

# CURRICULUM VITAE

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**Pratik Kunapuli**  
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NSF Graduate Research Fellow

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## EDUCATION

### University of Pennsylvania

*Ph.D. in Computer and Information Science*

*May 2026 (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, summa cum laude: 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

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## 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
- Agile Obstacle Avoidance using Vision Transformers

- Leveraging successes in large language models, we apply vision transformers (ViT) to learn obstacle avoidance behavior in agile quadrotor flight using imitation learning
- [Paper under review for ICRA 2025](#)

**Graduate Student Researcher**

Exoskeleton and Prosthetic Intelligent Control Lab

*August 2019 – August 2020*

Department of Mechanical Engineering

Georgia Institute of Technology

Advisor: Aaron J Young, PhD

- 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

*August 2017 – August 2019*

Department of Mechanical Engineering

Georgia Institute of Technology

Advisor: Aaron J Young, PhD

- 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

### **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  
Sea Box Incorporated

*April 2015 – August 2015*

- 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

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

- C4: **P. Kunapuli**, J. Welde, D. Jayaraman, V. Kumar, “Leveraging differential flatness for model-free reinforcement learning-based control of an aerial manipulator” – In Preparation
- C3: **P. Kunapuli\***, J. Welde\*, N. Rao\*, D. Jayaraman, and V. Kumar, “Leveraging Symmetry to Accelerate Learning of Trajectory Tracking Controllers for Free-Flying Robotic Systems”, International Conference on Robotics and Automation (ICRA) – Under Review
- C2: A. Bhattacharya, N. Rao, D. Parikh, **P. Kunapuli**, N. Matni, and V. Kumar, “Vision Transformers for End-to-End Vision-Based Quadrotor Obstacle Avoidance”, International Conference on Robotics and Automation (ICRA) – Under Review
- J3: J. Maldonado-Contreras, K. Bhakta, J. Camargo, **P. Kunapuli**, A. Young, “User- and Speed-Independent Slope Estimation for Lower-Extremity Wearable Robots”, *Annals of Biomedical Engineering*, November 2023 – In Press [[PDF](#)] [[BMES](#)]
- 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*, February 2020 – In Press [[PDF](#)] [[IEEE](#)]
- 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](#)]

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#### 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
  - 1<sup>st</sup> Prize, Robotics Track (\$2000)

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#### AWARDS AND HONORS

- National Science Foundation Graduate Research Fellowship Awardee (NSF GRF) 2019
- 1<sup>st</sup> 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

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#### 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

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#### PROFESSIONAL MEMBERSHIPS AND SERVICES

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