TAQIYA EHSAN

Website: taqiyaehsan.github.io
Email: taqiya.ehsan@rutgers.edu
LinkedIn: linkedin/taqiya-ehsan
GitHub: github.com/taqiyaehsan

Education

Rutgers University — New Brunswick, NJ
PhD in Machine Learning — 2023–present
Advisor: Dr. Jorge Ortiz, Dept. of Electrical & Computer Engineering
Research Interests: Multimodal Learning, Causal Reasoning, Computer Vision, Smart Spaces

Rutgers University — New Brunswick, NJ
M.S. in Electrical & Computer Engineering (ML track), GPA: 4.0/4.0 — 2023–2025
Certifications: Graduate Certificate in Socially Cognizant Robotics

Honors College, Rutgers University — New Brunswick, NJ
B.S. in Electrical & Computer Engineering, GPA: 4.0/4.0 — 2019–2023
Senior Capstone: *Data Insights Application for Obesity* (Advisor: Dr. Sasan Haghani)

Projects

Machine Causation
NIH BRAIN Initiative — May 2024 –present

- Developing an end-to-end causal discovery pipeline combining statistical methods (PC algorithm, SAM) with LLM-based reasoning to identify causal relationships through hypothesis generation and iterative validation.
- Designing an intervention-based framework that systematically tests causal hypotheses through controlled experiments, optimizing edge validation strategies to efficiently discover ground truth causal structures in complex systems.

BBQS-CAMERA
NIH BRAIN Initiative — January 2024 –present

- Developing a hardware/software framework of multimodal models for inference of anxiety state and memory efficiency from behavioral biomarkers.
- Studying the human brain–behavior relationship based on physiological indicators, neural and behavioral signals, environmental indicators, and Ecological Momentary Assessments (EMAs).

Profiling Communication Bottlenecks in Distributed LLaMA Training
Distributed Deep Learning (ECE, Rutgers University) — Fall 2025

- Characterized TP/CP/PP/DP configurations and pipeline P2P communication patterns for LLaMA-8B training on NERSC Perlmutter across 9 parallelism strategies using 16 GPUs.
- Developed custom NCCL monitoring infrastructure for Megatron-LM using probabilistic sampling and async CUDA events to profile inter-stage bandwidth and latency with <0.5% overhead.
- Demonstrated that balanced TP=4/PP=4 configurations achieved 30 TFLOP/s/GPU throughput (2.6× faster than pure pipeline parallelism) by leveraging intra-node NVLink while minimizing pipeline bubbles.

Enhanced Visual Awareness for Socially Cognizant Robot
SOCRATES (NSF-NRT) — September 2024 –December 2024

- Developed a real-time multi-object tracking system integrating YOLOv8 detection, OC-SORT tracking and Kalman filters, implementing appearance-based re-identification for occlusion and misdetections.

– Integrated enhanced visual awareness system into campus guide robot via ROS2 nodes for synchronized RGB-D camera processing, with modular architecture for tracking and robot control.

AI Agents for Smart Streetscapes

NSF Center for Smart Streetscapes (CS3) September 2023 –December 2023

– Developing a naïve pipeline to infer accelerometer readings from video footage of people on a crosswalk.

– Assisting data collection and development of a cross-modal inference model for visual and IMU data.

Data Insights Application for Obesity

Senior Capstone Project January - May 2023

– Collaborated with Data Scientists from Novo Nordisk to develop an iOS application to interface a machine learning model based on the LightGBM algorithm

– Conducted in-depth research on user experience for pharmaceutical representatives negotiating with healthcare payer programs.

– Developed a working prototype of an end-user platform that provides a quantitative view into the comorbidity risks of patients and the cost associated with their treatment based on state and national level data.

Visual Prompting for Depth Estimation

MIT CSAIL Summer - Fall 2022

– Studied prompting techniques for computer vision, specifically for depth estimation.

– Researched and curated datasets and pre-trained depth estimation models for implementing visual prompting.

– Developed training code and fine-tuned hyper-parameters (learning rate, prompt size, loss function, optimizer, evaluation metrics) for training a visual prompt on top of a CNN-based pre-trained model.

– Designed experiments to train the most optimal visual prompt that outperforms state-of-the-art in depth estimation.

– Adapted prompting to a Vision Transformer model.

– Trained and tested a visual prompt on out of distribution datasets to show improvement in evaluation metrics.

Domestic Audio Classifier

Rutgers CyberPhysical Intelligence Lab Fall 2021

– Researched potential datasets for the acoustic scene classifier and testing out different feature extraction techniques for building the most efficient audio classifier.

– Designed an effective pipeline to fetch, process, and extract features from audio clips of daily household activities like cooking, washing, exercising, etc.

Analyzing Social Distancing Based on Sensory Inputs

Rutgers WINLAB Summer 2021

– Designed multi-step preprocessing pipeline to optimize the results from the final distance estimation algorithm.

– Preprocessed a dataset consisting of over 300 million images from Nexar to optimize performance through a Distance Estimation algorithm.

– Implemented an object detection CNN model called You Only Look Once (YOLO) to filter out images with people and then used NumPy norm and geometric mean to develop an algorithm that filtered out blurry images which did not meet a designated threshold average-per-pixel brightness.

Research & Work Experience

Rutgers Sensing & Reasoning Lab Piscataway, NJ

Graduate Research Assistant Current

– Developing a causal discovery pipeline with LLM-based reasoning and intervention testing for complex systems [Projects 1]

– Leading research project on predicting anxiety from behavioral biomarkers [Projects 2]

Canfield Scientific, Inc. Parsippany, NJ
Computer Science Intern Summer 2025

– Researched state-of-the-art computer vision and machine learning methods for skin texture and pore detection.
– Designed and implemented a new algorithmic pipeline, improving detection accuracy and repeatability for VISIA® and NEXA® imaging systems.
– Optimized the pipeline for efficiency and deployment readiness in clinical applications.
– Supported the Clinical R&D team with patent documentation, contributing to the protection of novel imaging technologies.

Massachusetts Institute of Technology Cambridge, MA
Summer Research Intern at MIT CSAIL Summer 2022

– Led and developed an independent research project in collaboration with a PhD student, under the direct supervision of MIT Faculty
– Attended weekly Professional Development workshops and Research Seminars
– Participated in coffee chats with MIT Faculty to discuss research and graduate school
– Actively participated in journal club meetings for discussions on various social issues
– Completed weekly intern reports and other deliverables (research proposal, abstract, poster, bio-sketch, statement of objectives)

Rutgers University New Brunswick, NJ
Undergraduate Research Assistant at CyberPhysical Intelligence Lab Fall 2021

– Collaborated with another PhD student in building a model for training ambient sensing programs based on sensory inputs and activity patterns.
– Researching potential datasets for the acoustic scene classifier and testing out different feature extraction techniques for building the most efficient audio classifier.

Rutgers University New Brunswick, NJ
Summer Research Intern at WINLAB Summer 2021

– Collaborated with 5 interns to detect if social distancing was being followed by people in New York City based on dashboard and traffic camera image data.
– Processed and maintained image directories and Python scripts on a remote server and designing and updating the project website to establish a timeline, record of progress, and future goals

Publications and Posters

[1] **T. Ehsan**, S. Xia, and J. Ortiz, "PolicyGRID: Causal discovery for adaptive policy optimization in embodied agents (student abstract)", in *Proceedings of the AAAI Conference on Artificial Intelligence*, vol. 40, 2026, to appear.

[2] **T. Ehsan**, S. Xia, and J. Ortiz, *Grid: Graph-based reasoning for intervention and discovery in built environments*, 2025. arXiv: 2509.16397 [cs.LG]. [Online]. Available: https://arxiv.org/abs/2509.16397.

[3] **T. Ehsan**, S. Xia, and J. Ortiz, "PolicyGRID: Acting to understand, understanding to act", in *NeurIPS 2025 Workshop on Embodied World Models for Decision Making*, 2025. [Online]. Available: https://openreview.net/forum?id=SqaOyB89rE.

[4] N. S. Pargoo, M. Ghasemi, S. Xia, M. K. Turkcan, **T. Ehsan**, C. Zang, Y. Sun, J. Ghaderi, G. Zussman, Z. Kostic, and J. Ortiz, "Urban sensing for human-centered systems: A modular edge framework for real-time interaction", in Proc. 3rd Int. Workshop on Human-Centered Sensing, Modeling, and Intelligent Systems (HumanSys), 2025., 2025. [Online]. Available: https://par.nsf.gov/biblio/10582246.

[5] N. S. Pargoo, M. Ghasemi, S. Xia, M. K. Turkcan, **T. Ehsan**, C. Zang, Y. Sun, J. Ghaderi, G. Zussman, Z. Kostic, and J. Ortiz, "The streetscape application services stack (sass): Towards a distributed sensing architecture for urban applications", *arXiv preprint arXiv:2411.19714*, 2024. [Online]. Available: https://arxiv.org/pdf/2411.19714.

[6] Y. Sun, N. S. Pargoo, **T. Ehsan**, Z. Zhang, and J. Ortiz, "Vchar: Variance-driven complex human activity recognition framework with generative representation", *arXiv preprint arXiv:2407.03291*, 2024. [Online]. Available: https://arxiv.org/abs/2407.03291.

[7] **T. Ehsan**, H. Senthilkumar, A. Uddin, S. Bansal, J. Canevari, S. Motlani, and S. Haghani, "Data insights application for obesity", in *Poster Session of 45th Annual International Conference*, IEEE Engineering in Medicine & Biology Society, 2023. [Online]. Available: https://embc23-c10000.eorganiser.com.au/data/clients/1/697/submissions/164739/abstract.pdf.

[8] **T. Ehsan**, H. Senthilkumar, A. Uddin, S. Bansal, S. Motlani, J. Canevari, and S. Haghani, "Comorbiviz: A tool for visualizing comorbidity risks and costs associated with obesity", in *International Conference on e-Health and Bioengineering*, Springer, 2023, pp. 536–545. [Online]. Available: https://link.springer.com/chapter/10.1007/978-3-031-62502-2_62.

[9] T. Chowdhury, A. Bhatti, I. Mandel, **T. Ehsan**, W. Ju, and J. Ortiz, "Towards sensing urban-scale covid-19 policy compliance in new york city", in *Proceedings of the 8th ACM International Conference on Systems for Energy-Efficient Buildings, Cities, and Transportation*, ser. BuildSys '21, Coimbra, Portugal: Association for Computing Machinery, 2021, pp. 353–356, ISBN: 9781450391146. [Online]. Available: https://doi.org/10.1145/3486611.3491123.

Teaching

Workshop Facilitator at Rutgers Learning Centers — Fall 2024–Present
Workshops on metacognitive learning strategies, sustaining focus and motivation, effective time management, overcoming procrastination, and effective study practices

Academic Skills Instructor at Rutgers Learning Centers — Fall 2024–Present
Back on Track Program (4-week course supporting students in overcoming academic challenges and re-engaging with coursework)

Undergraduate Teaching Assistant at Rutgers University — Fall 2022–Spring 2023
Data Structures (CS112)

Learning Assistant at Rutgers University — Fall 2020–Spring 2022
Honors College Forum (SAS125)

Scholarships and Awards

- School of Engineering Fellowship — 2025–2026
- ECE Leadership and Service Award — 2024–2025
- Rutgers Eugene V. DuBois Fellowship — 2023–2024
- Matthew Leydt Society Inductee — 2023
- Rutgers James Dickson Clark Scholarship — 2019–2023
- Dean's List — 2019–2023
- Honors College Merit Pin — 2022
- Bangladesh National Merit Scholarship — 2014–2019

Extracurricular Activities

Member, Doctoral Students Advisory Board 2025–Present

I represent doctoral students' interests by providing strategic insights to Rutgers Office of Career Services and Exploration. I closely collaborate with the Senior Assistant Director of Graduate Student Career Pathways on initiatives that promote professional growth and shape supportive policies and programs for doctoral students' career development.

Founding Member and President, ECE Graduate Students Association 2024–Present

I lead the organization in fostering community and professional development among graduate students. I oversee the planning and execution of events and programs that promote academic growth, industry engagement, and peer networking, contributing to an enriching and supportive graduate experience within the department.

Academic Coach, Rutgers Learning Centers 2024–Present

I deliver one-on-one as well as group coaching to students, focusing on skills such as procrastination management, effective studying, and exam preparation. I also work with students to create tailored academic plans and strategies to improve time management, organization, and group project collaboration.

Assistant Residence Life Coordinator, Honors College & Brett Hall 2023–2024

I was responsible for directly supervising 17 Resident Assistants (RAs) and advising the Hall Govt. overseeing approx. 750 residents across 2 buildings. I also acted as the first point of contact for RAs across 2 campuses for crisis management and conflict resolution while on call.

Peer Mentor, Society of Women Engineers 2020–2024

I worked towards facilitating 1:1 mentorship for underclassman female engineers in the SWE Leaders-Learners Program with a view to providing guidance concerning available resources within the Rutgers School of Engineering and means by which SWE could support their undergraduate and professional careers

Resident Assistant, Sojourner Truth Apartments 2021–2023

I was responsible for addressing any issues students may have with other residents and acting as a moderator to solve any related problems, helping residents stay informed about campus resources and activities to encourage student involvement on campus, listening to student concerns and communicating those to administration

Secretary, Society of Women Engineers 2022–2023

I sent out weekly newsletters to club members, tracked member attendance, organized shared documents, coordinated the club Slack channels, and tracked action items during bi-weekly board meetings. I also collaborated with other the Internal VP and President to plan logistics for the Women in Engineering National Conference trip and the Annual Banquet.

First Year Mentor, Honors College Ally 2022–2023

I worked with first-year Honors College students to help guide them through their transition into college and prepare them for success. My primary responsibility was to help first-year students gain insight into navigating the diverse social, extracurricular, and academic areas of college life through team building events, and workshops aimed at fostering curiosity, knowledge, and purpose in them.

E-board Member, Honors College Student Advisory Board 2021–2022

I spearheaded a committee that advocated for the underrepresented majors within the Honors College, focusing on their needs and expectations for a successful college career. As a committee, we spoke with students from said majors 1-on-1 and presented their thoughts, opinions, and struggles to the Honors College Deans, along with ideas on how to serve them better.