MEGHNA ROY CHOWDHURY

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EDUCATION

PhD in Electrical and Computer Engineering, Purdue University, USA 2026 (expected)
Health AI | Low Power wearables | Signal Processing

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, Vivado, GNURadio

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.

RESEARCH EXPERIENCE

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

1. APPLYING MACHINE LEARNING DIGITAL WELL-BEING
   - Analyzed interaction features such as phone usage, physical activity, and social engagement to understand their distributions and implications for digital well-being and mental health.
   - Developed and preprocessed features to assess their relationship with mental health.
   - Leveraged self-supervised learning techniques to derive latent representations of user behaviors, enabling a deeper understanding of patterns and their association with mental health indicators.
   - Conducted analysis to enhance interpretability of the relationship between phone interactions and mental health.
   - Software/Library: Python (Tensorflow, pandas, numpy, scikit-learn, shap);
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 significantly 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. ENHANCING INTERNET OF BODIES BY HARNESSING LOW POWER WEARABLES THROUGH DISTRIBUTION OF NEURAL NETWORKS (DistNN)
   - Introduced the concept of DistNN for low-power wearables in Body Sensor Networks, enabling efficient edge computing for biomedical sensing.
   - Achieved sub-mW power at wearable nodes compared to traditional systems consuming power in the range of watts.
   - Tested DistNN with physiological signals (e.g., ECG, EMG), optimizing classification and prediction tasks while minimizing computational overhead.
4. 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

5. ELECTRIC-FIELD-BASED METHOD FOR LEVERAGING BIO-MEDICINE
   - Conducted experiments and simulations to analyze human body material properties for Human Body Communication.
   - Developed a novel FEM simulation-based study to determine the precise point of drug injection based on electric field and body conductivity.
   - Performed simulations using the Neva Human Model in Ansys HFSS, demonstrating a 10x increase in electric field strength at the destination at frequencies as low as 200 kHz.
6. LEVERAGING DEEP LEARNING FOR MEDICAL IMAGING
   - Developed a multi-modal CNN-based model integrating ECG, PPG, and EEG signals for Depth of Anesthesia prediction, achieving superior accuracy over single-modality models.
   - Incorporated Squeeze-and-Excitation Networks into the CNN, boosting prediction accuracy from 86% to 95% without increasing computational overhead.
   - Conducted comprehensive signal quality checks using various statistical measures.
   - Software/Libraries: Python (Tensorflow, scikit-learn, pandas, numpy, neurokit2)

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 image preprocessing.
- Achieved 86% accuracy with a custom 10-convolution layered model.
- Software: MATLAB and Python

WORK EXPERIENCE

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.

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

SELECTED PUBLICATIONS

(Refer to Google Scholar for more publications)

- **Chowdhury M.R**., & Sen. S (2025). 'Measurement and Analysis of System Parameter Effects on Noise in EEG Systems' in IEEE ISCAS. (accepted)
- **Chowdhury M.R**., Xuan W., Sen S., Zhao Y. & Ding. Y (2025). 'Predicting and Understanding College Student Mental Health with Interpretable Machine Learning' in IEEE/ACM CHASE. (accepted)
- **Chowdhury M.R**., Ghosh A., Bari M.F., & Sen. S (2024). 'Leveraging Ultra-Low-Power Wearables Using Distributed Neural Networks' in IEEE BSN [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 BSPC. [Link].

LEADERSHIP ROLES

- Director of Mental Health Awareness Week, Purdue Graduate School Government — Aug 2024 - Present
- Member, Community Team of Purdue Graduate School Council — Aug 2022- Aug 2024
- Events Co-ordinator, ECE Grad School Association, Purdue University — Aug 2021 - Aug 2022
- Head of Photography, Vellore Institute of Technology — July 2018-July 2019