MEGHNA ROY CHOWDHURY

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EDUCATION

PhD in Electrical and Computer Engineering, Purdue University, USA Fall'26 (expected)
Efficient ML for Health AI and 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, Embedded C, MicroPython, MATLAB, Verilog, Java, C++, HTML, CSS, JS
Libraries: Tensorflow, Scikit-learn, Numpy, Pandas, opencv, Pytorch, Matplotlib, Seaborn, Spacy
Tools: MATLAB, Ansys HFSS, GNURadio

WORK EXPERIENCE

Tata Consultancy Services, Mumbai, India Jan 2020 - Aug 2021
Systems Engineer, Analytics & Insights (Research & Innovation)

- 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.

ML Intern - Transportation and Logistics optimization using IoT and ML

- Developed a system for & achieved 95% accuracy in the prediction of the lifetime of Li-ion batteries used in Electric Vehicles using various machine learning models.
- Proposed a recommendation system based on existing battery lifetime, different terrains, charging time.
- Language used: Python

RESEARCH EXPERIENCE

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

1. ENHANCING INTERNET OF BODIES BY HARNESSING LOW POWER WEARABLES THROUGH DISTRIBUTION OF NEURAL NETWORKS (DistNN)
   - Developed DistNN, 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.
2. ENHANCEMENT OF EEG SENSING & PROCESSING
   - Conducted experiments to identify and characterize precise noise sources in EEG signals.
   - Applied signal processing techniques with ML models to achieve lower SNR, improving overall EEG data quality.
   - Utilized Self-Supervised Learning (SSL) to effectively handle real-world unlabeled and noisy EEG data.
   - Integrated Squeeze-and-Excitation Networks (SE-Nets) into SSL models, boosting prediction accuracy by 15% without increasing computational overhead.
   - Software/Tools: Python (TensorFlow, scikit-learn); MATLAB (Signal Processing Toolbox, DSP System Toolbox)
3. MACHINE LEARNING FOR MENTAL HEALTH AND DIGITAL WELL-BEING
   - Developed a novel hierarchical machine learning model integrating feature reduction, personalization, and interpretability, significantly improving mental health prediction on real-world dataset.

- Reduced computational cost by mapping 35-dimensional input to a compact 5-dimensional representation, leveraging personalized feature importance with decision trees, with no loss in accuracy.
- Implemented neural networks for mental health prediction, achieving 91% accuracy, improving baseline models by 30% while enhancing model efficiency and explainability.
- Software/Library: Python (Tensorflow, pandas, numpy, scikit-learn, shap);

4. IMPROVING DETECTION AND ANALYSIS OF FREQUENCY EMANATION WITH CNN
   - Created a dataset and analyzed rogue frequency emanations from unintended sources like USB/HDMI&Power Cables/Monitors/SDRs.
   - Detected leaky emanations using CNN and Signal Processing with an accuracy of 95%.
   - Improved range of emanation detection of HDMI up to 22.5m through signal processing and CNN.
   - Main Tools: GNU Radio, USRP B210.
5. ROBUST ECG SENSING & INFERENCE USING HUMAN BODY COMMUNICATION
   - Developed a flexible ECG patch for low-power communication through the body (HBC).
   - Developed code for transmitting and decoding ECG signals via HBC, achieving power consumption as low as 20uW.
   - Formulated and conducted experiments with multiple human subjects to ensure system robustness.
   - Optimized system power consumption, achieving 4x lower power usage compared to state-of-the-art solutions.
   - Main hardware: PSoC, PicoScope, Keysight U2741A ; Software/Tools: MATLAB, Python, PSoC Creator

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 (patent filed, under review).
- Collaborated with cross-functional teams to build reproducible ML pipelines for circuit design.
- Software/Library: Python (PyTorch, scikit-learn, etc.)

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

SELECTED PUBLICATIONS

(Refer to Google Scholar for more publications)

- **Chowdhury M.R**., Y.Ding., & Sen. S (2025). 'SSL-SE-EEG: A Framework for Robust Learning from Unlabeled EEG Data with Self-Supervised Learning and Squeeze-Excitation Networks'(EMBC) - *accepted*
- **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].

RELEVANT COURSES

Machine Learning, Artificial Intelligence, ML in Bioinformatics & Healthcare, ML in Cloud Computing, Linear Algebra, Probability & Random Variables, Digital Signal Processing, Embedded Systems, Advanced IoT Design.

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