

Saurabh Dash

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Education

- 2019-July 2022 **Ph.D. (on leave of absence)**, *Electrical & Computer Engineering*, Georgia Institute of Technology, *GPA - 4/4*.
Awards: ECE PhD Fellowship
- 2014-2019 **Dual Degree (B.S. + M.S.)**, *Electronics & Electrical Communications Engineering + Minor, Computer Science*, Indian Institute of Technology, Kharagpur, *GPA - 9.17/10*.
Awards: Order of Merit, IIT KGP for distinguished performance in the field of Technology

Select Publications

- 2024 *How Does Quantization Affect Multilingual LLMs?* K. Marchisio, [S. Dash](#), H. Chen, D. Aumiller, A. Üstün, S. Hooker, S. Ruder. *Empirical Methods in Natural Language Processing (EMNLP)*, 2024 [paper]
- 2024 *Aya 23: Open Weight Releases to Further Multilingual Progress*. V. Aryabumi, J. Dang, D. Talupuru, [S. Dash](#), D. Cairuz, H. Lin, B. Venkitesh, M. Smith, K. Marchisio, S. Ruder, A. Locatelli, J. Kreutzer, N. Frosst, P. Blunsom, M. Fadaee, A. Üstün, S. Hooker. arXiv preprint, 2024 [paper]
- 2024 *Outliers and Calibration Sets have Diminishing Effect on Quantization of Modern LLMs*. D. Paglieri, [S. Dash](#), T. Rocktäschel, J. Parker-Holder. *International Conference on Machine Learning (ICML) ES-FoMo II*, 2024 [paper]
- 2023 *Intriguing Properties of Quantization at Scale*. A. Ahmadian*, [S. Dash](#)*, H. Chen*, B. Venkitesh, S. Gou, P. Blunsom, A. Üstün, S. Hooker. *Neural Information Processing Systems (NeurIPS)*, 2023 [paper]
- 2023 *Associative Memory Augmented Asynchronous Spatiotemporal Representation Learning for Event-based Perception*. [S. Dash](#)*, U. Kamal*, S. Mukhopadhyay. *International Conference on Learning Representations (ICLR)*, 2023 [paper]
- 2022 *Sequence Approximation using Feedforward Spiking Neural Network for Spatiotemporal Learning: Theory and Optimization Methods*. X.She, [S. Dash](#), S. Mukhopadhyay. *International Conference on Learning Representations (ICLR)*, 2022 [paper]
- 2022 *Temporal Point Process Modelling using Recurrent Graph Network*. [S. Dash](#), X. She, S. Mukhopadhyay. *International Joint Conference on Neural Networks (IJCNN)*, 2022. [paper]
- 2021 *A Heterogeneous Spiking Neural Network for Unsupervised Learning of Spatiotemporal Patterns*. X.She, [S. Dash](#), S. Mukhopadhyay. *Frontiers in Neuroscience*, 2021 [paper]
- 2021 *Robust Processing-In-Memory with Multi-bit ReRAM using Hessian-driven Mixed-Precision Computation*. [S. Dash](#), Y.Luo, A.Lu, S.Yu, S. Mukhopadhyay. *IEEE Transactions on Computer Aided Design (TCAD)*, 2021 [paper]
- 2020 *Physics-Incorporated Convolutional Recurrent Neural Networks for Source Identification and Forecasting of Dynamical Systems*. P. Saha, [S. Dash](#), S. Mukhopadhyay. *Neural Networks* [paper]
- 2020 *Hessian-Driven Unequal Protection of DNN Parameters for Robust Inference*. [S. Dash](#), S. Mukhopadhyay. *International Conference on Computer Aided Design (ICCAD)*, 2020 [paper]

Work Experiences

- August 2022- Present **Member of Technical Staff, Cohere Inc.**
- Building Large Multimodal Models.
 - Building Inference Efficient (Latency and Memory Footprint) Large Language Models.
- May 2021- August 2021 **Machine Learning Research Intern (MIND Team), Apple Inc., US**
- Studied and implemented sample-adaptive augmentation strategies for improved generalization across various deep learning model families.
 - Obtained near SoTA (Adversarial AutoAugment) performance without the need to train a tightly coupled augmentation generator and classifier.

May 2018 - **Statistical Signal Processing Intern, Texas Instruments, India**

- July 2018
 - Developed Kalman Filter based approach for tracking and correction of sampling clock jitter in high speed ADCs.
 - Proposed solution obtained spurious-free dynamic range (SFDR) of 80dB.

May 2017 - **Visiting Student Researcher, Nanyang Technological University, Singapore**

- July 2017 Advisor: Dr.Arindam Basu
 - Explored a novel hardware amenable training rule to train binary and multi-bit synapses for neuromorphic classifiers to power the next generation of implantable Brain-Computer Interfaces.
 - Implemented a highly-efficient vectorized implementation to reduce the training time by 10 \times .

Invited Talks

- July 2023 Intriguing Properties of Quantization at Scale: Memorial Sloan Kettering
- October 2023 Intriguing Properties of Quantization at Scale: ML Collective

Research Experiences

Jan 2020 - **Deep Generative Models: A study**

- April 2020 Advisors: Dr.Matthieu Bloch, GeorgiaTech | Academic Project [**Code, Report**]
 - Implemented and compared various aspects of deep generative modelling approaches - Generative-Adversarial Networks, Variational Autoencoders and Normalizing Flows.
 - Studied how recent variants like Wasserstein GAN(GP), β -VAE, Glow etc. mitigated issues faced by the original approaches.

Jan 2020 - **Circuit Partitioning Using Graph Neural Networks**

- April 2020 Advisors: Dr.Sung-Kyu Lim, GeorgiaTech | Academic Project [**Code, Report**]
 - Implemented a deep-learning based fully differentiable approach to solve the problem of circuit partitioning using Graph Convolutional Networks.
 - Analytically derived custom loss gradients and extended pytorch autograd for sparse tensors to handle graphs with over 1M nodes.

July 2017 - **Low Power On-Chip Learner for a Neuromorphic Classifier**

- April 2019 Masters' Dissertation | *Nominated by the panel for the best dissertation award.*
Advisors: Dr.Indrajit Chakrabarti, IIT Kharagpur and Dr.Arindam Basu, NTU Singapore
Developed and implemented network rewiring rule based sub-threshold analog circuits that can be incorporated on chip to train a neuromorphic classifier.

Reviewing Experiences

- TMLR
- EACL 2023
- CVPR 2023
- ICCV 2023
- NeurIPS 2023

Other Achievements

- Invited to **Tesla AI Day 2021** to discuss self-driving technology with the AI team.
- **Contingent Head** of the first Indian Team to qualify for RoboCup 2017 held at Nagoya, Japan.
- Member of the **Bronze** winning team in FIRA MiroSot 2015 held at Daejeon, South Korea.
- Ranked among the **top 0.1% students** in IIT-Joint Entrance Examination among 485,000 students.
- **Kishore Vaigyanik Protsahan Yojna** (Young Scientist Award), 2013.
- Member of the **Gold** winning team in KPIT Sparkle 2015 - an inter collegiate innovation challenge.

Relevant Courses

- Statistical Machine Learning
- Convex Optimization
- Information Theory
- Math. Foundations of ML
- PDEs for Image Processing
- Computational Neuroscience
- Probabilistic Graphical Models
- Digital Signal Processing
- Real Analysis

Technical Competencies

Frameworks PyTorch, JAX, TensorFlow

Languages python, C, C++, Cuda, Triton, MATLAB

Service & Other

- Mentored a group of 20 students for a 7 day IEEE certified Robotics workshop leading to the design of a self-balancing robot.

Other Publications

- 2023 *Brain-Inspired Spatiotemporal Processing Algorithms for Efficient Event-Based Perception*. B. Chakraborty, U. Kamal, X. She, S. Dash, S. Mukhopadhyay. Design, Automation & Test in Europe (DATE), 2023 [paper]
- 2021 *Unsupervised Hebbian Learning for Point Set in StartCraft II*. B. Kang, H. Kumar, S. Dash, S. Mukhopadhyay. International Joint Conference on Neural Networks (IJCNN), 2022 [paper]
- 2021 *Reliable Edge Intelligence in Unreliable Environment*. M. Lee, X. She, B. Chakraborty, S. Dash, B. Mudassar, S. Mukhopadhyay. Design, Automation & Test in Europe (DATE), 2021 [paper]
- 2021 *Impact of HKMG and FDSOI FeFET drain current variation in processing-in-memory architectures*. N.E. Miller, Z. Wang, S. Dash, A.I. Khan, S. Mukhopadhyay. Journal of Materials Research, 2021 [paper]
- 2021 *Characterization of Drain Current Variations in FeFETs for PIM-based DNN Accelerators*. N.E. Miller, Z. Wang, S. Dash, A.I. Khan, S. Mukhopadhyay. IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS), 2021 [paper]
- 2020 *A Flexible Precision Multi-Format In-Memory Vector Matrix Multiplication Engine in 65nm CMOS with RF Machine Learning Support*. M. Mukherjee, Y. Long, J. Woo, D. Kim, N. Rahman, S. Dash, S. Mukhopadhyay. IEEE Solid-State Circuits Letters, 2020 [paper]
- 2017 *Low Power Implantable Spike Sorting Scheme based on Neuromorphic Classifier with Supervised Training Engine*. R. Pathak, S. Dash, M. Sharad. IEEE Computer Society Annual Symposium on VLSI (ISVLSI), 2017 [paper]