BISWADEEP CHAKRABORTY

biswadeep@gatech.edu || +1(404)932-2269

EDUCATION

Georgia Institute of Technology *January 2020 - Present*
Ph.D. in Electrical and Computer Engineering *Advisor:* Prof. Saibal Mukhopadhyay
Minor in Mathematics
Masters in Electrical and Computer Engineering

Jadavpur University *July 2015 - June 2019*
B. Tech. in Electronics and Telecommunication Engineering *Advisor:* Prof. Amit Konar
First Class with Honors & Distinction

EXPERIENCE

Georgia Institute of Technology Atlanta, USA
GREEN Lab *January 2020- Present*

Graduate Research Assistant under the supervision of Prof. Saibal Mukhopadhyay.

· I am working at the confluence of neural networks, machine learning, and neuromorphic computing. A pivotal aspect of my research involves delving into the realms of biologically plausible spiking neural networks with a focus on spike-timing-dependent plasticity and understanding how the brain stores information with extremely low energy consumption. Currently, I am working on stochastic Bayesian inference with spiking neural networks, pushing the boundaries of probabilistic modeling and inference. Specifically, my work concentrates on harnessing heterogeneous neuronal dynamics within spiking networks to devise spatio-temporal compression algorithms using Bayesian codes. This endeavor aims to forge more efficient and compact representational models for high-dimensional data streams, utilizing a discrete spike-based communication framework.

PanAgora Asset Management Boston, USA
Stock Selector & Equity Strategies Team *May 2023-August 2023*

· Worked as *Equity Research Intern* with Mr. Lei Liu and Mr. Richard Tan at the Stock Selector and Equity Strategies team, building event-driven volatility trading strategies using large language models.

National University of Singapore Singapore
NUS-Singtel Cyber-Security Research and Development Laboratory *July 2019-December 2019*

· Worked as *Research Assistant* at the Singtel-NUS Lab with Prof. Mohan Gurusamy, Dr. Dinil Divakaran, Dr. Ido Nevat, and Prof. Gareth Peters on developing and implementing a risk-aware feature selection algorithm for IoT Device Classification.

University of Sherbrooke Quebec, Canada
INTERLAB Research Laboratory *May 2018-August 2018*

· Worked on research projects involving developing algorithms and a simulator using VPython to perform stochastic simulations of the nano-wire formation in a nano-communication network.

Jadavpur University West Bengal, India
Artificial Intelligence Lab *December 2017 - June 2019*

· Worked under Prof. Amit Konar on several research projects based on deep learning and signal processing-based modeling and characterization of EEG and fMRI signals and their applications in novel brain-computer interface algorithms.

Indian Academy of Sciences New Delhi, India
National Physical Laboratory *May 2017– July 2017*

· Worked under Dr. Amitava Sen Gupta, ex-Director, National Physical Laboratory, India, on modeling an algorithm for shooter localization from gunshot acoustics using wireless sensor networks.

Jadavpur University West Bengal, India
Advanced Embedded and Digital Systems Laboratory *May 2016 – December 2017*

· Worked as an undergraduate research assistant under Dr. Amitava Mukherjee, IBM India, and Prof. Mrinal Kanti Naskar on future 5G Communication Networks, Information Centric Networks, and Network Security.

PREPRINTS

[**P1**] **Chakraborty, B.** , Kang, B., Kumar, H., and Mukhopadhyay, S., 2023. Sparse Spiking Neural Network: Exploiting Heterogeneity in Timescales for Pruning Recurrent SNN *Submitted in* ***International Conference in Learning Representations, 2024***.

[**P2**] Kumawat, H., **Chakraborty, B.** , and Mukhopadhyay, S., 2023. STAGE Net: Spatio-Temporal Attention-based Graph Encoding for Learning Multi-Agent Interactions in the presence of Hidden Agents *Submitted in* ***International Conference in Learning Representations, 2024***.

[**P3**] Kang, B., Kumar, H., Lee M., **Chakraborty, B.** , and Mukhopadhyay, S., 2023. Recurrent Neural Cellular Automata with Self-Attention for Multi-agent System *Submitted in* ***International Conference in Learning Representations, 2024***.

[**P4**] Kumar, H., Kang, B., **Chakraborty, B.** , and Mukhopadhyay, S., 2023. Unmasking the Limitations of Threshold-Based Evaluation: An ROC-AUC Solution for Stochastic Complex Systems *Submitted in* ***Nature Machine Intelligence***.

[**P5**] **Chakraborty, B.** and Mukhopadhyay, S., 2023. Methodology to Compare Representations of Recurrent Spiking Neural Network using Representation Topology Divergence *Submitted in* ***Transactions in Machine Learning Research***.

PUBLICATIONS

1. Journal Papers

[**J10**] Kumar, H. **Chakraborty, B.** , Sharma, S., and Mukhopadhyay, S., 2023. XMD: An Expansive Hardware-telemetry-based Mobile Malware Detector to enhance Endpoint Detection. In: *Accepted in* ***IEEE Transactions on Information Forensics & Security***.

[**J9**] **Chakraborty, B.** and Mukhopadhyay, S., 2022. Heterogeneous Recurrent Spiking Neural Network for Spatio-Temporal Classification. *Accepted in* ***Frontiers in Neuroscience***.

[**J8**] **Chakraborty, B.** and Mukhopadhyay, S., 2022. μ DARTS: Model Uncertainty-Aware Differentiable Architecture Search. In: ***IEEE Access***.

[**J7**] Kim, D., **Chakraborty, B.** , She, X., Lee E., Kang B. and Mukhopadhyay, S., 2021. MONETA: A Processing-In-Memory-based Hardware Platform for the Hybrid Convolutional Spiking Neural Network with On-line Learning. In: ***Frontiers in Neuroscience***.

[**J6**] **Chakraborty, B.** and Mukhopadhyay, S., 2021. Characterization of Generalizability of Spike Time Dependent Plasticity trained Spiking Neural Networks. In: ***Frontiers in Neuroscience***

[**J5**] **Chakraborty, B.**, She, X. and Mukhopadhyay, S., 2021. A Fully Spiking Hybrid Neural Network for Energy-Efficient Object Detection. In: ***IEEE Transactions on Image Processing.***

[**J4**] Ghosh, A., **Chakraborty, B.**, Raha, A. and Mukherjee, A., 2021. Improving Network Throughput by Hardware Realization of a Dynamic Content Caching Scheme for Information-Centric Networking (ICN). In: ***Wireless Personal Communications****, 116(4), pp.2873-2898.*

[**J3**] **Chakraborty, B.**, Divakaran, D.M., Nevat, I., Peters, G.W. and Gurusamy, M., 2021. Cost-aware Feature Selection for IoT Device Classification. In: ***IEEE Internet of Things Journal.***

[**J2**] **Chakraborty, B.**, Ghosh, L. and Konar, A., 2020. Optimal selection of EEG electrodes using interval type-2 fuzzy-logic-based semi-separating signaling game. In: ***IEEE Transactions on Cybernetics.***

[**J1**] **Chakraborty, B.**, Ghosh, L. and Konar, A., 2019. Designing phase-sensitive common spatial pattern filter to improve brain-computer interfacing. In: ***IEEE Transactions on Biomedical Engineering****, 67(7),*

pp.2064-2072.

2. Conference Papers

[C12] Miller, N. **Chakraborty, B.** and Mukhopadhyay, S., 2023. A Reconfigurable Quantum State Tomography Solver in FPGA. *Accepted in* ***IEEE International Conference on Quantum Computing & Engineering (QCE) 2023****.*

[C11] **Chakraborty, B.** and Mukhopadhyay, S., 2022. Heterogeneous Neuronal and Synaptic Dynamics for Spike-Efficient Unsupervised Learning: Theory and Design Principles. ***International Conference on Learning Representations (ICLR) 2023****.*

[C10] Kang, B., **Chakraborty, B.** and Mukhopadhyay, S., 2022. Unsupervised 3D object learning through neuron activity aware plasticity. ***International Conference on Learning Representations (ICLR) 2023****.*

[C9] **Chakraborty, B.** and Mukhopadhyay, S., 2023, July. Self-Organizing Spiking Neural Network for Continual Time Series Prediction. ***2023 International Joint Conference on Neural Networks (IJCNN) IEEE.***

[C8] **Chakraborty, B.** Kamal, U., She, X. and Dash S., Mukhopadhyay, S., 2023. Brain-Inspired Spatiotemporal Processing Algorithms for Efficient Event-Based Perception. In: ***2023 Design, Automation and Test in Europe Conference (DATE)****.*

[C7] Lee, M., She, X., **Chakraborty, B.**, Dash, S., Mudassar, B. and Mukhopadhyay, S., 2021, February. Reliable Edge Intelligence in Unreliable Environment. In *2021 Design, Automation & Test in Europe Conference & Exhibition* ***(DATE)*** *(pp. 896-901). IEEE.*

[C6] Dewan, D., Ghosh, L., **Chakraborty, B.**, Chowdhury, A., Konar, A. and Nagar, A.K., 2020, July. Cognitive Analysis of Mental States of People According to Ethical Decisions Using Deep Learning Approach. In *2020 International Joint Conference on Neural Networks (****IJCNN****) (pp. 1-8). IEEE.*

[C5] Chowdhury, A., **Chakraborty, B.**, Ghosh, L., Dewan, D. and Konar, A., 2019, December. A Dynamical Phase Synchronization Based Approach to Study the Effects of Long-Term Alcoholism on Functional Connectivity Dynamics. In *International Conference on Pattern Recognition and Machine Intelligence (****PReMI****) (pp. 218-226). Springer, Cham.*

[C4] **Chakraborty, B.**, Ghosal, S., Ghosh, L., Konar, A. and Nagar, A.K., 2019, October. Phase-Sensitive Common Spatial Pattern for EEG Classification. In *2019 IEEE International Conference on Systems, Man and Cybernetics (****SMC****) (pp. 3654-3659).* ***(Oral)***

[C3] Dambri, O.A., Cherkaoui, S. and **Chakraborty, B.**, 2019, June. Design and Evaluation of Self-Assembled Actin-Based Nano-Communication. In *2019 15th International Wireless Communications & Mobile Computing Conference (****IWCMC****) (pp. 208-213). IEEE.*

[C2] Ghosal, S., **Chakraborty, B.**, Laha, M. and Konar, A., 2019, June. *Phase-Synchrony And Causality Analysis Of Brain Signals To Determine Signal Transduction Pathways In Color Perception. In 2019 IEEE Region 10 Symposium (pp. 778-783). IEEE.*

[C1] **Chakraborty, B.**, Banerjee, B., Mukherjee, A. and Naskar, M.K., 2017, December. Optimal cache allocation in a mobility-based heterogeneous network using Bayesian games. In *2017 IEEE Calcutta Conference ((pp. 423-427). IEEE.*

ACADEMIC ACHIEVEMENTS

Qualcomm Innovation Fellowship Finalist 2022: Selected among the finalist proposals across North America for our project titled "Moving From Black-Box Models to Self-Introspecting Perception Engine for Autonomous Vehicles."

MITACS Globalink Fellow: Received scholarship by MITACS Globalink and Ministry of Human Resource Development (MHRD), India, for a summer research internship in Canada.

Indian Academy of Sciences Summer Research Fellow: Selected for the prestigious Summer Research Fellow by the Indian Academy of Sciences for a research internship at the National Physical Laboratory, India.

Best Undergraduate Thesis: For developing novel methods for common spatial pattern analysis in brain-computer interface

First Class with Honors & Distinction in Bachelor of Engineering from Jadavpur University in 2019.

TALKS

2023 SNUFA: Invited Talk and Poster
Title: Dynamics in Diversity: Harnessing Heterogeneity in Neuronal and Synaptic Dynamics in SNNs

2023 ICERM Workshop on Mathematical and Scientific Machine Learning
Title: Learning to Predict Using Network of Spiking Neurons

2019 IEEE International Conference on Systems, Man and Cybernetics (SMC)
Title: Phase-Sensitive Common Spatial Pattern for EEG Classification.

GRADUATE COURSEWORK

Machine Learning and Optimization: Probabilistic Graphical Models in Machine Learning, Statistical Machine Learning, Mathematical Foundations of Machine Learning, Systems for Machine Learning, Stochastic Systems, Topics on Continuous Optimization, Statistical Inference on Random Graphs
Neuroscience: Information Processing Models in Neural Systems, Neurophysics, Neuronal Dynamics and Networks
Probability and Statistics: Fourier Tech and Signal Analysis, Statistical Estimation

PROFESSIONAL ACTIVITIES

Reviewing Responsibilities

- **Journals:** IEEE Transactions on Neural Networks and Learning Systems, Neurocomputing, IEEE Transactions on Image Processing, Neural Networks
- **Conferences:** IEEE SMC, CVPR, AAAI, IEEE PReMI, NeurIPS, ECCV, ICLR, AISTATS

Mentorship Mentored six new Ph.D. students as a part of the Georgia Tech ECE Graduate Student Organization (GSO) mentorship program.