Kanishka Mitra

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Research Interests

Artificial Intelligence, Reinforcement Learning, Robotics, Brain-computer interfaces (BCI), Neuroscience.

Education

Massachusetts Institute of Technology 2024-2028
Electrical Engineering and Computer Science, Ph.D. 5.00/5.00
Advisor: Dr. Mehrdad Jazayeri

The University of Texas at Austin 2017 - 2023
Electrical and Computer Engineering, BSEE/MSE 3.95/4.00 GPA
Thesis title: "Characterizing the onset and offset of motor imagery during passive arm movements to control an upper-body exoskeleton"
Advisors: Dr. José del R. Millán and Dr. Ashish Deshpande

Research Experience

Clinical Neuroprosthetics and Brain Interaction Lab (CNBI) / Rehabilitation Neuromuscular (ReNeu) Robotics Lab, Supervisors**:** José del R. Millán, Ph.D. and Ashish Deshpande, Ph.D. *Jan 2022 to Aug 2024*

- Developed a non-invasive brain-machine interface to detect *onset* and *termination* of motor imagery and control upper-body rehabilitation exoskeleton for improving motor dysfunctions post-stroke.
- Designed experimental protocol to capture electroencephalogram (EEG) signals of onset and termination motor imagery during passive arm movements evoked by exoskeleton from 12 healthy participants.
- Processed and analyzed EEG signals in real-time using MATLAB to create decoders to detect and trigger the start and end of exoskeleton reaching task.
- Created novel real-time, non-linear machine learning algorithms (Riemannian geometry-based classifiers) to decode highly variant and non-stationary EEG signals. Achieved average onset decoder performance of 64.0% and termination decoder of 66.6%.

Graduate Research Assistant, Khurshid Lab, Dell Medical School *Jan 2022 to May 2023*
Supervisor: Anjum Khurshid, M.D., Ph.D.

- Applied data analysis and machine learning techniques to collect, analyze, and identify patterns in social service and health data that uncovered critical insights, revealing gaps in community-based health care.

President's Award for Global Learning, Texas Global *Jan 2019 to May 2021*
Supervisors**:** Jaqueline Angel, Ph.D., Meeta Kothare, Ph.D., Meghana Gadgil, M.D., MPH

- Awarded $113,000 grant to implement and execute 10-week project in Puebla, Mexico to study and address diabetic complications through design thinking and technological solutions.
- Published a peer-reviewed paper called "Mind the Gap: A Scoping Review of Aging and Diabetes in Mexico" in journal: *Aging in the Americas.*
- Recruited and interviewed 14 patients in the Austin area to discover gaps in diabetes management and care to identify potential points of intervention.

- Presented our findings to Lone Star Circle of Care Clinic in Rundberg, Austin, which helped fund new kitchen in the clinic to aid in better diet management and education for patients.

Undergraduate Research Assistant, ReNeu Robotics Laboratory *June 2018 to March 2020*

Supervisor**:** Ashish Deshpande, Ph.D.

- Constructed virtual simulation in VREP of stroke therapy exoskeleton robot using C++ to perform various external experiments on the individual joints.
- Conducted research experiments to analyze muscular efforts in exoskeleton by developing LabView code that measured and collected data from EMGs which were processed through MATLAB.

Research Apprentice, Applied Research Laboratories (ARL) *June 2017 to Aug 2017*

Supervisor**:** Brian La Cour, Ph.D.

- Developed QASM (Quantum Assembly Language) software interface for a quantum emulation device which allowed for more robust experimentation and aided in the education curriculum of the Quantum Computing FRI (Freshman Research Initiative) Stream.
- Published research paper in the "ARL Science and Engineering Apprenticeship Program" for ARL and presented research to ARL staff and UT faculty which was awarded honorable mention for the Best Presentation.

Industry Experience

Robotics Engineer II, Contoro Robotics *Sep 2023 to Aug 2024*

- Utilizing deep learning techniques to enhance object detection and perception capabilities of industrial robot arm, resulting in improved efficiency and precision in complex warehouse unloading tasks.
- Orchestrated and led successful pilot program in customer warehouse and improved overall unloading rate of automated robot from 100 boxes per hour to 250 boxes per hour.

Applications Engineering Intern, Cirrus Logic *Sep 2021 to Dec 2021*

- Created Python GUI that effectively configures different haptic waveforms and behaviors for haptic hardware devices that will be used by Cirrus Logic's Field Engineers and customers.
- Designed and implemented custom PCB on active stylus to enable haptic effects based on measured values from force sensor, which was pitched to relevant Cirrus Logic customers.

Applications Engineering Intern, Texas Instruments *May 2021 to Aug 2021*

- Evaluated competitor LDO models using PSPICE to compare and assess accuracy vs. input voltage and current, transient performance, PSRR, Noise, and thermal shutdown.
- Presented findings to our team of Application Engineers and Marketing Managers to identify competitive gaps and suggest possible innovations to current TI LDO models.

Analog Field Application Engineering Intern, Texas Instruments *May 2019 to Aug 2019*

- Designed and proposed power architecture for automotive HUD (heads-up display) from ideation to layout that was implemented in 2022 GM vehicles.
- Devised surround-view system schematic for level two autonomous driving.
- Supported various consumers in the automotive industry by meeting design requirements, drawing schematics, and debugging hardware issues.

- Led presentation on transistors with engineers in the office and product line managers that were invited to discuss current transistor technologies and their future applications.

Cofounder, sPark – Smart Parking, LLC *June 2017 to May 2018*

- Launched IOS application for peer-to-peer marketplace for parking, that connects people who need to park with available parking spaces, by using Swift to build the UI and CocoaPods as the backend.
- Pitched at Capital Factory Accelerator program, the largest startup accelerator in Austin, Texas.
- Collaborated with partner to develop and finance this application.

Publications

- **Mitra K.,** Kumar S., Racz F.S., Liu D., Deshpande A.D., Millán J. Del R. (2025). Real-Time Decoding of Movement Onset and Offset for Brain-Controlled Rehabilitation Exoskeleton, IEEE Conf. on Robotics and Automation (ICRA), ***in press.***

- Kumar S., **Mitra K.,** Liu R., Alawieh H., Surapaneni A., Deshpande A.D., Millán J. Del R. (2025). Performing Bimanual Tasks with a BCI: Combining a Brain-Controlled Hand Exoskeleton with the Functional Limb. IEEE EMBS Conf. on Neural Engineering (NER).

- Kang I., **Mitra K.,** Seethapathi N., (2025). Inverse adaptation reveals fall risk-aware locomotor performance. Proceedings of the National Academy of Sciences (PNAS), ***in review.***

- Kumar S., **Mitra K.,** Liu D., Alawieh H., Racz F.S., Gasperina S.D., Deshpande A.D., Millán J. Del R. (2025), Characterizing Expectation Mismatch in a Brain-Controlled Upper-Body Rehabilitation Exoskeleton. IEEE Robotics and Automation Letters (RA-L).

- **Mitra K.,** Racz F.S., Bucchieri, A., Kumar S., Alawieh H., Deshpande A.D., Millán J.R. (2023), A Hierarchical Machine Learning Approach for Real-Time BMI Control of an Upper-Body Exoskeleton [Robot Exhibition]. International Joint Committee on Artificial Intelligence (IJCAI).

- **Mitra K.,** Racz F.S., Kumar S., Deshpande A.D., Millán J.R. (2023), Characterizing the onset and offset of motor imagery during passive arm movements induced by an upper-body exoskeleton. IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS).

- Khurshid A., Hautala M., Oliveira E., Lakshminarayanan V., Abrol V., Collier J., Rosseau J., Granado L., Nallaparaju S., **Mitra K.**, Sohail R. (2023), Social and Health Information Platform: Piloting a Standards-Based, Digital Platform Linking Social Determinants of Health Data into Clinical Workflows for Community-Wide Use. Applied Clinical Informatics.

- Vazquez C.E., Gadgil M., Tiong J., **Mitra K.,** Mark H., Quan K., Kothare M., Angel, J.L. (2021), Mind the Gap: A Scoping Review of Aging and Diabetes in Mexico. In: Angel, J.L., López Ortega, M., Gutierrez Robledo, L.M. (eds) Understanding the Context of Cognitive Aging. Springer, Cham.

Presentations

- Kang I., **Mitra K.,** Seethapathi N., (2025) 'Personalized locomotor adaptation model reveals fall risk-aware locomotor performance,' International Society of Biomechanics.

- Kumar S., **Mitra K.,** Liu R., Alawieh H., et al., (2025) 'Bimanual BCI: Combining a Brain-Controlled Hand Exoskeleton with the Functional Limb,' 11th International BCI Meeting.

- **Mitra K.,** (2024) 'Brain-Computer Interface: Bridging Technology and Healthcare,' SXSW 2024 **(Demo).**

- **Mitra K.,** (2023) 'A Hierarchical Machine Learning Approach for Real-Time BMI Control of an Upper-Body Exoskeleton,' Texas Robotics Symposium **(Poster).**

- **Mitra K.,** (2023) 'Characterizing the onset and offset of motor imagery during passive arm movements induced by an upper-body exoskeleton,' IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) **(Poster + Talk).**

- **Mitra K.,** (2023) 'Characterizing motor imagery while an upper-body exoskeleton induces passive arm movements,' InterfaceRice **(Poster + Talk) – *Attendee's Choice Award for Best Poster.***

- **Mitra K.,** (2023) 'Detecting onset and offset of motor imagery while an upper-body exoskeleton induces passive arm movements,' Texas Regional Robotics Symposium **(Poster).**

- **Mitra K.,** (2023) 'Integration of an Upper-Body Exoskeleton with a Brain-Machine Interface for Elucidating Recovery Post-Stroke,' Cellular to Clinically Applied Rehabilitation Research and Engineering **(Poster).**

- Vazquez C.E., Tiong J., **Mitra K.,** Mark H., Quan K., Angel, J.L., (2021) 'Rural-Urban Difference in Older Adults with Diabetes in Mexico,' Latin America Studies Association Conference **(Talk).**

- Broussard B., Hall J., **Mitra K**., Nederveld A., (2021) 'Millimeter-Wave Radiation Sources using Negative Differential Resistance Devices,' Electrical and Computer Engineering Senior Capstone Project **(Talk) – *Honorable mention for Best ECE Capstone Research Project.***

- Mark H., **Mitra K.,** Quan K., Tiong J., (2019) 'Understanding and Addressing Diabetic Complications in Puebla, Mexico,' President's Award for Global Learning **(Talk).**

- **Mitra K.,** (2017) 'Developing a QASM software interface for Quantum Emulation,' Applied Research Laboratories, Science and Engineer Apprenticeship Program **(Poster + Talk) – *Honorable mention for Best Research Project.***

Teaching Experience

Teaching Assistant for Engineering Communications, UT Austin *Spring and Fall 2022, Spring 2023*

PGE 33T, Prof. Deborah Hempel-Medina, overall rating: 4.8/5

- Helping students build their career and communication skills through office hours and tutoring.
- Delivering lectures on the interviewing process, negotiating skills, and technical writing to a class size of 30 to 50 students.

Teaching Assistant for Digital Logic Design, UT Austin *Spring 2021*

EE 316, Dr. David Pan and Dr. Michael Orshansky, overall rating: 5/5

- Meet with students weekly to assist them through homework, projects, and exam preparation.
- Taught students how to code in Verilog and program Xilinx FPGA development boards.

Honors, Awards, and Fellowships

- **Patrick J. McGovern Travel & Technology Award**, McGovern Institute for Brain Research, **2026**
- **Siebel Scholar,** awarded annually for academic excellence and leadership to ~80 top graduate students across leading universities, **Class of 2026**.
- **SERC Scholar**, MIT Schwarzman College of Computing, **2025**.
- **NSF Graduate Research Fellowship Program (GRFP)**, **Honorable Mention**, **2025**.
- **Alan V. Oppenheim Fellowship of Exemplary Achievement**, MIT EECS, **2024**.
- **Attendee's Choice Award**, **Best Poster**, InterfaceRice Conference (out of 65 posters), **2023**.
- **ECE Capstone Design Showcase**, **Honorable Mention, Best Research Project**, **2021**.
- **Aggarwal–McGonigle Summer Research Fellowship**, **2020**.
- **President's Award for Global Learning**, Texas Global, **2019.**
- **Pacbot National Robotics Competition**, **Third Place**, IEEE Robotics & Automation Society (RAS), **2018**.
- **ARL Science & Engineering Apprenticeship Program**, **Honorable Mention, Best Presentation**, **2017**.
- **Dr. Francis X. Bostick, Jr. Endowed Scholarship,** UT Austin ECE.

Skills

Software: Python, PyTorch/TensorFlow, MATLAB, C/C++, BASH, Signal Processing, Machine Learning
Hardware: Verilog, RTL Design, PCB Design, Cadence (Schematic and Layout Design), PSPICE, Fusion 360, FPGA configuration, and Embedded Systems

References

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