

Patrick Slade

Assistant Professor of Bioengineering at Harvard University

[Harvard Ability Lab](#) slade@seas.harvard.edu

EDUCATION

Stanford University

Ph.D. Mechanical Engineering 2016 – 2021

Co-advisors: Mykel Kochenderfer, Steve Collins, Scott Delp

M.S. Mechanical Engineering 2017

University of Illinois at Urbana-Champaign

2013 – 2016

B.S. Mechanical Engineering

ACADEMIC POSITIONS

Assistant Professor of Bioengineering at Harvard University

July 2023 – current

Improving mobility through biomechanics, robotics, and data-science.

Stanford Bioengineering – Wu Tsai Human Performance Alliance

July 2021 – July 2023

Distinguished postdoctoral scholar – Advisor: Scott Delp

Improving human performance with biomechanics.

EXPERIENCE

[Technical Advisor at Voxel AI](#)

August 2022 – current

Developing ergonomic safety measures for reducing injuries during factory work.

Stanford Intelligent Systems, Biomechatronics, & Human Performance Labs

2016 – 2021

Graduate research assistant – Co-advisors: Mykel Kochenderfer, Steve Collins, Scott Delp

Thesis work: data science for monitoring health, intelligent human-robot collaboration, and customizing wearable exoskeletons.

[AI Resident at Google](#) – Mountain View, CA

July – December 2019

Developed AI/ML solutions for an early-stage Moonshot developing an assistive device.

CHARM Lab – Stanford, CA

Fall 2017

Graduate research assistant – Co-advisors: Allison Okamura and Elliot Hawkes

Designed soft vine-like endoscope for surgical applications.

Harvard REU, Biodesign Lab – Cambridge, MA

Summer 2015

Undergraduate research assistant – Advisor: Conor Walsh

Designed and manufactured active knee exosuit. Real-time, adaptive controller written in C.

Co-founder of PSYONIC – Champaign, IL

2014 – 2016

Startup for advanced and low-cost prosthetic hands with sensory feedback. Raised \$300k (NSF SBIR and I-CORPS, Cozad, Samsung Innovation). Ability Hand on sale in the US (psyonic.co).










Bretl Research Group – Champaign, IL

2013 – 2016






Undergraduate research assistant – Advisor: Timothy Bretl

Designed hand prosthesis with state-of-the-art performance for 1% of the cost. Developed haptic sensory feedback for upper-limb prosthesis: skin stretch, vibrotactile, and electrotactile.

JOURNAL PUBLICATIONS

12. **Patrick Slade**, Mykel J Kochenderfer, Scott L Delp, and Steven H Collins. Personalizing exoskeleton assistance while walking in the real world. *Nature*, 2022
11. **Patrick Slade**, Arjun Tambe, and Mykel Kochenderfer. Multimodal sensing and intuitive steering assistance improve navigation and mobility for people with impaired vision. *Science Robotics*, 6(59):eabg6594, 2021.   
10. **Patrick Slade**, Mykel Kochenderfer, Scott L Delp, and Steven H Collins. [Sensing Leg Movement Enhances Wearable Monitoring of Energy Expenditure](#). *Nature Communications*, 12(1):1–11, 2021.   
9. **Patrick Slade**, Ayman Habib, Jennifer L Hicks, and Scott L Delp. [An Open-source and Wearable System for Measuring Kinematics in Real-time](#). *IEEE Trans. on Biomedical Eng.*, 2021.   
8. **Patrick Slade**, Rachel Troutman, Mykel J Kochenderfer, Steven H Collins, and Scott L Delp. [Rapid energy expenditure estimation for ankle assisted and inclined loaded walking](#). *Journal of Neuroengineering and Rehabilitation*, 16(1):1–10, 2019
7. **Patrick Slade**, Mykel Kochenderfer, and Zachary Sunberg. [Estimation and Control Using Sampling-Based Bayesian Reinforcement Learning](#). *IET Cyber-Physical Systems: Theory & Applications*, 2019

PEER REVIEWED CONFERENCE PUBLICATIONS

6. Nathan Kau, Aaron Schultz, Natalie Ferrante, and **Patrick Slade**. [Stanford Doggo: An open-source, quasi-direct-drive quadruped](#). In *International Conference on Robotics and Automation (ICRA)*, pages 6309–6315, 2019.   
5. **Patrick Slade**, Preston Culbertson, Zachary Sunberg, and Mykel Kochenderfer. Simultaneous active parameter estimation and control using sampling-based Bayesian reinforcement learning. In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 804–810, 2017
4. **Patrick Slade**, Alex Gruebele, Zachary Hammond, Michael Raitor, Allison M Okamura, and Elliot W Hawkes. [Design of a soft catheter for low-force and constrained surgery](#). In *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, pages 174–180, 2017. 
3. Aadeel Akhtar, Kyung Yun Choi, Michael Fatina, Jesse Cornman, Edward Wu, Joseph Sombeck, Chris Yim, **Patrick Slade**, Jason Lee, Jack Moore, et al. [A low-cost, open-source, compliant hand for enabling sensorimotor control for people with transradial amputations](#). In *38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, pages 4642–4645, 2016
2. **Patrick Slade**, Aadeel Akhtar, Mary Nguyen, and Timothy Bretl. [Tact: Design and performance of an open-source, affordable, myoelectric prosthetic hand](#). In *IEEE International Conference on Robotics and Automation (ICRA)*, pages 6451–6456, 2015. 
1. Aadeel Akhtar, Mary Nguyen, Logan Wan, Brandon Boyce, **Patrick Slade**, and Timothy Bretl. Passive mechanical skin stretch for multiple degree-of-freedom proprioception in a hand prosthesis. In *International Conference on Human Haptic Sensing and Touch Enabled Computer Applications*, pages 120–128. Springer, 2014

GRANTS

1. **AI Grant (\$5,000)** PI 2017
Open-source project using AI to enable assistive devices.
2. **Cozad Winner and Samsung Innovation Grant (\$30,000)** Co-PI with Aadeel Akhtar 2016
Developing low-cost and high-performance prosthetic hands.

GRANT PREPARATION

1. **Toyota Research Institute Seed Funding (\$80,000)** PI: Mykel Kochenderfer 2021
Wrote proposal for improving navigation for people with impaired vision using an augmented cane.
2. **NIH P41 1P41EB027060-01A1 (\$1,504,632)** PI: Scott Delp 2020
Wrote one of three aims supporting my energy expenditure and kinematics sensing research.
3. **Human-Centered AI Grant (\$75,000)** PIs: Mykel Kochenderfer and Allison Okamura 2018
Wrote proposal extension for customizing haptic feedback and motion guidance with AI.
4. **NSF SBIR Phase I Award #1745999 (\$225,000)** PI: Aadeel Akhtar 2017
Wrote one third of application for developing robust, sensorizing prosthetic hands.

FELLOWSHIPS & AWARDS

1. STAT Wunderkind: National award for early stage scientists studying medicine 2021
2. Human Performance Alliance Distinguished Postdoctoral Fellowship 2021 – 2023
3. Stanford Graduate Fellowship: 3 year award, 100 awarded to graduate students 2016 – 2021
4. NSF Graduate Research Fellowship 2016 – 2021
5. Forbes 30 under 30: young innovator in healthcare 2016
6. Bronze Tablet: top 3% of graduating students in Engineering College (UIUC) 2016
7. Goldwater Scholar: Awarded to 260 undergrads in the U.S. for research excellence 2015
8. James Honors Scholar: Award for academic excellence (UIUC) 2013 – 2016
9. MechSE Outstanding Scholar: Departmental merit award (UIUC) 2013 – 16
10. James Newton Matthews Scholarship: Award for community service (UIUC) 2013 – 16
11. Deans List: Top 20% of engineering students (UIUC) 2013 – 2016
12. Illinois Scholar Undergrad Research: Research excellence program (UIUC) 2014 – 2016

TEACHING

Guest Lecturer in Decision Making Under Uncertainty (CS238) 2020, 2021
Presented hour lectures on belief planning and partially observable Markov decision processes.

Guest Lecturer in Engineering Design Optimization (CS361) 2020, 2021
Presented hour lectures on sampling plans, surrogate models, and probabilistic surrogate modeling.

Instructor for AI4ALL Summer 2018, 2021
Research mentor and instructor for Stanford Artificial Intelligence program for underrepresented high school students. Prepared lecture material, homework, and open-ended research project.

Teaching Assistant for Decision Making Under Uncertainty (CS238) Fall 2019

Held weekly office hours and discussion section and gave a guest lecture on belief planning.

Guest Lecturer in UIUC Mechanical Engineering Seminar (ME 390 course) 2015
Presented undergraduate research on advanced prosthetic hands.

MENTORSHIP

Mentor for Wu Tsai Human Performance Undergrad Research Summer 2022
Research mentor for a full-time eight-week program for a Stanford undergraduate student, Sam Ben-abou. Taught background material, the research process, and advised research.

Mentor for Stanford Undergraduate Research Internship (SURI) Summer 2021
Research mentor for a full-time eight-week program for two Stanford undergraduate students: Wesley Peisch and Max Harris. Taught background material, the research process, and advised research.

Mentor for Stanford Robotics Club 2017 – 2019
Research mentor for 6 Stanford undergrad students interested legged robotics. Taught the research process, assisted technical work, and was principle investigator for an all-student publication in ICRA 2019.

Mentor for Stanford Undergraduate Research Fellowship (SURF) Summer 2019, 2020, 2021
Research mentor for 8 week program for underrepresented undergraduates. Taught background material, the research process, and advised research. Students: Patrick Babb, Edgar Campbell, and Oscar.

Mentor for Raising Interest in Science and Engineering (RISE) Summer 2018
Research mentor for Ivan Morales during a seven-week Stanford STEM program for underrepresented high school students.

Mentor for Undergraduate Students
Arjun Tambe – Co-author on Science Robotics paper 2019 – 2022
Kyle Hatch Fall 2018
Ahmed Ahmed – Awarded NSF GRFP Fall 2018

Mentor for Graduate Students – Formal research rotation advising listed topic.
Paula Stocco – Multi-modal obstacle localization. Spring 2022
Nicholas Robles – Wearable robotic device to reduce knee contact force. Winter 2021 – Fall 2022
Yasmine Kehnemouyi – Sensing human movement and providing real-time feedback. Fall 2021
Parker Ruth – Estimating energy expenditure from video. Fall 2021
Arec Jamgochian – Personalizing haptic feedback with AI. Fall 2019
Soyeon Jung – Mobile SLAM implementation. Fall 2019
Rose Meacham – Measuring human motion with wearable sensors. Fall 2018

CONFERENCE PRESENTATIONS

1. Spotlight talk: Monitoring energy expenditure, *Bay Area Robotics Symposium* 2021
2. Invited speaker: Symposium on Recent Advances in Wearable Sensing and Machine Learning for Biomechanics, *IEEE Engineering in Medicine and Biology Society* 2021
3. Selected podium presentation: An open-source and wearable system for measuring 3D human motion in real-time, *American Society of Biomechanics* 2021
4. An open-source and wearable system for measuring 3D human motion in real-time, *Ambulatory Monitoring of Physical Activity and Movement*, **Poster award** 2021

5. Presentation by collaborator Julie Walker: User-adapting Haptic Interaction from Holdable Kinesthetic Devices, *SCIEN Industry Affiliates*, **Prize winner** 2019
6. Design of a soft catheter for low-force and constrained surgery, *International Conference on Intelligent Robots and Systems (IROS)* 2017
7. Simultaneous active parameter estimation and control using sampling-based Bayesian reinforcement learning, *Intelligent Robots and Systems (IROS)* 2017
8. Design of a soft catheter for low-force and constrained surgery, *International Conference on Robotics and Automation (ICRA)* 2015

INVITED TALKS AND PRESENTATIONS

1. Stanford Human Performance Alliance: Assistive devices for reducing knee contact forces 2022
2. Harvard SEAS Seminar: Improving health with biomechanics and assistive devices 2022
3. Harvard Biomedical Informatics: Democratizing biomedicine for mobility 2022
4. Princeton Robotics Seminar: Improving health with human-centered robotics 2022
5. CMU Robotics Institute Seminar: Improving health with human-centered robotics and AI 2022
6. Stanford eWear Seminar: Improving navigation for people with impaired vision 2022
7. Stanford Human-Robot Salon: Optimizing exoskeleton assistance in the real-world 2022
8. Mobilize Center Webinar: Monitoring physical activity with a DIY calorie counter 2022
9. Stanford MediaX Industry Alliance: Human-robot systems for improving mobility 2021
10. Google X Technical Talk: Estimating energy expenditure from movement 2019
11. Highlight talk: Rapidly estimating energy expenditure, *Dynamic Walking* 2019
12. TEDxUIUC: How to have real world impact as a student 2016
13. Illinois Project Lead the Way Organization: Keynote presentation to 400 STEM educators 2015
14. Plenary Speaker: Low-cost prosthetic hands, *UIUC Research Symposium* 2016
15. Highlight talk: Active knee exosuit to assist uphill and stairs, *Harvard REU Conference* 2015
16. Highlight talk: Prosthetic hands for developing nations, *UIUC Research Symposium* 2014

PEDAGOGICAL TRAINING

1. Stanford Grant Writing Boot Camp 2022
2. Accessibility 101: STEM Edition 2021
3. Mechanical Engineering Department Training on Diversity and Inclusion 2020
4. Stanford Graduate Summer Institute: Preparing for a Faculty Career 2020

SERVICE & OUTREACH

1. Palo Alto Vision Support Group: Demonstration and training with 'smart' cane 2022
2. GRAMS: Research demo and volunteer session with seniors 2021
3. NMBL Lab Outreach Committee: Biomechanics outreach in communities near Stanford 2021
4. AI Mentor (CS Dept.): Meetings with female undergrads to make AI and research accessible 2019

5. High School STEM Outreach: Prosthetics presentations in low-income schools 2016 – 2018
6. Engineering Open House: Prosthetics research demos to gradeschoolers in Urbana 2014 – 2016
7. Engineering Information Bureau: STEM orientations for highschool students (UIUC) 2014 – 2016
8. Volunteer Bike Mechanic: Annually repaired 50 bikes for low-income families 2009 – 2015

REVIEW EXPERIENCE

Science Advances
IEEE Transactions on Automatic Control
IEEE Transactions on Neural Systems and Rehabilitation Engineering
Journal of Biomechanics
Journal of Machine Learning Research
IEEE International Conference on Robotics and Automation
IEEE International Conference on Intelligent Robotics and Systems
MDPI Sensors

PATENTS

1. **P. Slade**, N. Robles, S. L. Delp “Exoskeleton for reducing knee contact forces and knee osteoarthritis pain”, *Provisional patent*, 2022.
2. **P. Slade**, M. J. Kochenderfer, S. L. Delp, S. H. Collins, “Sensing leg movement for wearable monitoring of energy expenditure”, *Full patent in process*, 2021.
3. **P. Slade**, S. H. Collins, “Customizing exoskeleton assistance from movement”, *Provisional*, 2021.
4. M. Boswell, **P. Slade**, S. L. Delp, “Seat sensing for health monitoring”, *Full patent in process*, 2021.