

Rachel A. G. Adenekan

Mobile, wearable, and digital health technologies • sensors • biomechanics • data analysis
Menlo Park, CA • adenekan@stanford.edu • racheladenekan.com

EDUCATION

Stanford University

PhD in Mechanical Engineering (Spring 2024)

Master of Science in Mechanical Engineering (2019)

Massachusetts Institute of Technology (MIT)

Bachelor of Science in Mechanical Engineering, Minor: Music (2017)

Relevant courses: Biomechanics of Movement, Modeling and Simulation of Human Movement, Orthopedic Bioeng., Controls, Mechatronics, Engineering Design Optimization, Algorithms, Applied Machine Learning, Statistical Learning, AI for Health, AI for Disease Diagnosis and Info. Rec., Probability and Statistics

HONORS AND AWARDS

National Science Foundation Graduate Research Fellow	2019-2022
Stanford Graduate Fellow (Medtronic Foundation Fellow)	2017-2022
Stanford Enhancing Diversity in Graduate Education Fellow	2019
MIT Lincoln Labs Undergraduate Research and Innovations Scholar	2015-2016

SKILLS

Research in health sensing, mobile devices, and wearables: Human subject research design, Data collection, Data analysis, Sensor data processing and analysis, Data Visualization, Technical writing and presenting, Building and leading collaborations between physicians and engineers

Software: MATLAB & Simulink (most proficient), R (proficient), Python (proficient)
Haven't used in years, but can re-learn: C++, Embedded C, Tensorflow

Biomechanics and Biomechatronics: Real-time Exoskeleton Control and Assistance, Electromyography, Respirometry, Motion Capture, OpenSim, Gait (esp. Balance)

RESEARCH EXPERIENCE

Stanford University's Collaborative Haptics and Robotics in Medicine Laboratory

PhD Candidate with Prof. Allison Okamura

Jan 2022-Present

Co-advisor: Prof. Scott Delp (Stanford), Collaborating Professor: Prof. Cara Nunez (Cornell)

Clinical collaborators: Dr. Sun Kim (Endocrinologist), Dr. Marilyn Tan (Endocrinologist), Dr. Kenneth Leung (Neurologist), Dr. Srikanth Muppidi (Neurologist), Dr. Sarada Sakamuri (Neurologist), Dr. Sandra Tsai (Internist-Primary Care)

Developing and deploying a high-resolution, reproducible, and accessible (to clinicians and patients) screening method for Diabetic Peripheral Neuropathy (DPN) using a smartphone which can identify individuals at risk for DPN prior to overt clinical manifestation and at a potentially reversible stage.

- Characterized smartphone vibrations and tuned their governing parameters to measure clinically relevant sensory response in humans
- Evaluated the reliability and resolution of the smartphone-based platform in measuring human vibration perception thresholds via one-day, in-lab and multi-day, at-home user studies with over 60 participants
- Built and led clinical collaborations with multiple endocrinologists, neurologists, and primary care physicians at Stanford Hospital to evaluate the performance of the smartphone-based platform in classifying over 100 patients with varying levels of risk of developing diabetic peripheral neuropathy
- Performed various statistical tests (ANOVAs, multivariate regressions, etc) and made various scientific figures to analyze the relationship between relevant electronic health record (EHR) data, health survey data, and experimentally collected perception data

- Contributed significantly to grants to support the project (awarded): Stanford Center for Digital Health (\$50k, wrote grant and submitted independently), Stanford Precision Health and Integrated Diagnostics (\$200k, contributed figures and text), Stanford Diabetes Research Center (\$25k, contributed figures and text)
- Presented project findings at various conferences, seminars, and journals (see Publications and Presentations)

Stanford University's Biomechanics Laboratory

Research Fellow with Prof. Steve Collins, Co-advisor: Prof. Scott Delp

Jan 2018-Fall 2021

Developed methods of controlling wearable robotic devices (exoskeletons) to enhance balance ability in older adults. Developed real-time controllers for exoskeletons that output assistive torque based on the user's state. Planned and executed human subject pilot experiments using biomechanics tools (EMG, Respirometry, Motion Capture, Force plates) and simulation platforms (OpenSim) to study human response to exoskeletons.

Politecnico Di Milano's Movement Biomechanics and Motor Control Lab

MIT MISTI Research Intern Scholar

Summer 2017

Assisted graduate students in using motion capture to analyze the kinematics and kinetics of amputees and assess the efficacy of their prostheses.

MIT's Soft Active Materials Lab and MIT's Lincoln Lab

Lincoln Labs Undergraduate Research & Innovation Scholar

Fall 2015-Dec 2016

Collaborated with an interdisciplinary team to design conductive, tough, stretchable, and biocompatible hydrogels that could create a seamless interface between electronics and biological tissues. Awarded for Advanced Research in Mechanical Engineering. Presented at EECScn, MIT's premier undergraduate research conference, in 2016.

MIT's Laboratory for Energy and Microsystems Innovation

Undergraduate Research Assistant

Summer 2015

Fabricated a flexible nanoparticle separation prototype that uses microfluidics and electrokinetics to separate catalytic nanoparticles in oil refining processes. Sponsored by the oil company Saudi Aramco. Also helped develop and publish a paper on a novel method of designing conductive hydrogel films.

SELECTED ADDITIONAL PROJECT EXPERIENCE

Stanford AI in Health Course (CS271/BIODS220)

Fall 2020

Project Member

Assessed squat form using 3D pose data, a convolutional neural net, and a long short-term memory network.

Stanford AI for Disease Diagnosis and Info. Recommendation Course (CS372)

Spring 2020

Project Member

Developed an understanding of the features that impact COVID burden using multivariate regression models.

Stanford's Applied Machine Learning Course (CS229A)

Spring 2019

Project Member

Predicted the presence of bacterial biofilm, using bacterial drop colony assay images, convolutional neural nets, and support vector machines.

Stanford's Mechatronics Design Sequence (ME218A, ME218B)

Fall 2017-Spring 2018

Project Member

Devised multiple user interactions using event driven programming, IR sensing and audio input to control system behaviors. Integrated visual, audio, and haptic feedback based on user input and system state.

Center for Sensorimotor Neural Engineering Hackathon Winner

Spring 2017

Developed an interactive rehabilitation system for patients with foot drop. Our system used muscle activity measurements to drive audio and visual feedback which allowed users to better understand their

improvement in assigned exercises in a clear and motivating manner.

TEACHING EXPERIENCE

Teaching Assistant, Biomechanics of Movement ME281, Stanford, CA Winter 2021
MIT Global Teaching Labs Instructor, Various High School STEM Classes, Badalona, Spain Jan. 2017
Math, Science, and Test Prep Tutor June 2017 - Present

PUBLICATIONS AND PRESENTATIONS

- R. A. G. Adenekan**, K. T. Yoshida, A. Benyoucef, A. Gonzalez Reyes, A. E. Adenekan, A. M. Okamura, and C. M. Nunez (2024) Reliability of Smartphone-Based Vibration Threshold Measurements. IEEE Haptics Symposium. **Best Paper Award Finalist.**
- R. A. G. Adenekan**, A. Gonzalez Reyes, K. T. Yoshida, S. Kodali, A. M. Okamura, and C. M. Nunez (2024) A Comparative Analysis of Smartphone and Standard Tools for Touch Perception Assessment Across Multiple Body Sites. IEEE Transactions on Haptics.
- R. A. G. Adenekan**, A. Gonzalez Reyes, K. T. Yoshida, A. M. Okamura†, and C. M. Nunez† (2023) Vibration Sensory Threshold Measurement Using Mobile Devices. At Stanford eWear Annual Meeting Symposium, Poster.
- K. T. Yoshida*, J. X. Kiernan*, **R. A. G. Adenekan**, S. H. Trinh, A. J. Lowber, A. M. Okamura†, and C. M. Nunez† (2023) Cognitive and Physical Activities Impair Perception of Smartphone Vibrations. In IEEE Transactions on Haptics.
- R. A. G. Adenekan**, A. J. Lowber, B. N. Huerta, A. M. Okamura, K. T. Yoshida†, and C. M. Nunez† (2022) Vibration Sensory Threshold Measurement Using Mobile Devices. In BioRobotics, Late-Breaking Abstract.
- R. A. G. Adenekan**, A. J. Lowber, B. N. Huerta, A. M. Okamura, K. T. Yoshida†, and C. M. Nunez† (2022) Feasibility of Smartphone Vibrations as a Sensory Diagnostic Tool. In EuroHaptics, Work-in-Progress.
- R. Adenekan**, S. H. Collins (2019) Balance enhancing controller for an ankle exoskeleton. In *Dynamic Walking*, Abstract.
- Y. S. Joung, R. B. Ramirez, E. Bailey, **R. Adenekan**, & C. R. Buie, Conductive hydrogel films produced by freestanding electrophoretic deposition and polymerization at the interface of immiscible liquids. *Composites Science and Technology*, (2017)153, 128-135
- R. Adenekan**, H. Yuk, X. Zhao (2016) Hydrogel Neural Probe. In *MIT EECSCon*

LEADERSHIP / ACTIVITIES

New Creation Home Volunteer with At-Risk Young Moms in East Palo Alto Spring 2018-Present
Contributing to learnings during weekly parenting classes for the moms. I also designed and taught one of the classes on Stress Management and Goal setting.

MIT Club of Northern California, Digital Health Track Volunteer Spring 2024-Present
Organize seminars and gatherings (open to MIT alum & the general public) that focus on digital health

Stanford Summer Undergraduate Research Fellowship (SURF) Mentor Summer 2022 and 2023
2023: Research Mentor: Guided a SURF student through data collection for one of my projects on the reliability of smartphone measurements in measuring human vibration perception. This resulted in a paper accepted to the 2024 Haptics Symposium (see Publications) of which the mentored student (Anis Benyoucef) is a co-author.

2022 Graduate Mentor: Mentored SURF students who are considering graduate school in engineering. Was a highly requested mentor due to “clear commitment to creating experiences that enhance physical, emotional, and spiritual health” in addition to leading clinically relevant research projects.

Stanford Summer First Mentor

Summer 2022

Mentored incoming Mechanical Engineering PhD students.

Stanford Vice Provost for Graduate Education (VPGE) Student Employee

Fall 2022-Present

Contribute to the organization and publication of events that foster a greater sense of community and wellbeing in graduate fellows. I’ve also served on numerous panels and was invited to speak at the 2023 VPGE New Graduate Student Orientation because of my resilience in overcoming several challenges in graduate school and my passion for helping others navigate the system successfully.

MIT Admissions Interviewer

Fall 2022-Present

Interview applicants to the undergraduate program.

Stanford CHARM Lab Social Chair

Winter 2022-Fall 2023

Organized various lab community building events including lab retreats, quarterly events to connect and celebrate birthdays, lab lunches, etc.

Neuromuscular Biomechanics Lab Outreach Committee Member

Summer 2020-Summer 2022

Organized a recruitment event for new Stanford graduate students. Helped with a video to showcase the lab’s work for Stanford SERGE, a program to recruit late-stage undergraduate students. Organized and developed slides for “Biomechanics of Sports,” our Stanford Splash class that exposed high school students to the fascinating world of biomechanics by sharing applications, tools, and demos of some of the most cutting edge biomechanics technologies. “Wow, thanks for teaching! That was actually fun.” - A student

Stanford Enhancing Diversity in Graduate Education Mentor

Fall 2021-Summer 2023

Mentoring early-stage doctoral students in Mechanical Engineering. Was requested as a return mentor due to “highly valuable dedication to mentees.”

Stanford School of Engineering Graduate Student Recruiter

Fall 2019-Spring 2020

Selected by Stanford School of Engineering’s diversity office to travel to undergraduate institutions and recruit under-represented minority students.

Brains On, Science Podcast for Kids, Guest Speaker

Summer 2020

Featured on the Oct 6, 2020 episode at time 40:25 to explain why humans swing their arms when they walk.

Stanford STEM Fellows Mentor

Fall 2019 - Fall 2020

Mentoring undergraduate students who are interested in pursuing graduate education in engineering

Bay Area Graduate Pathways to STEM Committee Member and Advisor , Mentor

2018- 2019, 2023

Organized informative workshops that prepare undergraduate students for the graduate school application process. Encouraged my graduate student peers to serve as mentors.

MIT’s Design For America, Service and Outreach Team Co-Founder

Fall 2015 -Fall 2016

Partnered with a local high school to offer disadvantaged students interactive workshops on skills ranging from 3D modeling and printing to basic electronics and Arduino software.