FNU Aakash (Aakash Yadav)

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RESEARCH INTEREST

I am primarily interested in understanding the interaction between *humans and technology*. I work closely with human subjects, wearable sensors, behavioral data and employ machine learning, statistics, quantitative & qualitative analysis.
Key words: Human-Robot Interaction, Robotics, Neuroergonomics, Trust, Human Factors, Affective Computing

EDUCATION

University of Wisconsin-Madison   Madison, USA
Doctor of Philosophy - Industrial & Systems Engineering; GPA: 4.0/4.0   *Aug'23 - Present*
Thesis: Team trust dynamics in multi-human robot teaming
Advisor: Dr. Ranjana K. Mehta

Texas A&M University *(transferred to UW-Madison)*   College Station, USA
Doctor of Philosophy - Industrial & Systems Engineering; GPA: 4.0/4.0   *Aug'21 - Jul'23*
Advisor: Dr. Ranjana K. Mehta

Indian Institute of Technology Tirupati   Tirupati, India
Bachelor of Technology - Mechanical Engineering; GPA: 8.67/10.0   *Jul'16 - Jun'20*

EXPERIENCE

Graduate Research Assistant   Neuroergonomics Laboratory
Project: Trust in Multi-Human Robot Teams (mHRT)   *Jan'22 - present*
PI: Ranjana K. Mehta, UW-Madison

- Conducted a comprehensive literature review on mHRT, identifying critical gaps in methodology, trust measurement, and teaming dynamics.
- Designed and executed an experimental study to objectively investigate the impact of robot performance on team dynamics using a high-fidelity virtual environment (neural, eye, eda, ecg, venv logs, communication data)
- Computed and analyzed data from different modalities to quantify synchrony between human dyads

Summer Research Intern   Honda Research Institute
Manager: Shashank Mehrotra   *May'24 - Aug'24*

- Design experiments and evaluate human interaction with future mobility systems
- Prosocial and helping behaviors in urban mobility environment interactions

Project: Disaster Robotics   *Jan'23 - present*
PI: Robin Murphy, Ranjana K. Mehta, Camille Peres

- Human-Robot Interaction between Small Unmanned Aircraft Systems (sUAS) pilots and Unmanned Aerial Vehicles (UAVs)
- Multi-university effort to understand HRI in sUAS pilots deployed in Hurricane Ian using contextual interviews, physiological measures, and observations

Project: Robot adaption using physiological response   *Jan'22 - Aug'23*
PI: Prabhakar Pagilla Ranjana K. Mehta

- Design, implementation, and validation of human-centered robot adaptation model to optimize task performance and aid cognitive fatigue recovery using Q-learning

Project: Human-Robot Collaboration   *Aug'21 - present*
PI: Ranjana K. Mehta, Prabhakar Pagilla

- Instrumented and analyzed multi-modal time series data (neuronal activity, eye-tracking, heart rate, etc.) along with subjective measures and performance to understand trust dynamics during human-robot collaborations
- Conducted mixed methods research with behavioral coding to assess trust in embodied AI agents
- Conceptualized & designed experimental test-bed to evaluate multi-human-robot teaming in time-critical scenarios

Pre-doctoral researcher   Johns Hopkins University
Andrew Hundt, CIRL, JHU (remote)   Jan'21 - Apr'21

- Benchmarking of Neural Architecture Search (NAS) Algorithms for robot manipulation tasks
- Optimization of the pareto-optimal front of network weight vs performance

Pre-doctoral researcher   Northwestern Polytechnical University
PI: Shuhui Bu, ADV-CI Lab (remote)   Aug'20 - Dec'20

- Generated sparse depth maps for custom data using geometric SLAM (ORB-SLAM2)
- Worked on fine-tuning end-to-end neural network for sparse-to-dense depth completion

Undergraduate Research Intern   Texas A&M University
PI: Satish Bukkapatnam, TAMU   Jun'19 - Jul'19

- Analyzed Laser-DED melt pool using image processing
- Conducted experiments on the Optomec LENS machine and performed high-speed imaging of the particle deposition and spatter in the process near melt-pool at 10,000 fps
- Developed and implemented an in-house particle detection and tracking algorithm on the recorded videos
- Complete trajectories were obtained even with adversaries of variable velocity, size, and shape of the particles

Undergraduate Research Assistant   IIT Tirupati
Prof. PC Deshmukh, IIT Tirupati, and Prof SR Valluri, UWO Canada   May'18 - Feb'19

- Thermoelectric materials and generalization of Wiedemann Franz Law
- Obtained solutions for the equations maximizing the figure of merit of thermoelectric materials in terms of the Lambert W function and the offset logarithmic function
- Contributed towards the generalization of Wiedemann Franz Law using polylogarithmic functions

Mechanical Engineering Intern   Ford India
Manager: Rahul Giri, MP&L division, Ford India   Jun'18 - July'18

- Just-in-time Execution Distribution Information Scheduling Tool Optimization
- Optimized scheduling for blanking and stamping processes to increase the efficiency of the job
- Collected and analyzed process data and proposed system changes for smooth flow of data across platforms

PUBLICATIONS

Peer-Reviewed Journal Papers

J3 Sarah K. Hopko, Yinsu Zhang, **Aakash Yadav**, Prabhakar R. Pagilla, and Ranjana K. Mehta (2023). *Brain-Behavior Relationships of Trust in Shared Space Human-Robot Collaboration*, J. Hum.-Robot Interact.

J2 Yuhao Zhong, Zimo Wang, Aditya V Yalamanchili, **Aakash Yadav**, BN Ravi Srivatsa, Srikanth Saripalli and Satish TS Bukkapatnam (2020). *Image-based flight control of unmanned aerial vehicles (UAVs) for material handling in custom manufacturing.* Journal of Manufacturing Systems, 56, 615-621.

J1 **Aakash Yadav**, PC Deshmukh, Ken Roberts, NM Jisrawi, and SR Valluri (2019). *An analytic study of the Wiedemann Franz law and the thermoelectric figure of merit.* Journal of Physics Communications, 3(10), 105001.

Peer-Reviewed Conference Papers

C8 **Aakash Yadav** and Ranjana Mehta (2024). *Beyond Dyadic Interactions: Assessing Trust Networks in Multi-Human-Robot Teams.* In Companion of the 2024 ACM/IEEE International Conference on Human-Robot Interaction (HRI'24 Companion), March 11–14, 2024, Boulder, CO, USA. ACM, New York, NY. Best poster honorable mention.

C7 Yinsu Zhang, **Aakash Yadav**, Sarah K. Hopko, and Ranjana K. Mehta (2024). *In Gaze We Trust: Comparing Eye Tracking, Self-report, and Physiological Indicators of Dynamic Trust during HRI.* In Companion of the 2024 ACM/IEEE International Conference on Human-Robot Interaction (HRI '24 Companion), March 11–14, 2024, Boulder, CO, USA. ACM, New York, NY.

C6 Jay K. Shah, **Aakash Yadav**, Sarah K. Hopko, Ranjana K. Mehta, and Prabhakar R. Pagilla (2023). *Robot Adaptation Under Operator Cognitive Fatigue Using Reinforcement Learning.* In 2023 32nd IEEE International Conference on Robot and Human Interactive Communication (RO-MAN) (pp. 1467-1474). IEEE.

C5 **Aakash Yadav**, Patralika Ghosh, Malik Rawashdeh, Diane Lee, Thomas Bolf, and Ranjana K. Mehta (2023). *All Human Versus Human-Robot Teaming: Measuring Neurophysiological Synchrony, Team Performance, and Trust during Search and Rescue.* Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 67(1), 432-433.

C4 **Aakash Yadav**, Sarah Hopko, and Ranjana Mehta, (2022).*Neural Signatures of Trust in Human-Robot Collaboration: A Tale of Two Use-Cases*, Neuroergonomics Conference.

C3 **Aakash Yadav**, Sarah Hopko, and Ranjana Mehta (2022). *Interplay of Cognitive Fatigue and Trust in Human-Robot Collaboration.* Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 66(1), 535-535.

C2 Yinsu Zhang, Sarah Hopko, **Aakash Yadav**, and Ranjana Mehta (2022). *Capturing Dynamic Trust Metrics during Shared Space Human-Robot Collaboration: An eye-tracking approach.* Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 66(1), 536-536.

C1 Ashif S. Iquebal, **Aakash Yadav**, Bhaskar Botcha, Rama Krishna Gorthi, and Satish Bukkapatnam (2022). *Tracking and quantifying spatter characteristics in a laser directed energy deposition process using Kalman filter.* Manufacturing Letters, 33, 692-700.

Peer-Reviewed Workshop Papers

W1 **Aakash Yadav**, Sarah Hopko, Yinsu Zhang, Ranjana Mehta, *Multimodal Bio-Behavioral Approaches to Study Trust in Human-Robot Collaboration*, IEEE HRI Test Methods & Metrics (2022).

In Preparation

P3 **Aakash Yadav**, Sarah K. Hopko, Ranjana K. Mehta *Neurophysiological Dynamics of Trust and Cognitive Fatigue during Human-Autonomy Teaming*, IEEE Transactions of Affective Computing.

P2 **Aakash Yadav**, Ranjana K. Mehta *Trust prediction using neurophysiological measures in HRC.*

P1 **Aakash Yadav**, Ranjana K. Mehta *Trust in multi-human automation teaming: A systematic review, IJHCI.*

HONORS AND AWARDS

- Best paper honorable mention at IEEE Human-Robot Interaction 2024
- Graduate Student Travel Award from Industrial Engineering, TAMU, for attending HFES 2022 in Atlanta.
- HFES Human AI Robot Teaming (HART) Video Contest Winner 2022
- Abbott Emerging Scientist Award Travel Grant for attending the Neuroergonomics Conference 2022
- Awarded the prestigious Indian National Academy of Engineering Innovative Student Projects Award 2020
- Halliburton Engineering Global Programs TAMU (covered 2019 summer stay at TAMU, USA)
- Awarded the Institute Merit-cum-Means scholarship by IIT Tirupati for the years 2016-2019
- Secured **All India Rank 365** in National Entrance Screening Test 2016

RELEVANT COURSES

Human Factors: Cognitive Neuroscience, Cognitive Systems, Mind-Motor-Machine Interaction, Biomechanics, Human Operators in Complex Systems

Mathematics and CS: Interactive Data Analytics, Machine Learning, Artificial Intelligence, Statistics, Machine Learning for Image Processing, Differential Equations, Linear Algebra, Real Analysis and Calculus, Computational Engineering

SKILLS

- **Languages:** Python, R, MATLAB, C++, Bash, LaTeX,
- **Tools:** Git, PyTorch, TensorFlow, ROS, Gazebo, PyBullet, Unity3D, SolidWorks, RViz
- **Platforms:** Linux, macOS, Windows, Raspberry Pi OS, BeagleBone, Arduino
- **Visualization:** Matplotlib, Inkscape
- **Wearable Sensors:** EEG, EMG, fNIRS, ECG, Eye-tracking, Electrodermal activity
- **Methods:** Ground-up design of research experiments involving human subjects. Neural, physiological, and behavioral data collection, analysis, and interpretation. Mixed-methods research.

TEACHING

BME/ISE 564: Occupational Ergonomics and Biomechanics *Spring 2024*
Graduate Teaching Assistant University of Wisconsin-Madison
Enrollment: 48. Delivered lectures (2), facilitated in-class activities, graded HW, exams, and projects

ISEN 405: Facilities Design and Material Handling *Fall 2021*
Graduate Teaching Assistant Texas A&M University
Enrollment: 90. Graded weekly assignments and course projects

MENTORING

Aarav Gupta, Undergraduate Researcher, Computer Science, WISC *Jan'24 - present*

Jacqueline Aleman, Undergraduate Researcher, Electrical Engineering, TAMU *May'23 - Jul'23*

Aiden Nyugen, Undergraduate Researcher, Chemical Engineering, TAMU *May'23 - Jul'23*

Patralika Ghosh, Undergraduate Researcher, Computers Science, TAMU *Aug'22 - Jul'23*

Malik Rawashdeh, Undergraduate Researcher, Computer Science, TAMU *Aug'22 - May'23*

Diane Lee, Undergraduate Researcher, Applied Mathematics, TAMU *Aug'22 - May'23*

Thomas Bolf, Undergraduate Researcher, Applied Mathematics, TAMU *Aug'22 - May'23*

Carlos Meisel, Undergraduate Researcher, Aerospace Engineering, TAMU *Jan'22 - Dec'22*

Christopher Notzon, Undergraduate Researcher, Industrial & Systems Engineering, TAMU *Jan'22 - Aug'22*

SERVICE AND OUTREACH

VP of Events, HFES at UW-Madison *Aug'24-July'24*

Technical session co-chair at HFES Human-AI-Robot Teaming *Oct'23*

Neuroergonomics: Fundamentals, Applications, and Hands-on Training Workshop at HFES AM 2023 *Oct'23*

Member of Human Factors and Ergonomics Membership Committee *Jan'23 - present*

Student Volunteer at Annual Conference HFES *Oct'22*

Judged student presentations at TAMU Student Research Week *Mar'22 and Mar'23*

Prepared and facilitated outreach activities for Society for Women Engineers STEMfest *Feb'22*

Designed and administered STEM activities to students at Regional Science Center Tirupati *2018-2019*

Reviewing

ACM/IEEE Human-Robot Interaction 2024

Human Factors and Ergonomics Society Annual Meeting 2022, 2023, 2024

PROFESSIONAL MEMBERSHIPS

ACM, Professional Member *Dec'23 - present*

Human Factors and Ergonomics Society (HFES), Student Affiliate Member *Feb'22 - present*

HFES Human-AI-Robot Teaming Technical Group Member *Feb'22 - present*

Indian National Academy of Engineering, Student Member *Dec'20 - present*