PRATIK KUNAPULI

pratikk@seas.upenn.edu PratikKunapuli pratikkunapuli.github.io

EDUCATION

Ph.D. in Computer Science May, 2026 (expected)
University of Pennsylvania, GRASP Lab *Philadelphia, PA*
Advisors: Dr. Dinesh Jayaraman & Dr. Vijay Kumar
My ongoing research lies at the intersection of machine learning and robotics, specifically related to using reinforcement learning for control of agile and dynamic systems as well as transferring learning approaches from simulation to the real world (sim2real)

M.S. in Electrical & Computer Engineering August, 2020
Georgia Institute of Technology, EPIC Lab *Atlanta, GA*
Thesis: *Online Adaptive User State Estimation in a Powered Hip Exoskeleton*
Advisor: Dr. Aaron Young

B.S. in Computer Engineering May, 2019
Georgia Institute of Technology, summa cum laude *Atlanta, GA*

PUBLICATIONS

1. **"Leveling the Playing Field: Carefully Comparing Classical and Learned Controllers for Quadrotor Trajectory Tracking"**
Pratik Kunapuli, Jake Welde, Dinesh Jayaraman, Vijay Kumar
Robotics: Science and Systems (RSS), 2025 [PDF][Website]

2. **"Leveraging Symmetry to Accelerate Learning of Trajectory Tracking Controllers for Free-Flying Robotic System"**
Pratik Kunapuli*, Jake Welde*, Nishanth Rao*, Dinesh Jayaraman, Vijay Kumar
IEEE International Conference on Robotics and Automation (ICRA), 2025
NeurReps Workshop, NeurIPS, 2024
Best Paper Award (Neuroscience and Interpretability Track) [arXiv][PDF] [Website] [Code]

3. **"Vision Transformers for End-to-End Vision-Based Quadrotor Obstacle Avoidance"**
Anish Bhattacharya*, Nishanth Rao*, Dhruv Parikh*, **Pratik Kunapuli**, Yuwei Wu, Yuezhan Tao, Nikolai Matni, Vijay Kumar
IEEE International Conference on Robotics and Automation (ICRA), 2025 [arXiv] [PDF] [Website]

4. **"User- and Speed-Independent Slope Estimation for Lower-Extremity Wearable Robots"**
Jairo Y. Maldonado-Contreras, Krishan Bhakta, Jonathan Camargo, **Pratik Kunapuli**, Aaron Young
Annals of Biomedical Engineering, 2023 [Paper] [PDF]

5. **"Real-Time Neural Network-Based Gait Phase Estimation using a Robotic Hip Exoskeleton"**
Pratik Kunapuli*, Inseung Kang*, Aaron Young
IEEE Transactions on Medical Robotics and Bionics (TMRB), 2020 [Paper][PDF]

6. **"Impedance control strategies for enhancing sloped and level walking capabilities for individuals with transfemoral amputation using a powered prosthesis"**
Krishan Bhakta, Jonathan Camargo, **Pratik Kunapuli**, Lee Childers, Aaron Young
Military Medicine, 2019 [Paper]

7. **"Electromyography (EMG) Signal Contributions in Slope and Speed Estimation Using Robotic Hip Exoskeletons"**
Inseung Kang, **Pratik Kunapuli**, Hsiang Hsu, Aaron Young
IEEE International Conference on Rehabilitation Robotics (ICORR), 2019 [Paper] [PDF]

8. **"Real-Time Neural Network-Based Gait Phase Estimation using a Robotic Hip Exoskeleton"**
   Pratik Kunapuli, Inseung Kang, Aaron Young
   Biomedical Engineering Society (BMES) Annual Meeting, 2018 [PDF]

POSTERS AND PRESENTATIONS

Poster, Oral Robotics: Science and Systems (RSS) 2025
"Leveling the Playing Field: Carefully Comparing Classical and Learned Controllers for Quadrotor Trajectory Tracking"

Poster, Oral International Conference on Robotics and Automation (ICRA) 2025
"Leveraging Symmetry to Accelerate Learning of Trajectory Tracking Controllers for Free-Flying Robotic Systems"

Poster, Oral NeurReps Workshop at NeurIPS 2024
"Leveraging Symmetry to Accelerate Learning of Trajectory Tracking Controllers for Free-Flying Robotic Systems"
Accepted as Oral Presentation (< 15% Acceptance Rate)
🏆 ***Best Paper**, Neuroscience and Interpretability Track*

Poster Biomedical Engineering Society (BMES) Annual Meeting 2018
"Neural Network Based Estimation of Gait Phase in a Powered Hip Exoskeleton"

Poster Vertically Integrated Projects (VIP) Innovation Competition 2018
"Robotic Human Augmentation using a Powered Prosthetic Device"
🏆 ***1st Prize**, Robotics Track*

AWARDS AND HONORS

Best Paper Award, NeurReps Workshop, NeurIPS 2024
National Science Foundation Graduate Research Fellowship (GRFP) 2019
President's Undergraduate Research Award (PURA), Georgia Institute of Technology 2019
1st Place Poster, VIP Innovation Competition, Robotics Track 2018
Warren Batts Innovation Scholarship, Georgia Institute of Technology 2018
President's Undergraduate Research Award (PURA), Georgia Institute of Technology 2018

RESEARCH AND INDUSTRY EXPERIENCE

Ph.D. Student, University of Pennsylvania August, 2020 - Current
Working on leveraging advances in machine learning for agile aerial robots

- Combined imitation learning and reinforcement learning for dynamic and fast trajectory tracking of a quadrotor
- Developing controllers for aerial manipulation using model-free reinforcement learning and benchmarking against known model-based methods
- Investigated relationship between symmetry and reinforcement learning, showing that sample efficiency can be drastically improved with careful design of the observation and reward functions
- Leveraged vision transformers (ViT) for agile obstacle avoidance using depth information, and transferring from simulation to real-world flight

Research Assistant, Georgia Institute of Technology August, 2017 - August, 2020
Worked in the Exoskeleton and Prosthetic Intelligent Controls (EPIC) Lab, led by Dr. Aaron Young. I developed controls for a knee-ankle robotic prosthesis, and went on to integrate machine learning algorithms for a robotic hip exoskeleton.

- Developed hierarchical control strategy for robotic knee-ankle prosthesis, with finite state machine for ambulatory modes and impedance control for assisted walking

- Created sensor fusion-based gait phase estimation algorithm using machine learning, eliminating the need for distal sensors for ground contact
- Improved control algorithms with the use of user-independent state estimation for gait phase, walking speed, and slope estimation using supervised learning
- Proposed and tested online adaptation paradigm for machine learning-based state estimators, improving state estimation in minutes and improving assistive control efficacy

Motion Control Intern, Lexmark International May, 2016 - August, 2016
Development of testing software to improve reliability of printers and detect failures

- Performed data analysis to predict poorly performing motors with 95% accuracy
- Created and implemented testing protocol in engine firmware for motor systems
- Improved detection of manufacturing defects by 15%
- Won award at the Summer Student Symposium

Software Engineering Intern, Sea Box Incorporated April, 2015 - August, 2015
Worked on the control system for a remote-controlled container moving vehicle

- Implemented autonomous features for pick-up and drop-off, reducing operater training time by 15%
- Designed dashboard for live-streaming of diagnostic information
- Rapidly prototyped control system and developed remote-control infrastructure

MENTORSHIP

- **Bryan Alfaro** M.S. Robotics, University of Pennsylvania
- **Nishanth Rao** M.S. Robotics, University of Pennsylvania Ph.D. Student. Princeton University
- **Harsh Goel** M.S. Robotics, University of Pennsylvania Ph.D. Student, UT Austin
- **Akshay Manikandan** M.S. Robotics, University of Pennsylvania Tech Consultant, Birlasoft

SERVICE

Outreach and Tours, GRASP Lab 2022-2025
Manuscript Reviewer, Nature Machine Intelligence 2024
Manuscript Reviewer, IEEE Robotics and Automation Letters (RAL) 2023

SKILLS

Programming Languages Python, C++, C
Tools Pytorch, JAX, Tensorflow, IsaacSim, Mujoco, Drake
Technical Model Training, Model Inference, Quantization, Model Deployment, Sim2Real, Reinforcement Learning (RL), Imitation Learning (IL), Model-Based Control