

CURRICULUM VITAE

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Pratik Kunapuli
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NSF Graduate Research Fellow

EDUCATION

University of Pennsylvania

Ph.D. in Computer and Information Science

May 2025 (Expected)

Advisors: Vijay Kumar, Ph.D. and Dinesh Jayaraman, Ph.D.

Research Area: Reinforcement learning for control of agile aerial robots; mixed imitation learning and reinforcement learning from demonstrations; sim2real transfer of control policies

Georgia Institute of Technology

M.S. in Electrical and Computer Engineering

August 2020

Thesis Option: "Online Adaptive User State Estimation in a Powered Hip Exoskeleton"

Relevant Coursework: Mathematical Foundations of Machine Learning, Statistical Methods in Machine Learning

B.S. in Computer Engineering, GPA: 3.60, Highest Honors

May 2019

Minor in Robotics

Relevant Coursework: Control System Design, Introduction to Robotics and Automation, Feedback Control Systems, Machine Learning, Data Structures and Algorithms, Statistics and Applications

RESEARCH EXPERIENCE

Graduate Student Researcher

General Robotics, Automation, Sensory and Perception (GRASP) Lab *August 2020 – Present*
University of Pennsylvania

Advisors: Vijay Kumar, Ph.D. and Dinesh Jayaraman, Ph.D.

- Reinforcement learning-based control for agile aerial robots
 - Using model-free deep reinforcement learning (PPO) to train aerial manipulator in reaching tasks
 - Leveraging differential flatness to reduce complexity of reaching tasks by modifying action modality into ego-centric control
- Reinforcement learning from demonstrations for aerial robots
 - Combining imitation learning and reinforcement learning for improved sample efficiency in training model-free controllers for quadrotor control
 - Differential flatness-based trajectories for expert guidance, goal conditioned reinforcement learning for control

Graduate Student Researcher

Exoskeleton and Prosthetic Intelligent Control Lab
Department of Mechanical Engineering
Georgia Institute of Technology
Advisor: Aaron J Young, PhD

August 2019 – August 2020

- Developed state-of-the-art user state estimation techniques for wearable robotic applications using machine learning and sensor fusion
 - User-independent gait phase, walking speed, and incline estimation for hip exoskeletons
 - Online adaptation of user-independent machine learning models to optimize model performance in real-time
- Pioneering reinforcement learning paradigm for human augmentation in powered hip exoskeletons
 - First of its kind human-in-the-loop based optimization of metabolic cost in an autonomous hip exoskeleton using reinforcement learning
 - Online adaptive user state and environment estimation of gait phase, walking speed, and slope for better informed torque application

Undergraduate Research Student

Exoskeleton and Prosthetic Intelligent Control Lab
Department of Mechanical Engineering
Georgia Institute of Technology
Advisor: Aaron J Young, PhD

August 2017 – August 2019

- Developed a robotic prosthesis for assisting patients with transfemoral amputations
 - Developed a 3-tier hierarchical controller featuring closed loop torque control, a finite-state machine, and user intent recognition
 - Implemented 6-axis load-cell, CAN bus protocol for motor commands, and SPI-based IMU communication
- Created sensor-fusion based gait phase estimation for a powered hip exoskeleton
 - Applied supervised learning techniques to develop a continuous phase estimation
 - Eliminated auxiliary, distal sensors
 - Allowed for more accurate biological torques to be applied, improving assistance to user
- Explored the human robot interaction when using powered prosthesis through biomechanical analysis

PROFESSIONAL EXPERIENCE

Motion Control Intern

Research and Development
Lexmark International

May 2016 – August 2016

- 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%

Software Engineering Intern

Special Projects

April 2015 – August 2015

Sea Box Incorporated

- Rapidly prototyped control system for wireless container-moving vehicle
- Developed final control system software for wireless operation of vehicle
- Implemented autonomous features, reducing driver training time by 15%
- Designed dashboard for live-streaming of diagnostic information

PEER-REVIEWED PUBLICATIONS (J – Journal, C – Conference, A – Abstract)

- C2: **P. Kunapuli**, J. Welde, D. Jayaraman, V. Kumar, “Leveraging differential flatness for model-free reinforcement learning-based control of an aerial manipulator” – In Preparation
- J2: **P. Kunapuli**, I. Kang, A. Young, “Real-Time Neural Network-Based Gait Phase Estimation using a Robotic Hip Exoskeleton”, *IEEE Transactions on Medical Robotics and Bionics*, June 2019 – In Review [[PDF](#)]
- C1: I. Kang, **P. Kunapuli**, H. Hsu, A. Young, “Electromyography (EMG) Signal Contributions in Slope and Speed Estimation Using Robotic Hip Exoskeletons”, *IEEE International Conference on Rehabilitation Robotics (ICORR)*, March 2019 – In Press [[PDF](#)] [[IEEE](#)]
- J1: K. Bhakta, J. Camargo, **P. Kunapuli**, L. Childers, A. Young, “Impedance control strategies for enhancing sloped and level walking capabilities for individuals with transfemoral amputation using a powered prosthesis”, *Military Medicine*, November 2018 – In Press [[Military Medicine](#)]
- A1: **P. Kunapuli**, I. Kang, A. Young, “Real-Time Neural Network-Based Gait Phase Estimation using a Robotic Hip Exoskeleton”, BMES Annual Meeting, Atlanta, GA, October 2018 [[PDF](#)]

PRESENTATIONS (T – Talk, P – Poster)

- P3: **P. Kunapuli**, I. Kang, A. Young, Neural Network Based Estimation of Gait Phase in a Powered Hip Exoskeleton, *Biomedical Engineering Society Conference*, Atlanta, GA, October 2018
- P2: **P. Kunapuli**, J. Li, A. Young, Robotic Human Augmentation using a Powered Prosthetic Device, *Institute of Robotics and Intelligent Machines Spring Symposium*, April 2018
- P1: **P. Kunapuli**, J. Li, A. Young, Robotic Human Augmentation using a Powered Prosthetic Device, *Vertically Integrated Projects Innovation Competition*, March 2018

- 1st Prize, Robotics Track (\$2000)

AWARDS AND HONORS

- National Science Foundation Graduate Research Fellowship Awardee (NSF GRF) 2019
- 1st Place Poster, Robotics Track, V.I.P. Innovation Competition (\$2000) 2018
- Warren Batts Innovation Scholarship (\$4000) 2018
- President's Undergraduate Research Award (PURA) (\$1700) Summer 2018, Fall 2018
- Highest honors upon graduation of B.S. 2019
- Faculty Honors Fall 2017, Fall 2018
- Dean's List Fall 2015, Fall 2016, Spring 2018
- Winner, Lexmark Summer Student Symposium 2016

OUTREACH PROGRAMS

- National Robotics Week, Georgia Tech 2017 – Present
- Institute of Robotics and Intelligent Machines Lab Showcase 2017 - Present
- Mentor, FRC 1648 G3 Robotics 2015 – Present

PROFESSIONAL MEMBERSHIPS AND SERVICES

- Student Member, IEEE 2018 – 2019
- Member, Eta Kappa Nu (ECE Honors Society) 2018 – 2019