YUSUF AHMED KHAN

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RESEARCH INTERESTS

Machine Learning for efficient and robust systems, large language models, neuromorphic & neuroscience-inspired learning, biomedical signal & image analysis, AI for healthcare.

ACADEMIC BACKGROUND

PhD in Electrical Engineering 2029 (expected)
The Pennsylvania State University, GPA: 4.0/4.0
Relevant Coursework: EE 560 – Probability, Random Variables, and Stochastic Processes; EE 456 – Introduction to Neural Nets

SKILLS

Programming	Python (PyTorch, NumPy, SciPy, Pandas, Matplotlib); MATLAB; C; LaTeX
Machine Learning	CNNs; LSTMs; Spiking NNs; Equilibrium Propagation; STDP; Fault Tolerance
Hardware/Tools	GPU Computing; Memristor Crossbar Simulation; Arduino; Raspberry Pi; Linux CLI; Git
Data Processing	EEG/ECG Signal Analysis; Feature Engineering; Biomedical Imaging

ACADEMIC & RESEARCH EXPERIENCE

Graduate Research Assistant August 2024 – Present
The Pennsylvania State University | Supervisor -Dr. Abhronil Sengupta *State College, Pennsylvania, USA*

- Conducting research on optimizing AI models to enhance computational efficiency, focusing on scalable algorithms for real-time applications.
- Designing and implementing ML techniques for resource-constrained environments, enabling on-device learning and improved accessibility.
- Building GPU-based pipelines (PyTorch/CUDA) with rigorous evaluation and reproducibility practices; documenting insights for dissemination.

Mitacs Globalink Research Internship June 2023 – August 2023
Athabasca University | Supervisor -Prof. Vivekanandan S. Kumar *Edmonton, Alberta, Canada*

- Conducted structured literature synthesis on 4IR technologies (e.g., AI, blockchain) and their impacts on higher education; produced a landscape analysis and implications report.

Research Intern May 2022 – December 2022
National Remote Sensing Centre, ISRO | Supervisor -Ms. Khusboo Mirza *New Delhi, India*

- Leveraged multi-spectral bands of Sentinel-2 imagery to pinpoint brick kilns, showcasing proficiency in remote sensing analysis.
- Developed an ML model to classify brick kilns in Sentinel-2 images, achieving an accuracy of 96.4%.

PROJECTS

Equilibrium Propagation with Astrocyte-Inspired Self-Repair for Fault-Tolerant Neural Systems Aug 2024 – Present
Graduate Research Project, Neuromorphic Computing Lab, Penn State

- Integrated astrocyte-inspired modulation with EP to enhance robustness under stuck-at faults motivated by memristor crossbar fault models while preserving learning efficiency.
- Implemented differential-pair updates (W^+, W^-) and compared EP baselines across datasets (MNIST, CIFAR-10).

- Designed reproducible GPU training/eval pipelines: fault injection, convergence diagnostics, weight statistics, and accuracy/efficiency trade-off analyses (PyTorch/CUDA).

Sleep Quality Assessment using Physiological Signals   December 2022 – May 2024

Bachelor's Thesis | Supervisor- [*Prof. Omar Farooq*](#)

- Utilized EEG signals from the Sleep EDF database to classify sleep stages, achieving a validation accuracy of 96.2% (Ensemble Bagged Trees) and 94.9% (Ensemble Boosted Trees).

- Engineered features including KL Divergence across sub-bands, entropy features, IQR, and MAD to improve reliability and precision.

EMG Based Prosthetic Control   January 2023 – May 2023

Minor Project

- Developed EMG-based prosthetic control system using MuscleBioAmp BisCute sensor and Arduino UNO for natural, effort-minimized control.

- Implemented biofeedback rehabilitation using EMG signals from residual muscles to support recovery and assistive mobility.

SELECTED PUBLICATIONS

- **Y. A. Khan**, A. Mahboob, O. Farooq, "Enhancing Sleep Wake Classification Accuracy: Unveiling The Significance of KL Divergence In EEG Signal Analysis", *ICCCI 2024*. [Link]

- **Y. A. Khan**, M. Tahreem, O. Farooq, "Single Channel EEG Based Binary Sleep and Wake Classification using Entropy Based Features", *REEDCON 2023*. [Link]

- **Y.A. Khan**, S. Imaduddin, et al., "Artificial Intelligence Based Approach for Classification of Human Activities Using MEMS Sensors Data", *Sensors*, 23:1275, 2023. [Link]

ACHIEVEMENTS

- Awarded **Melvin P. Bloom Memorial** Graduate Fellowship in Electrical Engineering.

- Awarded the prestigious **IEEE Richard E. Merwin** student scholarship worth $1000 in acknowledgment of dedicated volunteering efforts within the IEEE community.

- Selected under the highly prestigious & competitive **Mitacs GRI** program at Athabasca University (Fully funded).

- Selected as the recipient of the highly esteemed **DAAD WISE** scholarship to work on a research project at University of Keil, Germany (Fully funded).

- Appointed as **President** (Chair) at IEEE Robotics and Automation Society (RAS), ZHCET, AMU chapter, leading a team of 30 people, since April 2023 (formerly a founding team member).