Haedo Cho

hcho@seas.harvard.edu ◇ website ◇ google scholar

SUMMARY

Ph.D. candidate in Electrical Engineering at Harvard SEAS (Slade Lab) and recipient of the Harvard Dean's Competitive Fund for Promising Scholarship. My work lies at the intersection of wearable robotics, biomechanics, and AI, using wearable sensing and biomechanical simulation to understand human movement and to design assistive technologies (e.g., exoskeletons) that improve mobility. I focus on translational research with real-world impact beyond the lab.

EDUCATION

Harvard University Sep. 2020 - May. 2026 (Anticipated)
Ph.D., in Electrical Engineering
Thesis Advisor: Professor Patrick Slade

Korea Advanced Institute of Science and Technology Aug. 2016
M.S., in Mechanical Engineering

Inha University, Incheon, Korea Aug. 2014
B.S with Honors, *Summa Cum Laude*, Mechanical Engineering

RESEARCH EXPERIENCE

Harvard University, Slade Lab
Graduate Researcher with Prof. Patrick Slade Jan. 2023 – Present

- **A simulation-informed framework that generalizes and personalizes robotic assistance**
  - Built an end-to-end framework combining biomechanical simulation with human-in-the-loop optimization to design and personalize assistive force profiles across many daily activities.
  - Led Harvard IRB-approved human-subject studies (10+ participants) spanning young healthy adults and older adults; managed protocol design, data collection, and analysis.
- **OpenMetabolics: Estimating energy expenditure using a smartphone worn in a pocket**
  - Developed a biomechanically inspired, data-driven model to estimate energy expenditure from smartphone data.
  - Built a scalable AWS pipeline for storing and processing smartphone sensor data.
  - Designed and led Harvard IRB-approved real-world human-subject studies (30+ participants), including protocol development, data collection, and analysis.

Harvard University, Biodesign Lab
Graduate Researcher with Prof. Conor Walsh Sep. 2020 – Jun. 2022

- **IMU-based tracking system for strength training**
  - Developed a portable embedded Linux system with real-time wireless data streaming.
  - Led Harvard IRB-approved human-subject studies (25+ participants, 12 weight-training exercises).
  - Built a deep-learning model for multi-class exercise classification and motion trajectory estimation (98%+ accuracy).
  - Mentored a Harvard senior on signal processing, human-subject research, and HCRP funding applications.

Research Fellow with Prof. Conor J. Walsh Jan. 2019 – Aug. 2020

- **Soft wearable shoulder-assist robot**
  - Developed a textile-based wearable pressure array for torque estimation and accompanying capacitance readout electronics.

Korea Advanced Institute of Science and Technology (KAIST), Biorobotics Lab
Graduate Researcher with Prof. Jung Kim Sep. 2014 – Aug. 2016

- **Skin-mountable stretch sensing with piezoresistive sensors and hysteresis compensation** [link]
  - Developed a 3D-printed, skin-mountable soft stretch sensor.
  - Ran human-subject experiments (3+ participants) to estimate multi-axis joint motion.
- **Cable-driven soft exo-glove with optical soft sensor** [link]
  - Developed an optical soft sensor for fingertip force measurement using light-intensity modulation.
  - Integrated the sensor into a cable-driven soft glove to augment grasping performance.

INDUSTRY EXPERIENCE

Wurq Inc.
Signal Processing Engineer (Part-time) July 2022 – May 2023

- AI-powered fitness technology company
  - Developed and field-tested real-time fitness tracking algorithms for wearable hardware platforms.
  - Engineered and managed biometric data pipelines, leveraging large-scale datasets from wearable devices.
  - Built and deployed AI models for activity recognition and automated health monitoring.
  - Designed and implemented validation metrics for strength training, grounded in biomechanics and signal analysis.

Beflex Inc.
Senior Researcher Sep. 2016 – Feb. 2018

- Biometric data-driven personal healthcare company
  - Designed and established an experimental test platform using motion capture systems to analyze biomechanical performance for personalized health metrics in runners.
  - Developed and tested a prototype with Raspberry Pi Zero microcontroller, optimizing embedded firmware and data processing algorithms for wearable devices.

PATENTS

WO2024151781A1, "Methods and systems for activity detection and quantification of movement kinematics", 18 July 2024.
Inventors: D. Popov, C.J. Walsh, D. Kim, **H. Cho**, F. Bertacchi.

PUBLICATION

Journal publications

[J8] **Haedo Cho**, Zoe Kutulakos, Filippo Andrea Mariani, Matteo Amigoni, Nathan Irniger, Xabier Irizar Amuchastegui, Camille Guillaume, and Patrick Slade. **A simulation-informed framework that generalizes and personalizes robotic assistance**. Submitted, 2026.

[J7] **Haedo Cho***, Chelsey Campillo Rodriguez*, Patrick Slade. **Smartwatches with activity-specific tracking estimate energy expenditure with near lab-grade performance during outdoor walking**. Under review, 2026.
*These authors contributed equally.

[J6] **Haedo Cho**, Patrick Slade. **OpenMetabolics: Estimating energy expenditure using a smartphone worn in a pocket**. *Nature Communications Engineering*, 5(35), 2026.
Harvard SEAS media coverage, Facebook, Instagram

[J5] Daekyum Kim, Yichu Jin*, **Haedo Cho***, Truman Jones, Yu Meng Zhou, Ameneh Fadaie, Dmitry Popov, Krithika Swaminathan, Conor J. Walsh. **Learning-based 3D human kinematics estimation using behavioral**

constraints from activity classification. *Nature Communications*, 16 (1), 2025.
*These authors contributed equally.
Media coverage (Korean)

[J4] Zhou, Y.M., Hohimer, C.J., Young, H.T., McCann, C.M., Pont-Esteban, D., Civici, U.S., Jin, Y., Murphy, P., Wagner, D., Cole, T., Phipps, N., **Haedo Cho**, et al. **A portable inflatable soft wearable robot to assist the shoulder during industrial work**. *Science Robotics*, 9(91), 2024.

[J3] Hyosang Lee*, **Haedo Cho***, Sangjoon J. Kim, Yeongjin Kim, Jung Kim. **Dispenser printing of piezo-resistive nanocomposite on woven elastic fabric and hysteresis compensation for skin-mountable stretch sensing**. *Smart Materials and Structures*, 27, 2018.
*These authors contributed equally.

[J2] **Haedo Cho**, Hyosang Lee, Yeongjin Kim, Jung Kim. **Design of an optical soft sensor for measuring fingertip force and contact recognition**. *International Journal of Control, Automation and Systems*, 15(1), 16–24, 2017.

[J1] Hyosang Lee, Donguk Kwon, **Haedo Cho**, Inkyu Park, Jung Kim. **Soft nanocomposite based multi-point, multi-directional strain mapping sensor using anisotropic electrical impedance tomography**. *Scientific Reports*, 7:39837, 2017.

CONFERENCE & INVITED TALKS

[T1] **Haedo Cho**, **A smartphone-based system for accurately estimating energy expenditure during real-world physical activity**. *Harvard Robotics Trainee Seminar Series*, December 2025.

[C3] **Haedo Cho**, Patrick Slade, **A smartphone-based system for accurately estimating energy expenditure during real-world physical activity**. *Poster presented at the American Society of Biomechanics (ASB 2024)*, Madison, WI, August 5–8, 2024.

[C2] Yichu Jin, Christina M. Glover, **Haedo Cho**, Oluwaseun A. Araromi, Moritz A. Graule, Na Li, Robert Wood, Conor J. Walsh, **Soft sensing shirt for shoulder kinematics estimation**. *IEEE International Conference on Robotics and Automation (ICRA)*, 2020.

[C1] Hyosang Lee, **Jiseung Cho***, Jung Kim, **Printable skin-adhesive stretch sensor for measuring multi-axis human joint angles**. *IEEE International Conference on Robotics and Automation (ICRA)*, pp. 4975–4980, 2016. (*This paper was published before I legally changed my name.)

TEACHING EXPERIENCE

Biomechanics of Movement and Assistive Robotics (Harvard BE 124) Fall 2023, Spring 2025
Teaching Fellow

- Undergraduate/graduate-level, 4 credits, 30 students per term.
- Lectured in lab sessions on inverse dynamics, advised final projects, and supported students during office hours.

Data Science 2: Advanced topics in to Data Science (Harvard CS109B/AC209B) Spring 2023
Teaching Fellow

- Graduate-level, 4 credits, 180 students
- Lectured in lab sessions on Gap statistics, prepared lecture slides and problem sets, graded assignments and assisted students through office hours

Data Science 1: Introduction to Data Science (Harvard CS109A/AC209A) Fall 2022
Teaching Fellow

- Graduate-level, 4 credits, 303 students
- Lectured lab session, assisted mid-term final exams led office hours

Introduction to Robotics (Harvard ES159/259) Summer-Fall 2022
Teaching Fellow

- Undergraduate/Graduate-level, 4 credits, 11 students
- Developed course materials (lecture notes and assignments), graded assignments and assisted students through office hours

Technology Venture Immersion (Harvard MS/MBA program) Fall 2021 - Winter 2022
Teaching Fellow

- Developed course materials for an introduction to IoT-based embedded systems using Arduino
- Advised Harvard MBA students on human-centered design project development

MENTORING

Truman Jones — Harvard undergraduate; now NFL player (Tennessee Titans) Feb. 2022 – Aug. 2022

- Supervised an independent capstone project fulfilling engineering degree requirements.
- Guided the student through multiple rounds of Harvard College Research Program (HCRP) funding applications.

Justin Huang — Visiting undergraduate, Northeastern University Jul. 2023 – Dec. 2025

- Mentored the development of an AWS-based platform for a smartphone-based energy expenditure system.

Filippo Andrea Mariani — Visiting M.Sc. student, Politecnico di Milano Mar. 2025 – Sep. 2025

- Advised on a master's thesis focusing on signal processing and human-subject experiments.

Matteo Amigoni — Visiting M.Sc. student, Politecnico di Milano Mar. 2025 – Sep. 2025

- Advised on a master's thesis focusing on signal processing and human-subject experiments.

HONORS AND AWARDS

Dean's Competitive Fund for Promising Scholarship Sep. 2023 – Aug. 2024
Harvard University Amount: $50,000

Korean Government Scholarship Sep. 2014 – Aug. 2016
Ministry of Education, Science and Technology, Korea

Hanjin Scholarship Mar. 2013 – Aug. 2014
Inha University, Korea

Undergraduate Scholarship Mar. 2008 – Aug. 2012
Inha University, Korea

LEADERSHIP & SOCIAL ACTIVITIES

National Biomechanics Day [link] May 2025
Volunteer

- Demonstrated wearable sensing and biomechanics concepts to Boston-area high school students.

Habitat for Humanity Jul. 2013
Team Leader

- Led a volunteer team on a Habitat construction site and participated in educational activities for local children.

Republic of Korea Marine Corps Mar. 2009 – Jan. 2011
Platoon Leader

- Completed two years of mandatory military service as a platoon leader.

REFERENCES

Available upon request. Please contact hcho@seas.harvard.edu.