MEGHNA ROY CHOWDHURY

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EDUCATION

PhD in Electrical and Computer Engineering, Purdue University, USA Jan'27 (expected)
Efficient ML for Real-World Domains: Health AI, Circuits, Wearables
B.Tech in Electronics and Communication Engineering, Vellore Institute of Technology, India July 2020
GPA: 9.24/10 (Top 4% in batch)

TECHNICAL SKILLS

Programming Languages: Python, C++, Embedded C, MicroPython, MATLAB, Verilog
Libraries: PyTorch, TensorFlow, scikit-learn, NumPy, pandas, OpenCV, spaCy, Matplotlib
Hardware: MCU(ARM,PSoC, NRF, ESP32, NodeMCU, Arduino)

WORK EXPERIENCE

ML Intern, Qualcomm, California May 2026 - Aug 2026

- Designed end-to-end custom ML architectures for circuit design that advanced previous solutions by ∼99% .
- Collaborated with cross-functional teams to data collection and model validation.
- Software/Library: Python (PyTorch, scikit-learn, pandas, numpy, MATLAB)

ML Intern, Qualcomm, California May 2025 - Aug 2025

- Developed end-to-end ML solutions for circuit optimization, from problem formulation to scalable software implementation.
- Designed and implemented two novel ML architectures that advanced state-of-the-art by ∼32% (patent filed, under review).
- Collaborated with cross-functional teams to build reproducible ML pipelines for circuit design.
- Software/Library: Python (PyTorch, scikit-learn, pandas, numpy.)

Graduate Research Assistant, Purdue University, USA Sept 2021-present

1. EMG-BASED TEXT GENERATION (ongoing work)
   - Developing a physiologically grounded sEMG-to-text framework combining CNN–BiLSTM–Attention encoding with a T5 decoder for silent-speech text reconstruction.
   - Implemented modular preprocessing, feature extraction, and constrained beam-search decoding; evaluating cross-participant generalization and latency on EMG typing data.
   - Early results show 85% finger-classification accuracy and 5–7% CER/WER, demonstrating feasibility of robust EMG-driven communication.
   - Tools: Python (PyTorch, Hugging Face Transformers, NumPy, pandas)
2. ENHANCEMENT OF EEG SENSING & PROCESSING
   - Designed and conducted experiments to identify, quantify, and mitigate dominant noise sources in EEG acquisition using the ADS1299 platform.
   - Developed signal-processing and filtering techniques that improved SNR, enhancing EEG data quality.
   - Built a self-supervised learning (SSL) framework integrating Squeeze-and-Excitation (SE) modules for robust modeling of unlabeled, noisy EEG data.
   - Achieved a 15% accuracy gain over baseline SSL models with no added computational cost, demonstrating efficacy of SE-based feature recalibration.
   - Tools: Python (TensorFlow, scikit-learn), MATLAB (Signal Processing Toolbox, DSP System Toolbox); Hardware: ADS1299
3. ENHANCING INTERNET OF BODIES BY HARNESSING LOW POWER WEARABLES THROUGH DISTRIBUTION OF NEURAL NETWORKS (DistNN)
   - Developed a framework for energy-efficient neural network inference, distributing computations between wearable nodes and resource-rich hubs to optimize performance and power efficiency.
   - Designed custom hardware leveraging low-precision fixed-point arithmetic, achieving ultra-low power inference while maintaining real-time processing.
   - Achieved 1000× energy efficiency over GPUs and 11× lower power consumption than ML ASICs, making edge AI scalable for real-world applications.
   - Optimized autoencoders and CNNs for image reconstruction and denoising, achieving SSIM scores of 0.9.
4. MACHINE LEARNING FOR MENTAL HEALTH AND DIGITAL WELL-BEING

- Leveraged a large-scale real-world dataset to develop a hierarchical, personalized ML model integrating feature reduction and interpretability for mental health prediction.
- Reduced input dimensionality from 35 to 5 features using personalized feature importance, cutting computational cost with no accuracy loss.
- Achieved 91% accuracy with neural networks—outperforming baselines by 30% while improving efficiency and explainability.
- Software/Tools: Python (TensorFlow, pandas, numpy, scikit-learn, SHAP)

5. ROBUST ECG SENSING, LOW-POWER COMMUNICATION & INFERENCE
   - Designed a flexible ECG patch powered perpetually by body heat (∼35uW), enabling continuous operation without external charging.
   - Implemented low power body-based commutation using PSoC, consuming 4× less power than Bluetooth.
   - Orchestrated sensing and reception pipeline (timing, low-power operation), verified robustness through BER checks and python based ECG signal quality analysis.
   - Conducted experiments demonstrating perpetual operation with system-level optimizations, achieving reliable health data transfer while maintaining ultra-low power.
   - Hardware: PSoC, PicoScope, Keysight U2741A; Software/Tools: MATLAB, Python, PSoC Creator

Research Intern, Yuan Ze University, Taiwan (Remote) May 2020 - Aug 2020
DEEP LEARNING VIA ECG AND PPG SIGNALS TO PREDICT THE DEPTH OF ANAESTHESIA

- Conducted DSP techniques like FFT to generate heatmaps as a part of data preprocessing.
- Achieved 86% accuracy with a custom 10-convolution layered model.
- Evaluated the model using 10-fold cross validation and LOOCV.
- Software: MATLAB and Python

Tata Consultancy Services, Mumbai, India Jan 2020 - Aug 2021
Research & Innovation Engineer

- Developed an automated prediction system for structured data, streamlining data augmentation, model selection, and adaptation using GAN, AutoML, and Adaptive ML technologies.
- Leveraged graph neural networks to analyze relationships and patterns in emissions data, optimizing model accuracy and interpretability, showcasing advanced data analysis and model comparison skills to develop a predictive framework to assess carbon footprints using knowledge trees.
- Collaborated with Life Science Team to build ML-based solutions for automating information extraction from unstructured data, leveraging NLP with Spacy and ML models.
- Utilized Python, HTML/CSS for development and integrated MLOps with Airflow for workflow automation.

SELECTED PUBLICATIONS

(Refer to Google Scholar for more publications)

- **Chowdhury M.R.**, Y.Ding., & Sen. S (2025). ŚSL-SE-EEG: A Framework for Robust Learning from Unlabeled EEG Data with Self-Supervised Learning and Squeeze-Excitation Networks'(EMBC) - *accepted* [Link]
- **Chowdhury M.R.**, et al. (2025). 'Predicting and Understanding College Student Mental Health with Interpretable Machine Learning'(CHASE) [Link]
- **Chowdhury M.R.**, & Sen. S (2025). 'Measurement and Analysis of System Parameter Effects on Noise in EEG Systems' (ISCAS) [Link]
- **Chowdhury M.R.**, Ghosh A., Bari M.F., & Sen. S (2024). 'Leveraging Ultra-Low-Power Wearables Using Distributed Neural Networks'(BSN) [Link]
- Bari, M. F., **Chowdhury, M. R.**, & Sen, S. (2023) 'Long Range Detection of Emanation from HDMI Cables Using CNN and Transfer Learning' in Design, Automation & Test in Europe Conference & Exhibition (DATE) [Link]
- **Chowdhury, M. R.**, Madanu, R., Abbod, M. F., Fan, S. Z., & Shieh, J. S. (2021), 'Deep learning via ECG and PPG signals for prediction of depth of anesthesia' in Biomedical Signal Processing and Control (BSPC). [Link].

LEADERSHIP ROLES

- Vice Chair, Community Team, Purdue Graduate School Government — Aug 2025 - Present
- Director of Mental Health Awareness Week, Purdue Graduate School Government — Aug 2024 - Aug 2025
- Member, Community Team of Purdue Graduate School Council — Aug 2022- Aug 2024
- Head of Photography, Vellore Institute of Technology — July 2018-July 2019