.00

ACHIEVEMENTS

Georgia Tech President's Undergraduate Research Award
(08/2021 - 12/2021)