# Saurabh Dash

## **E**ducation

2019-July Ph.D. (on leave of absence), Electrical & Computer Engineering, Georgia Institute of Technol-2022 ogy, 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

- 2023 Intriguing Properties of Quantization at Scale. A. Ahmadian\*, <u>S. Dash</u>\*, 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 Eventbased Perception. <u>S. Dash</u>\*, 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, <u>S. Dash</u>, S. Mukhopadhyay. International Conference on Learning Representations (ICLR), 2022 [paper]
- 2022 Temporal Point Process Modelling using Recurrent Graph Network. <u>S. Dash</u>, 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. <u>S. Dash</u>, 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, <u>S. Dash</u>, S. Mukhopadhyay. Neural Networks [paper]
- 2020 Hessian-Driven Unequal Protection of DNN Parameters for Robust Inference. <u>S. Dash</u>, S. Mukhopadhyay. International Conference on Computer Aided Design (ICCAD), 2020 [paper]

## Work Experiences

- August 2022- Member of Technical Staff, Cohere Inc.
- Present Building Inference Efficient (Latency and Memory Footprint) Large Language Models.

#### May 2021- Machine Learning Research Intern (MIND Team), Apple Inc., US

- August 2021 Studied and implemented sample-adaptive augmentation strategies for improved generalization across various deep learning model families.
  - Obtained near SoTA (Adverserial 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 suprious-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×
  - Implemented a highly-efficient vectorized implementation to reduce the training time by  $10\times$ .

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),  $\beta$ -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 C
  - Convex Optimization
    - on Information Theory
      - Computational Neuroscience
      - Real Analysis

- Math. Foundations of MLProbabilistic Graphical Models
- PDEs for Image Processing Digital Signal Processing
- **–** Technical Competencies
- Frameworks PyTorch, JAX, TensorFlow

Languages python, C, C++, cuda, 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, <u>S. Dash</u>, S. Mukhopadhyay. Design, Automation & Test in Europe (DATE), 2023 [paper]
- 2021 Unsupervised Hebbian Learning for Point Set in StartCraft II. B. Kang, H. Kumar, <u>S. Dash</u>, S. Mukhopadhyay. International Joint Conference on Neural Networks (IJCNN), 2022 [paper]
- 2021 Reliable Edge Intelligence in Unreliable Environment. M. Lee, X. She, B. Chakraborty, <u>S. Dash</u>, 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, <u>S. Dash</u>, 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, <u>S. Dash</u>, 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, <u>S. Dash</u>, M. Sharad. IEEE Computer Society Annual Symposium on VLSI (ISVLSI), 2017 [paper]