SOHAN SALAHUDDIN MUGDHO

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EDUCATION

Doctor of Philosophy, Ph.D., Computer Engineering **2023 - Present**
Iowa State University of Science and Technology, Ames, IA

Bachelor of Science, B.Sc., Electrical and Electronic Engineering **2017 - 2022**
Bangladesh University of Engineering and Technology, Dhaka, Bangladesh

SKILLS

Python, PyTorch, MATLAB, TensorFlow, Hugging Face, C/C++, VHDL, Verilog, Xilinx Vivado, Cadence Virtuoso, LaTeX, Timeloop/Accelergy, CiMLoop, FastAPI, Docker, GitHub, CI/CD, Amazon Web Services, Google Cloud Platform

EXPERIENCE

Hardware/Software Co-Designer Graduate Research Assistant **2023 - Present**
Iowa State University of Science and Technology *Ames, IA*

- Enhanced Deep Neural Network (DNN) fairness by 32% with <1% accuracy loss on medical imaging datasets by developing FairXbar, a framework leveraging hardware errors for improving fair inference
- Improved Energy-Delay-Product (EDP) by up to 130x by designing StoX-Net, an In-memory Computing (IMC) architecture that mitigates the analog-to-digital converter (ADC) bottleneck using novel stochastic converter
- Designed a novel, scalable multi-bit synapse for IMC architecture using Magnetoresistive Random-Access Memories (MRAMs) based on exchange-coupled nanostructures, improving hardware efficiency by 3.2x over binary MRAM
- Engineered hardware-aware training algorithms incorporating 5 types of hardware characteristics like quantization, fairness, write error, conductance variation, stochastic conversion for co-optimizing DNNs for deployment on emerging hardware
- Validated architectures for 3 accepted publications with device-to-system simulations using MATLAB (device), Pytorch (functional accuracy), and Timeloop/Accelergy (system PPA)
- Evaluated the functional performance of proposed algorithms on complex datasets, including Tiny ImageNet, Fitzpatrick-17k, and ISIC-2019
- Authored 5 papers in premier conferences and journals like DATE, ICRC, CCMCC, IJMLC, detailing significant advancements in AI hardware acceleration and fairness
- Delivered a guest lecture titled "Device-to-Algorithm Co-Design of Processing-In-Memory Architecture for Efficient Machine Learning" for CPRE 5870 – Hardware Design for Machine Learning, Iowa State University

Machine Learning Engineer **2022 - 2023**
Anchorblock Technology *Dhaka, Bangladesh*

- Built a performance monitoring system for a mobile financial service tracking 4 features (balance check, money transfer, payment, withdrawal) with 2 metrics (latency, success rate), and supplied data to an analytical dashboard
- Developed an AI-driven credit scoring system using semi-supervised learning and generative AI for data augmentation; deployed a demo application on AWS for client presentation
- Developed & containerized 5 NLP microservices for a Bangla grammar correction framework (NER, grammar & punctuation correction, address & pronoun resolution) using Pytorch, Hugging Face, and Docker
- Researched automated crypto trading systems using time series analysis, risk modeling, and machine learning, and improved the Sharpe ratio from 1.2 to 1.7 by testing on trading data spanning over 5 years

- Collaborated on project planning, cross-team coordination, and version management and release in GitHub for 3 projects

PUBLICATIONS

- **S. S. Mugdho**, Y. Guo, E. G. Rogers, W. Zhao, Y. Shi and C. Wang,"FairXbar: Improving the Fairness of Deep Neural Networks with Non-Ideal in-Memory Computing Hardware," 2025 Design, Automation & Test in Europe Conference (DATE), Lyon, France, 2025, pp. 1-7, DOI: 10.23919/DATE64628.2025.10993038.(**25%** Acceptance Rate)
- K. K. Gupte*, **S. S. Mugdho*** and C. Wang, "Scalable Spintronic Synapses for Analog In-Memory Computing Based on Exchange-Coupled Nanostructures," 2024 IEEE International Conference on Rebooting Computing (ICRC), San Diego, CA, USA, 2024, pp. 1-8, DOI: 10.1109/ICRC64395.2024.10937014.(*Equal Contribution)
- E. G. Rogers*, **S. S. Mugdho***, K. K. Gupte and C. Wang, "StoX-Net: Stochastic Processing of Partial Sums for Efficient In-Memory Computing DNN Accelerators," 2024 IEEE International Conference on Rebooting Computing (ICRC), San Diego, CA, USA, 2024, pp. 1-9, DOI: 10.1109/ICRC64395.2024.10937005.(*Equal Contribution)
- **S. S. Mugdho**, K. K. Gupte, Md. S. Hasan and C. Wang, "Area-Efficient Heterogeneous MRAM for High-Performing AI Acceleration", 2025 IEEE Cross-disciplinary Conference on Memory-Centric Computing (CCMCC), Dresden, Germany, 2025. (Accepted)
- K. K. Gupte*, **S. S. Mugdho***, C. Huang and C. Wang, " Scalable and robust multi-bit spintronic synapses for analog in-memory computing," npj Unconventional Computing, 2026, DOI: 10.1038/s44335-026-00055-7.(*Equal Contribution)
- **S. S. Mugdho** and H. Imtiaz, "Privacy-preserving matrix factorization for recommendation systems using Gaussian mechanism and functional mechanism," International Journal of Machine Learning and Cybernetics, 2024, 15, 5745–5763, DOI: 10.1007/s13042-024-02276-3.

AWARDS & HONORS

- **Best Paper Award**, IEEE ICRC 2024 – Scalable Spintronic Synapses for Analog In-Memory Computing Based on Exchange-Coupled Nanostructures
- **Best Paper Award**, IEEE CCMCC 2025 – Area-Efficient Heterogeneous MRAM for High-Performing AI Acceleration