Md Farhan Tasnim Oshim

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Research Interest

Research Areas.
Radar perception, computer vision, multi-modal sensing, embedded and ubiquitous systems, signal processing, machine learning, human-centered computing, and mobile health.

Research Goals and Interests.
My research is driven by the vision of building intelligent, context-aware systems that can perceive, interpret, and respond to the physical world through a fusion of radar, vision, and other sensing modalities. I am particularly focused on leveraging radar perception and multi-modal sensing to develop robust and privacy-preserving solutions for healthcare monitoring, human-object interaction, and intelligent environments. By combining machine learning with embedded and ubiquitous systems, I aim to push the boundaries of real-time, resource-efficient sensing technologies deployable on the edge.

My work also emphasizes the development of interpretable and resilient models that function reliably across diverse conditions and user populations. In the long term, I aim to bridge the gap between advanced signal processing and human-centered computing, enabling adaptive systems that promote well-being, autonomy, and inclusivity in everyday life.

Education

University of Massachusetts Amherst — MA, USA
PhD in Computer Science — *Dec 2025 (Expected)*
- Advisor: Prof. Tauhidur Rahman
- Thesis: High-Fidelity Motion Characterization via Radar Vibrometry

MS in Computer Science — *May 2024*
- Advisor: Prof. Tauhidur Rahman
- Thesis: Radar based Vital Sign Monitoring and Human-Object Interaction.

RWTH Aachen University — NW, Germany
MS in Electrical and Computer Engineering — *Oct. 2015*
- Advisor: Prof. Peter Vary
- Thesis: Optimized Signal Constellations for Hierarchical Modulations with Iterative Decoding.

Islamic University of Technology — Dhaka, Bangladesh
BS in Electrical and Electronic Engineering — *Oct. 2011*
- Advisor: Prof. Mohammad Rakibul Islam
- Thesis: Efficient Design of Decoding Algorithms using Low Density Parity Check Codes for Wireless Networks.
- CGPA: 3.96/4.00 (Top 5% of the class)

Honors and Awards

Scholarship & Fellowships
- ***Graduate Teaching Fellowship*** by CICS, UMass Amherst — AY 2023 – 2024
- *Dr. Dave Lomet Graduate Scholarship for Systems Research* at CICS, UMass Amherst ($5,000) — 2025
- *Krithi Ramamritham Computer Science Scholarship* at CICS, UMass Amherst ($1,600) — 2022
- *Organization of Islamic Cooperation (OIC) Scholarship* for Undergraduate studies ($7,500) — 2011

Travel Grants
- *CICS UMass Amherst Travel Grant* for attending ICRA 2025 ($800) — 2025
- *IEEE Robotics & Automation Society Travel Grant* for attending IROS 2024 ($1,000) — 2024
- *CICS UMass Amherst Travel Grant* for attending IROS 2024 ($800) — 2024

Research Experience

Research Assistant, MOSAIC Lab Sep 2018 – Present
University of Massachusetts Amherst *Amherst, MA*

- Developed contactless sensing systems for health monitoring, integrating radar, vision, and embedded platforms for real-time respiratory and cardiac signal estimation in clinical and home environments.
- Advanced radar perception research through neural radiance field modeling, motion magnification, and generative imaging for tasks including indoor localization, human-object interaction, and activity recognition.
- Integrated deep learning, signal processing, and embedded systems to develop deployable solutions for mobile health and ubiquitous sensing, with findings published in top-tier HCI and robotics venues.

Research Intern, Halıcıoğlu Data Science Institute Jul 2024 – Sep 2024
University of California San Diego *San Diego, CA*

- Designed *AntiSensing*, a gradient based adversarial perturbation algorithm to prevent unauthorized radar-based vital sign and gesture sensing, improving robustness of privacy-preserving wearable devices.
- Led experimental validation and digital-to-physical domain translation of spoofing attacks; results published at IEEE ICRA 2025.

Research Intern, Qualcomm Jun 2023 – Aug 2023
AI Research *San Diego, CA*

- Engineered an RNN-based real-time gesture recognition system using FMCW radar data, achieving 97% classification accuracy.
- Benchmarked against MLP, GMM, and LSTM architectures, delivering an 18% accuracy improvement and reducing inference latency by 20%.
- Optimized radar feature extraction pipeline for edge deployment using PyTorch and ONNX.

Research Intern, Tesla Sep 2022 – Jan 2023
Passive Entry Systems Research *Palo Alto, CA*

- Built a vision-based autonomous robot for Passive Entry system testing, reducing manual effort by 75% (40→10 hrs) and cutting operational costs.
- Developed a real-time embedded vision system on Raspberry Pi using OpenCV and CNNs for object detection, localization, and OCR.
- Engineered full-stack software in Python for sensor fusion, hardware control, and data logging, enabling robust edge deployment.
- Benchmarked RADAR modules for in-cabin occupancy detection, delivering a data-backed hardware recommendation.

Research Intern, Qualcomm Jun 2022 – Sep 2022
Modem Systems Research *San Diego, CA*

- Developed a contactless vital sign monitoring system using FMCW radar with $\leq$0.5 bpm MAE (breathing rate) and $\leq$1.5 bpm MAE (heart rate).
- Applied digital filters, ICA, PCA, and MUSIC algorithm to extract physiological signals with high precision in real-time applications.

Research Intern, Bosch Jan 2015 – Jul 2015
Communication Systems *Stuttgart, Germany*

- Implemented Software Defined Radio (SDR) for a Continuous Phase Frequency Shift keying (CP-FSK) based communication system in GNU Radio for power line communication within EV car-battery.
- Designed, evaluated, and tested single and multicarrier modulation schemes with synchronization algorithms through real-channel measurements using USRPs (Universal Software Radio Peripherals) .

Research Intern, Fraunhofer FKIE Jan 2014 – Jul 2014
Communication Systems *Bonn, Germany*

- Developed a Bit-Interleaved Coded Modulation with Iterative Decoding (BICM-ID) system with adaptive complexity based on channel conditions and receiver capabilities.
- Supported development of next-gen tactical wideband networking waveforms as part of the Software Defined Radio (SDR) systems team.

Publications

1. **Md Farhan Tasnim Oshim**, Huaishu Peng, Tauhidur Rahman, "MetaScatter: Computational Design of 3D Printed Meta-Reflector Structures Supporting Radar-Based Identification" (Under Review).
2. **Md Farhan Tasnim Oshim**, Nigel Doering, Bashima Islam, Tsui-Wei Weng, Tauhidur Rahman, "Anti-Sensing: Defense against Unauthorized Radar-based Human Vital Sign Sensing with Physically Realizable Wearable Oscillators", *2025 IEEE International Conference on Robotics and Automation (ICRA 2025).*
3. **Md Farhan Tasnim Oshim**, Albert Reed, Suren Jayasuriya, Tauhidur Rahman, "NeRF-enabled Analysis-Through-Synthesis for ISAR Imaging of Small Everyday Objects with Sparse and Noisy UWB Radar Data", *2024 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2024), pp. 4586–4593.* [Video]
4. Charlotte Goldfine, **Md Farhan Tasnim Oshim**, Brittany Chapman, Deepak Ganesan, Tauhidur Rahman, Stephanie Carreiro, "Contactless Monitoring System Versus Gold Standard for Respiratory Rate Monitoring in Emergency Department Patients: Pilot Comparison Study", *2024 JMIR Formative Research, Feb 16:8:e44717.*
5. **Md Farhan Tasnim Oshim**, Toral Surti, Charlotte Goldfine, Stephanie Carreiro, Deepak Ganesan, Suren Jayasuriya, Tauhidur Rahman, "Eulerian Phase-based Motion Magnification for High-Fidelity Vital Sign Estimation with Radar in Clinical Settings", *2022 IEEE Sensors, pp. 1-4.* [Video]
6. **Md Farhan Tasnim Oshim**, Julian Killingback, Dave Follette, Huaishu Peng, Tauhidur Rahman, "MechanoBeat: Monitoring Interactions with Everyday Objects using 3D Printed Harmonic Oscillators and Ultra-Wideband Radar", *Proceedings of the 33rd Annual ACM Symposium on User Interface Software and Technology (UIST 2020), pp. 430–444.* [Video] [Media Coverage]
7. **Md Farhan Tasnim Oshim***, Charlotte Goldfine*, Stephanie Carreiro, Brittany Chapman, Deepak Ganesan, Tauhidur Rahman, "Respiratory Rate Monitoring in Clinical Environments with a Contactless Ultra-Wideband Impulse Radar-based Sensor System", *Proceedings of the Annual Hawaii International Conference on System Sciences, (HICSS 2020), pp. 3366–3375.* (*Equal Contribution)
8. Matthias Tschauner, **Md Farhan Tasnim Oshim**, Marc Adrat, Markus Antweiler, Benedikt Eschbach, Peter Vary, "Design and analysis of hierarchically modulated BICM-ID receivers with low inter-layer interferences", *2017 Springer - Journal of Signal Processing Systems, 89, pp. 145–161.*
9. Matthias Tschauner, **Md Farhan Tasnim Oshim**, Marc Adrat, Markus Antweiler, Benedikt Eschbach, Peter Vary, "On the Design of Hierarchically Modulated BICM-ID Receivers with Low Inter Layer Interferences", *2015 Wireless Innovation Forum Conference on Wireless Communications Technologies and Software Defined Radio (WInnComm Europe 2015), pp. 38-47.*
10. Marc Adrat, **Md Farhan Tasnim Oshim**, Matthias Tschauner, Markus Antweiler, Benedikt Eschbach, Peter Vary, "On hierarchically modulated BICM-ID for receivers with different combinations of Code Rate and Modulation Order", *2015 Wireless Innovation Forum Conference on Wireless Communications Technologies and Software Defined Radio (SDR15-WInnComm) pp. 129–134.*
11. Mohammad Rakibul Islam, Khandaker Sultan Mahmood, **Md Farhan Tasnim Oshim**, and Md. Moshiur Rahman Farazi, "Intensity reflection coefficient based Min-Sum decoding for Low Density Parity Check Codes", *2012 Frequenz - Journal of RF-Engineering and Telecommunications, 66(3–4), pp. 145–161.*
12. Mohammad Rakibul Islam, Khandaker Sultan Mahmood, Md. Moshiur Rahman Farazi, **Md Farhan Tasnim Oshim**, Mohd. Azfar Nazim, Iftekhar Hasan, "Difference to sum ratio factor based min-sum decoding for low density parity check codes", *2012 Computing, Communications and Applications Conference (ComComAp) pp. 222–226.*

Patents

Neural radiance field-enhanced inverse synthetic aperture radar 2025

- Filed *US utility patent* integrating Neural Radiance Fields (NeRF) with inverse synthetic aperture radar (ISAR) imaging to enhance radar-based perception and reconstruction.

Teaching Experience

Instructor of Record, CICS, UMass Amherst Fall'25, Spring'24, Fall'23, Spring'23

CICS 256: Make - A Hands-on Introduction to Physical Computing (4 credits)

- Orchestrated timely design, procurement, and distribution of custom makerboards, sensors, actuators, and hardware kits for over 120 students across three semesters.
- Revamped instructional materials, including lecture slides, lab modules, and embedded systems assignments to improve clarity and learning outcomes.
- Directed and advised 50+ student teams on Arduino-based prototyping, electronics integration, robotics, and sensor-driven hardware projects.

Teaching Assistant, CICS, UMass Amherst Spring'22, Spring'20

CS 311: Introduction to Algorithms (4 credits)

- Collaborated with instructors to refine lecture content and assessment materials for core undergraduate algorithms curriculum.
- Facilitated weekly discussion sections and office hours, supporting the academic progress of over 150 students per semester.
- Constructed and evaluated examination questions and homework assignments; ensured academic integrity and fair grading practices.

Teaching Faculty, BRAC University May 2016 – Aug 2018

Dept. of Electrical and Electronic Engineering *Dhaka, Bangladesh*

- Served as Instructor of Record for eight undergraduate theory and laboratory courses, including Signals and Systems, Digital Signal Processing (DSP), Communication Engineering, Circuits I & II, Electronic Devices I & II, and Digital Communication.
- Supervised and mentored multiple undergraduate thesis projects, guiding students in research methodology, experimental design, and technical writing.
- Redesigned course syllabi and laboratory manuals to meet ABET and BAETE accreditation requirements and reflect modern engineering practices.
- Supported institutional quality assurance by contributing to curriculum review and accreditation committees.

Teaching Faculty, Ahsanullah University of Science and Technology Apr 2012 – Aug 2012

Dept. of Electrical and Electronic Engineering *Dhaka, Bangladesh*

- Conducted laboratory instruction for Numerical Methods, Power Electronics, and Microwave Engineering, engaging over 190 students.
- Devised annual academic workload plans and participated in administrative committees overseeing exams, events, and departmental planning.

Pedagogical Training

Graduate Teaching Fellowship Training Summer 2023

College of Information and Computer Sciences, UMass Amherst

- Completed an intensive one-week training focused on learner-centered instruction, inclusive pedagogy, and effective classroom management strategies.
- Engaged in workshops on fostering student engagement, assessment techniques, and leveraging active learning methods in computing education.

COMPSCI 879: Teaching Assistants as Tomorrow's Faculty Fall 2021

College of Information and Computer Sciences, UMass Amherst

- Semester-long pedagogical course designed to prepare graduate TAs for future faculty roles through evidence-based teaching practices.
- Designed a Reusable Learning Object (RLO), an interactive hands-on tutorial for ESP32 makerboard setup across multiple OS platforms, currently used in CICS 256.
- Conducted structured peer observation and received feedback via formal class observation, enhancing instructional delivery and classroom presence.

Certificate in Higher Education Teaching (CHET) Summer 2017

Professional Development Center, BRAC University, Bangladesh

- Completed comprehensive training in course planning, assessment strategies, and Outcome-Based Learning (OBL).
- Received four formal class observations from senior faculty and pedagogical experts, with detailed feedback to improve instructional effectiveness.
- Applied evidence-based pedagogical strategies to promote inclusive learning and enhance student engagement and performance.

Advising & Mentoring Experience

Graduate Student Mentoring 2020 - Present

Manning College of Information and Computer Sciences, UMass Amherst

- **Nigel Doering.** Working on adversarial ML for *Anti-Sensing*, a defense against radar-based vital sign monitoring using wearable oscillators (2023-Present).
- **Samih Khobji.** Worked on FMCW radar algorithms for real-time contactless *Vital-sign estimation* (2022).
- **Julian Killingback.** Worked on early prototyping of *MechanoBeat*, a UWB radar system for monitoring human-object interactions (2020–2021).

Undergraduate Thesis Supervision 2017 – 2018

Department of Electrical and Electronic Engineering, BRAC University

- **Jahidur Rahman Dipu.** Completed thesis on Power Line Communication Channel Modeling: Investigation of Multipath PLC Channel Model for Households.
- **Sandipan Paul Arnab.** Completed thesis on Implementation of Dynamic Vehicular Rerouting, Vehicular Safety and Pollution Reduction Techniques Using VANET.
- **Nasif Ahmed.** Completed thesis on Over and Under Voltage Protection for Three-Phase System Using GSM Module.

Service Experience

Graduate Representative AY 2021 – 2022

Manning College of Information and Computer Sciences, UMass Amherst

- Acted as a liaison between graduate students and faculty to represent student concerns in departmental meetings.
- Represented the student body in faculty hiring by attending candidate talks, participating in one-on-one interviews, and casting votes in hiring decisions.
- Organized elections for CICS social committee, new students committee, graduate student senators, & GEO stewards.

Hackathon Judge

UMass Amherst

- HackUMass Hackathon Nov 2024
- Hack(H)er-413 Hackathon Feb 2024

Student Volunteer

- Student Volunteer at CICS Candidate Friday, UMass Amherst 2023
- Student Volunteer at 34th ACM Symposium on User Interface Software and Technology (UIST'21) 2021

Reviewer

- ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies (IMWUT) 2019 & 2024
- International Conference on Computer and Information Technology (ICCIT) 2017

Technical Skills

Languages : Python, C++, MATLAB, R, SQL
Libraries & Frameworks : OpenCV, PyTorch, TensorFlow, NumPy, pandas, Matplotlib, scikit-learn
Machine Learning : CNNs, RNNs, Transformers, Object Detection, Image Segmentation, Generative Imaging
3D Vision & Perception : Neural Radiance Fields (NeRF), Gaussian Splatting, 3D Reconstruction, Radar Imaging
Hardware Platforms : UWB Radar, FMCW Radar, Doppler Radar, Arduino (ESP32), Raspberry Pi, USRP
Tools & Technologies : CUDA, Git, Docker, Apache Spark, Hadoop, Jupyter, VS Code, Simulink, CST Studio.

References

Tauhidur Rahman
Assistant Professor, Halıcıoğlu Data Science Institute, University of California San Diego
Adjunct Assistant Professor, College of Information and Computer Sciences, University of Massachusetts Amherst

Rui Wang
Associate Professor, College of Information and Computer Sciences, University of Massachusetts Amherst

Stefan Krastanov
Assistant Professor, College of Information and Computer Sciences, University of Massachusetts Amherst