Asiful Arefeen

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Profile Overview

Biomedical Informatics and Data Science PhD Candidate at Arizona State University developing AI-enabled biomedical engineering methods for intelligent health monitoring, personalized medicine, and clinical decision support. My research integrates explainable and trustworthy AI, counterfactual reasoning, multimodal deep learning, biomedical signal processing, wearable sensing, longitudinal modeling, and digital twins to transform heterogeneous physiological and clinical data into interpretable and actionable health insights. Experienced in interdisciplinary and translational research with clinicians, biomedical researchers, engineers, and data scientists. Published 20+ peer-reviewed papers in IEEE JBHI, ACM HEALTH, JAMIA Open, EMBC, BHI, BSN, and CHASE. Recipient of the NIH T32 AI in Precision Nutrition Fellowship and PI/lead student investigator on a $55,000 health research award. My long-term research vision is to develop trustworthy and human-centered intelligent biomedical systems that integrate multimodal sensing, AI, and computational modeling for personalized disease monitoring, prediction, and intervention.

– Explainable, trustworthy & human-centered biomedical AI.
– Multimodal sensing & biomedical signal processing.
– Digital twins & personalized health interventions.
– Longitudinal health modeling & predictive analytics.
– Intelligent clinical decision-support systems.

Education

Arizona State University Aug 2021 - Dec 2026

PhD in Biomedical Informatics & Data Science *Aug 2021 - Dec 2026*
MS in Computer Science *Jan 2024 - Dec 2025*
MS in Biomedical Informatics *Aug 2021 - May 2023*

- **Advisor:** Dr. Hassan Ghasemzadeh – website: ghasemzadeh.com
- **PhD Thesis:** Toward AI-Driven Realistic Interventions for Improved Health Outcomes
- **MS Thesis:** Label-Efficient Artificial Intelligence in Digital Health
- **Notable Courses:** Machine Learning, Neural Network Design, Embedded Machine Learning, Data Mining, Linear Algebra, Clinical & Health Informatics, Foundations of Biomedical Informatics Methods

Bangladesh University of Engineering & Technology Feb 2015 - Apr 2019

BS in Electrical & Electronic Engineering

Research Interests

- **Explainable and Trustworthy AI for Biomedical Engineering:** Developing interpretable and robust machine learning methods to characterize model decisions, identify clinically meaningful biomarkers and phenotypes, and improve the transparency, reliability, and clinical utility of AI-enabled biomedical systems.
- **Human-Centered AI and Clinical Decision Support:** Designing intelligent biomedical systems that combine predictive modeling, explainable AI, and actionable recommendations to support effective collaboration among patients, clinicians, and AI systems.
- **Counterfactual Reasoning and Actionable AI:** Developing realistic and patient-centered counterfactual methods that move beyond prediction and explanation to identify actionable physiological and behavioral changes associated with improved health outcomes.
- **Multimodal Biomedical AI and Physiological Sensing:** Developing deep learning methods that integrate heterogeneous physiological signals, wearable sensors, clinical data, behavioral information, and other biomedical modalities for disease prediction, health monitoring, and personalized medicine.

- **Biomedical Signal Processing and Intelligent Health Monitoring:** Developing signal processing and machine learning methods for EEG, ECG, CGM, IMU, and wearable sensor data to characterize physiological states, detect health events, and enable continuous and remote health monitoring.
- **Digital Twins and Personalized Medicine:** Developing patient-specific computational models that integrate longitudinal physiological and clinical data to forecast health trajectories, simulate alternative interventions, and support personalized treatment and behavioral decision-making.
- **Longitudinal Modeling and Predictive Health Analytics:** Developing computational methods to model temporal health trajectories, disease progression, treatment response, and evolving physiological states using large-scale longitudinal and multimodal biomedical data.

Technical Skills

Programming & Computing: Python, R, SQL, MATLAB, C/C++, HPC, Slurm

Machine Learning & Deep Learning: PyTorch, TensorFlow, Scikit-learn, Deep Learning, Neural Networks, Self-Supervised Learning, Representation Learning, Active Learning, Predictive Modeling

Explainable & Counterfactual AI: Explainable AI (XAI), Counterfactual Learning, Actionable Explanations, SHAP, LIME, InterpretML, OmniXAI, GradCAM

Multimodal & Longitudinal Modeling: Multimodal Learning, Longitudinal Data Analysis, Time-Series Modeling, Statistical Modeling, Signal Processing, Feature Engineering

Biomedical & Health Data: EEG, ECG, CGM, IMU, Wearable Sensor Data, Physiological Signals, Clinical Data, EHR Data, Longitudinal Patient Data

Data Analysis & Visualization: Pandas, NumPy, SciPy, OpenCV, Seaborn, Plotly, Power BI, Jupyter

Generative AI & Foundation Models: Transformers, Hugging Face, Foundation Models, LLM Fine-Tuning, RAG, Prompt Engineering, LangChain, LangGraph

Research Computing & Reproducibility: Git/GitHub, AWS, Azure, Google Cloud Platform, Reproducible Research Workflows

Experience

Idaho National Laboratory, Idaho | *AI, Computer Vision Intern* May 2026 – Aug 2026
– Developed computational methods for extracting structured relational information and connectivity graphs from large-scale engineering schematics using computer vision, graph-based modeling, and multi-agent AI.

Mayo Clinic (Endocrinology Dept.), Arizona | *Research Affiliate* Oct 2023 – April 2026
– Developed counterfactual and predictive methods for personalized intervention planning using longitudinal CGM and insulin pump data and collaborated with endocrinologists to translate model outputs into clinically meaningful recommendations.

Embedded Machine Intelligence Lab, ASU | *Grad Research Assistant* Aug 2021 – Present
– Conducted quantitative research using longitudinal clinical, epidemiological cohort, wearable sensor, and physiological data, including ECG, CGM, and EEG. Developed statistical, predictive, and counterfactual modeling methods for longitudinal health outcomes and personalized interventions; developed *ExAct*, improving counterfactual validity by at least 10% and proximity by 6.6% over established baselines.

Washington State University | *Grad Teaching & Research Assistant* Aug 2020 – July 2021
– Conducted research on motion-artifact suppression in physiological signals and supported undergraduate instruction in Computer Security, Data Structures (C/C++), and Program Design and Development through laboratory sessions, office hours, assessment development, and grading.

Fellowships, Grants & Awards

Fellowship: 1. NIH T32 Institutional Training Grant for AI in Precision Nutrition (AIPrN) Research (2024-ongoing). 2. ASU Graduate College Completion Fellowship 2026.

Research Grant: Champion of 2024 College of Health Solutions (CHS) Student Heat and Health Research Challenge Award. Awarded $55,000 in research funding.

Best Poster: 1. Best poster award at the 2024 and 2026 ASU College of Health Solutions (CHS) Faculty Research Day. 2. 2nd Runner up Demo-Poster at the 2025 IEEE-EMBS International Conference on Wearable and Implantable Body Sensor Networks (BSN'25), Los Angeles, CA, USA..

Travel Award: NSF Student Travel Award to attend IEEE BHI 2024, BHI 2023, ACM CHASE 2022, ASU GSG Travel Award for EMBC 2025 in Copenhagen, Denmark, 2x ASU CHS Travel Support in 2025 for EMBC 2025 and BSN 2025, IEEE BHI 2025 NSF-EMBS-Google Sponsored Young Professional NextGen Scholar

Entrepreneurship Translational Research: NSF I-Corps Regional Program and NSF I-Corps National Program.

Grant: ASU Graduate College University Grant 2022-23, 2023-24

Assisted Dr. Hassan Ghasemzadeh in securing multiple NSF, NIH and Arizona State University-Mayo Clinic Alliance funded projects.

Teaching Experience

1. **Instructor,** BMI 310: App Development for Population Health, Arizona State university, Spring 2024.
2. **Guest Lecturer,** Wearable Sensing and Machine Learning for Precision Nutrition, BMI 570: BMI Seminar Series, Arizona State university, Spring 2023.

Mentorship Experience

Research Mentor, Arizona State University: One Master's student and one High-School student

1. Aashritha Machiraju (MS, CS, 2024-2025), in thesis formulation and conference publication.
2. Prisha Shroff (Hamilton High School, Chandler, AZ, 2023, current affiliation: undergrad student in Computer Science at Stanford), mentorship led to publishing a research paper on glycemic management using AI (GlucoAssist in IEEE BSN 2023).

Invited Talks

1. Towards Generating User-Centric and Realistic Counterfactuals for Positive Health Outcomes, Truveta, Seattle, WA, July 2025.
2. Towards AI-Driven Behavioral Interventions in Digital Twin Systems for Improved Health Outcomes, Control Systems Engineering Laboratory (CSEL), Tempe, AZ, June 2025.

Workshops

1. AI/ML for Digital Health Interventions in the 2025 Emerging Digital Methods to Enable Precision Health series held at Phoenix Bioscience Core, Arizona State University (November 7th, 2025).

Publications

Peer reviewed Journals

1 **Arefeen, A.**, Khamesian, S., Grando, M. A., Thompson, B., & Ghasemzadeh, H. (in press). GlyTwin: Enhancing digital twin for glucose control in type 1 diabetes using patient-centric counterfactual treatments. IEEE Journal of Biomedical and Health Informatics. Accepted for publication

2 Soumma, S.B., **Arefeen, A.**, Carpenter, S.M., Hingle, M., & Ghasemzadeh, H. (2026). Counterfactual Modeling with Fine-Tuned LLMs for Health Intervention Design and Sensor Data Augmentation. IEEE Open Journal of Engineering in Medicine and Biology (OJEMB). Accepted for publication.

3 Khamesian, S., **Arefeen, A.**, Grando, M. A., Thompson, B. M., & Ghasemzadeh, H. (in press). Glycemic-aware and architecture-agnostic training framework for blood glucose forecasting in type 1 diabetes. BMC Artificial Intelligence.

4 **Arefeen, A.**, Singh, S.J., Razavi, C., Ghasemzadeh, H., & Dev, S. (2025). Assessing the quality of reporting in artificial intelligence/machine learning research for cardiac amyloidosis. JAMIA open, 8 5, ooaf104.

5 Mamun, A., **Arefeen, A.**, Racette, S.B., Sears, D.D., Whisner, C.M., Buman, M.P., & Ghasemzadeh, H. (2025). LLM-Powered Prediction of Hyperglycemia and Discovery of Behavioral Treatment Pathways from Wearables and Diet. *Sensors (Basel, Switzerland)*, 25.

6 **Arefeen, A.**, & Ghasemzadeh, H. (2025). Cost-Effective Multitask Active Learning in Wearable Sensor Systems. *Sensors (Basel, Switzerland)*, 25.

7 **Arefeen, A.**, Akbari, A., Mirzadeh, S., Jafari, R., Shirazi, B., & Ghasemzadeh, H. (2023). Inter-Beat Interval Estimation with Tiramisu Model: A Novel Approach with Reduced Error. *ACM Transactions on Computing for Healthcare*.

8 Mirzadeh, S., **Arefeen, A.**, Ardo, J., Fallahzadeh, R., Minor, B.D., Lee, J., Hildebrand, J.A., Cook, D., Ghasemzadeh, H., & Evangelista, L.S. (2022). Use of machine learning to predict medication adherence in individuals at risk for atherosclerotic cardiovascular disease. *Smart health, 26*.

Peer reviewed Conferences

9 Soumma, S.B., **Arefeen, A.**, Carpenter, S.M., Hingle, M., & Ghasemzadeh, H. (2025). SenseCF: LLM-Prompted Counterfactuals for Intervention and Sensor Data Augmentation. In Proceedings of the *IEEE-EMBS International Conference on Body Sensor Networks (BSN'25)*.

10 Khamesian, S., **Arefeen, A.**, Thompson, B., Grando, M.A., & Ghasemzadeh, H. (2025). AZT1D: A Real-World Dataset for Type 1 Diabetes. In Proceedings of the *IEEE-EMBS International Conference on Body Sensor Networks (BSN'25)*.

11 Machiraju, A., Farahmand, E., Soumma, S.B., **Arefeen, A.**, Johnston, C., & Ghasemzadeh, H. (2025). Time-Aware Cross-Attention for Multi-Modal Sensor-Based Blood Glucose Forecasting. 2025 IEEE 21st International Conference on Body Sensor Networks (BSN), 1-4.

12 **Arefeen, A.**, Fessler, S.N., Mostafavi, S.M., Johnston, C., & Ghasemzadeh, H. (2025). MealMeter: Using Multimodal Sensing and Machine Learning for Automatically Estimating Nutrition Intake. In Proceedings of the *47th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC'25)*.

13 **Arefeen, A.**, & Ghasemzadeh, H. (2025). LEAD: Localized explanations with adversarial decision boundary characterization for interpretable disease prediction. In Proceedings of the *47th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC'25)*.

14 **Arefeen, A.**, Khamesian, S., Grando, M.A., Thompson, B., & Ghasemzadeh, H. (2024). GlyMan: Glycemic Management using Patient-Centric Counterfactuals. *2024 IEEE EMBS International Conference on Biomedical and Health Informatics (BHI)*, 1-5.

15 Shroff, P., **Arefeen, A.**, & Ghasemzadeh, H. (2023). GlucoseAssist: Personalized Blood Glucose Level Predictions and Early Dysglycemia Detection. *2023 IEEE 19th International Conference on Body Sensor Networks (BSN)*, 1-4.

16 **Arefeen, A.**, & Ghasemzadeh, H. (2023). GlySim: Modeling and simulating glycemic response for behavioral lifestyle interventions. *2023 IEEE EMBS International Conference on Biomedical and Health Informatics (BHI)*, 1-5.

17 **Arefeen, A.**, Fessler, S.N., Johnston, C., & Ghasemzadeh, H. (2022). Forewarning Postprandial Hyperglycemia with Interpretations using Machine Learning. *2022 IEEE-EMBS International Conference on Wearable and Implantable Body Sensor Networks (BSN)*, 1-4.

18 **Arefeen, A.**, Jaribi, N., Mortazavi, B.J., & Ghasemzadeh, H. (2022). Computational Framework for Sequential Diet Recommendation: Integrating Linear Optimization and Clinical Domain Knowledge. *2022 IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE)*, 91-98.

19 Alinia, P., Parvaneh, S., Mirzadeh, S., **Arefeen, A.**, & Ghasemzadeh, H. (2022). Boosting Lying Posture Classification with Transfer Learning. *44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC'22)*, 109-114.

20 **Arefeen, A.**, Shehreen, S., Islam, A.K., Rahman, M., & Rahman, H. (2019). Measuring and Assessing the Effects of Harmonics on the Grid of Bangladesh Power System During EV Charging. *2019 IEEE International Conference on Power, Electrical, and Electronics and Industrial Applications (PEEIACON)*, 5-9.

Preprints

21 **Arefeen, A.**, Soumma, S.B., & Ghasemzadeh, H. (2025). RealAC: A Domain-Agnostic Framework for Realistic and Actionable Counterfactual Explanations. *ArXiv, arXiv:2508.10455*.

22 **Arefeen, A.**, & Ghasemzadeh, H. (2023). Designing User-Centric Behavioral Interventions to Prevent Dysglycemia with Novel Counterfactual Explanations. *ArXiv, abs/2310.01684*.

Conference Presentations

Oral

1 LEAD: Localized Explanations with Adversarial Decision Boundary Characterization for Interpretable Disease Prediction at the 47th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC'25), Copenhagen, Denmark.

2 GlySim: Modeling and Simulating Glycemic Response for Behavioral Lifestyle Interventions at the 2023 IEEE EMBS International Conference on Biomedical and Health Informatics (BHI'23), Pittsburgh, PA, USA.

3 Computational Framework for Sequential Diet Recommendation: Integrating Linear Optimization and Clinical Domain Knowledge at the 2022 IEEE/ACM Conference on Connected Health: Applications, Systems and Engineering Technologies (CHASE'22), Washington, DC, USA.

Poster

4 MealMeter: Using Multimodal Sensing and Machine Learning for Automatically Estimating Nutrition Intake at the 47th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC'25), Copenhagen, Denmark.

5 GlyMan: Glycemic Management using Patient-Centric Counterfactuals at the 2024 IEEE EMBS International Conference on Biomedical and Health Informatics (BHI'24), Houston, TX, USA.

6 GlucoGuide: Retrospective Counterfactual Decision Support to Address Stakeholder Needs at the 2025 IEEE EMBS International Conference on Biomedical and Health Informatics (BHI'25), Atlanta, GA, USA.

Demo

7 GlucoGuide: A Retrospective Counterfactual Decision Support to Address Stakeholder Needs at the 2025 IEEE-EMBS International Conference on Wearable and Implantable Body Sensor Networks (BSN'25), Los Angeles, CA, USA.

Professional Services

- Journal reviewer for ACM Transactions on Computing for Healthcare (HEALTH)
- Journal reviewer for PLOS Digital Health
- Journal reviewer for IEEE Journal Of Biomedical & Health Informatics (JBHI)
- Journal reviewer for ACM Transactions on Intelligent Systems and Technology (TIST)
- Journal reviewer for Nature Portfoloio Scientific Reports
- Journal reviewer for Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies
- Reviewer for International Conferences of the IEEE Engineering in Medicine and Biology Society (EMBC 2025)
- Reviewer for International Conferences of the IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI 2023, 2024, 2025)
- Reviewer for International Conferences of the IEEE International Conference on Pervasive Computing and Communications (PerCom 2023)
- Reviewer for International World Wide Web Conference (WWW 2026)

Projects

MetaPlate: Counterfactual-Guided RAG-LLM for Food Recommendation & Anomaly Prevention | *GitHub*

- MetaPlate is a personalized nutrition recommendation system that forecasts postprandial blood glucose responses from glucose, wearable sensors, and logged meal data. It integrates counterfactual modeling with LLM to translate metabolic optimization into food-level suggestions that minimizes glucose spikes while preserving user preferences.

GlyTwin: Digital Twin for Glucose Control in Type 1 Diabetes Through Behavior Change | *GitHub*

- We enhance the capabilities of traditional digital twin paradigm with counterfactual interventions/explanations. We are working on getting it validated with physicians and users.

FoodOCR: Information Extraction from Handwritten Food Logs | *GitHub*

- In this project, we had several participants who logged their meals on paper. Later, we used Google Cloud Vision OCR to extract the handwritten food logs. As the extractions were not 100% accurate, the extracted texts were fixed using BERT through prompt engineering.

GlySynth: Autoregressive Framework for Synthetic Glycemic Response Generation | *GitHub*

- A conditional autoregressive scheme for generating synthetic physiological signals (preferably glycemic response) given contextual information. As validated by downstream classification task, GlySynth produces better signals compared to GANs under data scarcity.

MealMeter: Meal Macronutrient Estimation with Multimodal Sensing and Machine Learning | *GitHub*

- MealMeter is a lightweight Machine Learning framework for nutrient intake tracking, trained and validated on controlled data collected from 12 healthy individuals, improves carb and fat estimation errors by at least 10.8% and 21.9%, respectively, compared to the baselines (multitask-learning and self-supervised learning).

HMAL: Effective Data Labeling with Human-Model Partnership for Multi-task Active Learning

- HMAL is an active learning framework that creates a human-model partnership for unlabeled data annotation in multi-task active learning to reduce labeling burden on end users of digital health. HMAL improves model performance in multiclass classification with fewer label queries/labeled datapoints.