Rohith Karthikeyan

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Research Interests

My core research interest is on *human augmentation* across cognitive, physical, and collaborative interactions, in human-human and human-robot systems. I wish to integrate Systems Neuroscience, Robotics, Wearable Sensing, and Machine Learning to understand human behavior across situations and to develop better human-centered technology. My present focus is on identifying physiological representations of cognitive fatigue towards personalized and fieldable countermeasures.

Education

Texas A&M University, College Station 2017 – 2022 (Spring)
Ph.D. in Mechanical Engineering
Dissertation: Towards a Closed-loop Framework for Non-invasive Brain Stimulation
Committee: Ranjana K. Mehta (PI), Anthony D. McDonald, Jason Moats, Cynthia Hipwell, Kiju Lee

Texas A&M University, College Station 2015 – 2017
M.S. (thesis) in Mechanical Engineering
Thesis: Optically Sensorized Tendons for Articulate Robotic Needles
Committee: Seok Chang Ryu (PI), Won Jong Kim, Michael Moreno

BMS College of Engineering, Bengaluru, India 2011 – 2015
B.E. (with high honors) in Mechanical Engineering

Selected Honors and Activities

- **Best Student Paper Award** – International Annual Meeting, HFES 2021
  - Recognized by the Augmented Cognition Technical Group for our submission on cognitive fatigue
- Awarded the **Graduate Teaching Fellowship**, College of Engineering, 2021-22
- J. Mike Walker '66, Department of Mechanical Engineering **Research Grant Award** 2021
  - **Proposal**: Investigating the Impact of High-Definition tDCS on Working Memory and Fatigue under Ecologically Valid Task Conditions in Emergency Responders
- Completed the **Neuromatch Academy's summer school on Deep Learning** in 2021
  - **Project:** Kaggle competition on radiogenomic detection of malignant glioblastomas in brain MRI using efficient 3D-CNNs (RESNET-10). Our submission ranked 11 (in the Gold zone)

Experience

NeuroErgonomics Laboratory, Texas A&M University — December, 2019 – Present
Graduate Research Assistant — *College Station, TX*

Aescape, Inc. — May – December, 2019
Robotics Intern — *New York City, NY*

BioRobotics Laboratory, Texas A&M University — January, 2016 – April, 2019
Graduate Student Researcher — *College Station, TX*

Intelligent Fiber-Optic Systems, Inc. — June, 2016 – August, 2016
Research Intern — *Santa Clara, CA*

Fluid Mechanics Laboratory, Indian Institute of Science — January, 2015 – July, 2015
Undergraduate Researcher — *Bengaluru, India*

Robert Bosch Engineering, Pvt. Ltd. — June, 2014 – August, 2014
Engineering Intern — *Bengaluru, India*

Selected Talks and Presentations

Closed-loop Non-invasive Brain Stimulation as a Fatigue Countermeasure February 2022
Clemson University, Clemson, SC

Visuospatial Working Memory Under Fatigue October 2021
Annual Meeting, Human Factors and Ergonomics Society, Baltimore, MD

The Differential Effects of tDCS on Working Memory Capacity September 2021
Neuroergonomics Conference, Ludwig-Maximilians-Universität München

Personalized VR training using Eye-tracking and Brain-based Metrics March 2021
Annual Meeting, Applied Ergonomics Society

Affective State Detection during Fatiguing Motor Tasks November 2020
Annual Conference, Insititute of Industrial and Systems Engineers

On Augmenting Working Memory Through Neurostimulation October 2020
Workshop on Advanced Neurotechnologies, IEEE Brain Initative

Towards Closed-loop Neurostimulation October 2020
IEEE International Conference on Systems, Man, and Cybernetics, Toronto, CA

Miniaturized Robotic-tubes for Minimally-Invasive Surgery May 2019
IEEE International Conference on Robotics and Automation, Montreal, CA

Force Sensing in Surgical Instruments using Sensorized Tendons July 2017
REU/ RET Seminar at Texas A&M University

On Bimodal Sensing and Actuators for Robot-Assisted Surgery June 2017
Seminar at the National University of Singapore

Peer-reviewed Publications

Updated lists on: Google Scholar and my webpage
Legend: * students mentored; † equal contributions

Journal Publications

1. **Karthikeyan, R.**, Carrizales, J.*, Johnson, C.*, Mehta, R.K. A Window into the Tired Brain: Neurophysiological Dynamics of Visuospatial Working Memory under Fatigue. *Human Factors* (in press).

2. Mehta, R. K., Moats, J., **Karthikeyan, R.**, Gabbard, J. L., Srinivasan, D., Du, E. J., ... & Fernandes, R. (2022). Human-centered intelligent training for emergency responders. *AI Magazine*, 43(1), 83-92.

3. **Karthikeyan, R.**, Mcdonald, A. D., & Mehta, R. (2022). Stress Detection during Motor Activity: Comparing Neurophysiological Indices in Older Adults. *IEEE Transactions on Affective Computing*, (01), 1-1.

4. **Karthikeyan, R.**; Smoot, M. R.*; Mehta, R. K. (2021). Anodal tDCS augments and preserves working memory beyond time-on-task deficits. *Scientific Reports*, 11(1), 1-11.

5. Abujelala, M., **Karthikeyan, R.**, Tyagi, O., Du, J., Mehta, R. K (2021). Brain Activity-based Metrics for Assessing Learning in VR under Stress among Firefighters: An Explorative Machine Learning Approach in Neuroergonomics. *Brain Sciences*.

6. **Karthikeyan, R.**, Sigmund, K.*, Park, Y. L., Ryu, S. C. (2019). Performance Evaluation of Optically Sensorized Tendons for Articulate Surgical Instruments. *ASME Journal of Medical Devices*.

7. Nuamah, J.K., Mantooth, W. P., **Karthikeyan, R.**, Ryu, S.C., Mehta, R. K. (2019). Neural Efficiency of Human-Robotic Feedback Modalities under Stress differs with Gender. *Frontiers in Human Neuroscience*.

8. Chen, S., **Karthikeyan, R.**, Ryu, S. C. (2018). Towards the design of mechanically superior tubular structures for microcatheters. *Smart Materials and Structures*.

In preparation

9. **Karthikeyan, R.**, McDonald, A. D., Mehta, R.K. What's in a Label? Annotation Differences in Forecasting Cognitive Fatigue using ECG Data and Seq2Seq Architectures (working title). To be submitted to the *IEEE Transactions on Cybernetics*.

Conference Publications

10 **Karthikeyan, R.**, Carrizales, J.*, Johnson, C.*, Mehta, R.K. (2021) Visuospatial Working Memory under Fatigue: Observations with Cerebral Hemodynamics and Heart Rate Variability. *Proceedings of the Human Factors and Ergonomics Society.* 🏆 Best Student Paper Award

11 **Karthikeyan, R.**, Mehta, R.K. (2021) Differential Effects of tDCS on Visuospatial Working Memory Performance under Fatigue. *Neuroergonomics Conference.*

12 **Karthikeyan, R.**, Mehta, R. K. (2020, October). Towards a Closed-Loop Neurostimulation Platform for Augmenting Operator Vigilance. In *2020 IEEE International Conference on Systems, Man, and Cybernetics (SMC).*

13 Kalatzis A., **Karthikeyan, R.**, Stanley, L., Mehta, R.K. (2020, September) Mental Stress Classification during Motor Tasks in Older Adults using an Artificial Neural Network, *Adjunct Proceedings of the 2020 ACM International Joint Conference on Pervasive and Ubiquitous Computing and Proceedings of the 2020 ACM International Symposium on Wearable Computers.*

14 **Karthikeyan, R.**, Pattanshetti, S.V., Ryu, S.C. (2019, May) Miniature Robotic Tubes with Rotational Tip-Joints as a Medical Delivery Platform, *IEEE International Conference on Robotics and Automation (ICRA) 2019.*

15 Mantooth, W. P., **Karthikeyan, R.**, Ryu, C. S., Mehta, R. K. (2018, September). Exploring Stress Resilient Feedback Modalities: Investigation of Physiological and Perceptual Load. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting.*

16 **Karthikeyan, R.**†, Pattanshetti, S.V.†, Ryu, S.C. (2017, June) Force Sensing Steerable Needle with Articulated Tip and Sensorized Tendons, C4-Surgical Robotics Workshop, *IEEE International Conference on Robotics and Automation (ICRA) 2017.* 🏆 Finalist: Best Poster-paper Award

Peer-reviewed non-archival publications

17 **Karthikeyan, R.**, Shi, Y., Du, E., Mehta, R.K. (2021, March). Personalized VR-based training using eye-tracking and brain-based metrics, *Applied Ergonomics Conference 2021.*

18 **Karthikeyan, R.**, AlKader, A.*, McDonald, A. D., Mehta, R.K. (2020, November) Affective State Detection during Fatiguing Motor Tasks in the Elderly using Brain Hemodynamics. *Proceedings of the 2020 IISE annual conference (2020).*

19 **Karthikeyan, R.**, Mehta, R.K. (2020, October) On Augmenting Working Memory through Neurostimulation, *2020 IEEE Brain Initiative Workshop on Advanced NeuroTechnologies.*

Theses

20 **Karthikeyan, R.** Optically Sensorized Tendons for Articulate Robotic Needles. Diss. 2017.

Patents

21 Ryu, Seok Chang, **Rohith Karthikeyan**, and Shivanand Pattanshetti. "Surgical Cannulas and Related Methods." U.S. Patent Application No. 16/418,429.

Teaching

Legend: * positions held at Texas A&M University.

Graduate Assistant Lecturer* 2021
Introduction to Mechanical Engineering Design I
- Lead studio instruction for the Senior Capstone Design teams in Mechanical Engineering
- Mentor students through the design process across eight industry facing projects for 55 students

Graduate Teaching Assistant* 2019
Experimental Physics and Engineering Lab II
- Handled labs and recitations on the physics of motion for two sections with 60+ students each.
- Coordinated grading and instruction for 8 sections, and 12 peer-teaching assistants.

Graduate Teaching Assistant* 2018
Engineering Lab I - Computation
- Instructed a class of 90 students on the design and development of computer applications
- Introduced programming and software design fundamentals on Python

Graduate Teaching Assistant* 2016–2017
Foundations of Engineering I, II
- Introduced classes with 100+ students to engineering fundamentals
- Developed tutorials for hardware-oriented programming on MATLAB and LabVIEW

Volunteer ESL Instructor 2016 (Winter)
Guayasamin Institute, Quito, Ecuador
- Shared my experiences with English as a Second Language.
- Learned conversational Spanish and engaged classroom discussions.

Volunteer Math Tutor 2014
Youth for Seva, Bengaluru, India
- Volunteered as a Math tutor for grades II - VI at a government school in suburban Bengaluru.

Selected Honors and Awards

Best Student Paper Award HFES Annual Meeting
Augmented Cognition Technical Group *2021*
- Awarded for our peer-reviewed conference proceeding on cognitive fatigue [10].

COE Graduate Teaching Fellowship Texas A&M University
College of Engineering, Graduate Teaching Fellows Program *2021*
- Competitive fellowship awarded to hone future instructors in engineering.

Fellowship for Future Faculty in Mechanical Engineering Texas A&M University
Department of Mechanical Engineering *2021 – 2022*
- Fellowship awarded by the MEEN program to mentor and encourage future faculty candidates.

Graduate Student Travel Award Texas A&M University
Department of Mechanical Engineering *2021 – 2022*
- Towards my participation and presentation at HFES21 [10] in Baltimore, MD.

Graduate Student Summer Research Grant Texas A&M University
Department of Mechanical Engineering *Summer 2021*
- On Investigating the Impact of High-Definition tDCS on Working Memory, extending [2].

Graduate Student Travel Award Texas A&M University
Department of Mechanical Engineering *2020 – 2021*
- Towards my participation and presentation at the IEEE SMC 2020 [12].

Graduate Student Presentation and Travel Award Texas A&M University
Office of Graduate and Professional Studies *2019*
- Towards my participation and presentation at the IEEE ICRA 2019 [14].

IEEE RAS Travel Grant IEEE
Robotics and Automation Society *2019*
- Towards my participation and presentation at the IEEE ICRA 2019 [14].

Best Poster-paper Award (Finalist) IEEE ICRA
C4 Workshop on Surgical Robotics *2017*
- For my presentation on force-sensing tendons at the IEEE ICRA 2017 [16].

Graduate Student Travel Award Texas A&M University
Department of Mechanical Engineering *2017 – 2018*
- Towards my participation and presentation at the IEEE ICRA 2017 Workshop on Surgical Robotics [16].

Undergraduate Honors BMS College of Engineering
Department of Mechanical Engineering *2015*
- Ranked third in the Bachelors ME Program across 200+ candidates.

Arvin Meritor Scholarship BMS College of Engineering
Department of Mechanical Engineering *2014*
- Awarded a scholarship and stipend for scholastic excellence as a junior in the ME program.

Mentoring

Note: all mentees are currently affiliated with Texas A&M University unless indicated otherwise

NeuroErgonomics Laboratory

Mentored 19 students over a span of 2 years across the NHANCE and LEARNER projects, leading two AggiE-challenges and NSF I-Corps cohorts during this time.

Name	Year	Current Affiliation
Yu-Po Cheng	2022 – present	Ph.D. student, Neuroscience
Zachary Laguna	Fall 2021	Senior, Computer Science
Margaret Zhuang	Fall 2021	Sophomore, Computer Science
Shaye Smith	Fall 2021	Senior, Environmental Engineering
Yixin Zhang	2021 – present	Senior, Statistics
Joceleen Hardjadinata	2021 – present	Senior, Mechanical Engineering
Shivangi Dwiviedi	Fall 2021	Ph.D. student , Industrial Engineering
Anay Bhat	Summer 2021	Intern, High School Senior
Meredith R. Smoot	2020 – present	Junior, Electrical Engineering
Joshua Carrizales	2020 – 2021	Ph.D. student at Iowa State University
Connor Johnson	2020 – 2021	Ph.D. student at University of Texas, Austin
Iaroslava Konopleva	2020	Junior, Electrical Engineering
Ethan Vargas	2019 – 2020	M.S. degree, Electrical Engineering
Santiago Garcia	2019 – 2020	Senior, Industrial Engineering
Caleb Jones	2019 – 2020	Reynolds & Reynolds, Inc.
Mikash Kothari	2020 – 2021	Junior, Mechanical Engineering
Jaduna Jegatheeswaran	2020	Junior, Biomedical Engineering
Jesse Lien	2020	Junior, Biomedical Engineering
Emilie Vawter	2020	M.S., Industrial Engineering
Alvin H. Xiong	2020	M.S., Industrial Engineering

BioRobotics Laboratory

Mentored 10 undergraduate students in research on soft-tissue mechanics, force-sensing, and surgical robotics.

Grayson Aldrich	2018	Employed at Lockheed Martin
Sara Van Kalker	2018	left to Georgia Tech for an M.S. degree
Abigail Glatman	2018	Employed at Lockheed Martin
Imannuel Ponminissery	2019	MBA at the University of Texas, Austin
Harsha Mohan	2019	M.S. degree at Johns Hopkins University
Kelly Sigmund	2016 – 2017	left to work at Stryker Medical
Christopher Kim	2017	Ph.D. at University of Pennsylvania
Henry Kim	2017	Graduated from the University of Michigan
Krystopher Terreri	2016	left to the University of Notre Dame for an M.B.A
Apurva Patil	2016	Ph.D. student at the University of Texas, Austin.

Service, Outreach and Activities

- **Reviewer:**
  - Neuroergonomics Conference (2021)
  - IEEE International Conference on Systems, Man and Cybernetics (2021)
  - Proceedings of the Human Factors and Ergonomics Society (2021)
  - IEEE International Conference on Intelligent Robots and Systems, IROS (2018 – present)
  - ACM – CHI Conference on Human Factors in Computing Systems (2021)
  - IEEE International Conference on Robotics and Automation, ICRA (2018 – present)
  - IEEE International Conference on Advanced Intelligent Mechatronics (AIM 2018)
  - IEEE International Symposium on Medical Robotics (2019)
  - IEEE Transactions on Robotics (2019)
  - International Journal of Control, Automation and Systems (2019)
- **Professional Societies:**
  - Human Factors and Ergonomics Society
  - IEEE Brain Initiative
  - IEEE Robotics and Automation Society
  - IEEE Systems, Man and Cybernetics Society
  - Institute for Industrial and Systems Engineers
  - Academy for Future Faculty at Texas A&M University
  - IEEE Young Professionals
- **Other**:
  - Informal organizer of the graduate-student running group in College Station, Texas
  - Founding member, and president-elect of the Rotaract Club at BMSCE 2014-15
  - Founder and head of the speaker's club VAK at BMSCE, 2013-14
  - Member of the BAJA-SAE team at BMSCE, 2014-15
  - Organizing member of the Quiz club at BMSCE, 2011-15