ROHIT VARTAK

📞 +91 78755 52236 ✉ rohitkvartak4@gmail.com 💼 Linkedin

Examination	University	Institute	Year	CPI/%
Graduation	IIT Bombay	IIT Bombay	2024	8.9
Intermediate	Maharshtra State Board	Sri Chaitanya Junior College	2019	88.15 %
Matriculation	ICSE	St. Mary's School	2017	97.60 %

SUMMARY

I am presently pursuing my fifth year in the integrated Master's program at the Indian Institute of Technology Bombay, specifically within the Center for Machine Intelligence and Data Science Department. My research is primarily focused on exploring the fields of meta-learning, semi-supervised learning, and knowledge distillation.

SCHOLASTIC ACHIEVEMENTS

- Awarded **Undergraduate Research Award** for an exceptional **bachelor's thesis** *(2023)*
- Allotted a **branch change** to Electrical engineering Department on basis of exemplary CPI. *(2020)*
- Bagged an All-India Rank **1580** in **JEE Advanced** 2019 out of 200,000+ students *(2019)*
- Secured 99.84 Percentile in JEE Mains 2019 out of 1.5 million+ students *(2019)*
- Recipient of **The Principal's Prize** for standing third in my school in the ICSE Board Exams *(2017)*

PUBLICATIONS

- Prashant Khatri, **Rohit Vartak**, Preeti Rao, Hansjörg Mixdorff, Albert Rilliard. Classification of Prosodic Attitudes with AudioVisual features *IEEE International Conference on Acoustics, Speech, and Signal Processing 2024* ***Under review***
- **Rohit Vartak** et al. Robustness to Variability and Asymmetry of In-memory On-chip Training *32nd International Conference on Artificial Neural Networks, 2023*

RESEARCH EXPERIENCE

Meta Learning and Semi Supervised Distillation | *Collaboration with Google Research*
Guide: Ganesh Ramakrishnan (IIT Bombay), Pradeep Shenoy (Google Research, India) *(May '23 - Present)*

- Implementing a meta-network to generate logit-wise, instance-wise weights, to effectively denoise labels from a noisy teacher model, with the aim of enhancing the accuracy of the student model during the knowledge distillation process.
- Utilizing the meta-network for generating teacher-specific statistics, akin to methodologies presented in contemporary literature, to observe and improve the performance of the student model in semi-supervised learning setting.

Training Unstructured Networks using Perturbation | **Master's Thesis**
Guide: Udayan Ganguly, SemiX, IIT Bombay *(June '23 - Present)*

- Successfully showed the application of weight perturbation in Recurrent Neural Networks (RNNs) and Spiking Neural Networks (SNNs), proving its viability as an alternative to backpropagation without requiring the storage of hidden states in recurrent models.
- Established that weight perturbation is not a practical training method for Liquid State Machines (LSMs) owing to its inefficiency, characterized by long training durations.

Robustness to Variability and Asymmetry of In-memory On-chip Training | **Bachelor's Thesis**
Guide: Udayan Ganguly, SemiX, IIT Bombay *(Jan '22 - Apr '23)*

- Investigated challenges associated with on-chip neural network, including weight quantization to N bits and the impact of chip-related non-idealities such as variability and asymmetry
- Proposed Weight Perturbation (WP) as a simplified on-chip training technique, eliminating the need for the computationally expensive backward pass, used in Backpropagation (BP), thereby reducing resource requirements and hardware costs
- Demonstrated cost-efficiency of WP by achieving similar performance to BP while demanding fewer resources, particularly unidirectional synapses/connections, contributing to cost reduction in hardware implementation
- Developed novel variability-aware weight update rule to enhance accuracy of on-chip neural network learning; investigated robustness of BP and WP in scenarios with distinct forward/backward weights to analyse performance of methods under asymmetrical conditions
- Established that weight update step rather than backward pass was the primary bottleneck in on-chip neural networks training; demonstrated significance of optimizing weight update processes for achieving optimal performance of Artificial Neural Networks (ANNs) on-chip

Speech Emotion Recognition
Guide: Preeti Rao, Digital Audio Processing Lab, IIT Bombay *(Jan '23 - July '23)*

- Trained multiclass SVC (Support Vector Classifier) models for audio -visual modalities to better classify/ process emotion recognition by working with the SAVEE and RAVDESS emotion dataset

- Extracted and pre-processed eGEMAPS audio features (pitch, frequencies) and visual features (eyebrow, pupil movement) for accurate emotion recognition; utilized transfer learning with RAVDESS to enhance SVM classifier on novel Hindi Attitude dataset
- Distinguished different audio-visual expressions by mapping the emotion and attitude spaces of the two datasets, addressing challenges posed by dataset novelty, a high number of classes, and limited samples per class

INTERNSHIPS

CloudChef | *Helping chefs expand from brick & mortar to a global scale*   *Mumbai, India*
Software intern   *(May '22 - June '22)*
- Improved kitchen efficiency and human-computer interaction by providing clear item information in trays using printed label; automated inventory label printing to minimise human error and integrated automation process with existing codebase
- Utilized Zebra Programming Language-II (ZPL2) for label design and formatting, and developed a Python script to streamline label printing process to align movement of trays and racks in the kitchen
- Optimized ZPL2 to create label customization and consolidated existing code segments for clarity and streamlined functionally

PROJECTS

Coordinate Descent Methods for DC Minimization | **Course Project**   *(Mar '23 - Apr '23)*
Optimization in Machine Learning, IIT Bombay | Guide: Prof. Ganesh Ramakrishnan
- Implemented Sequential Convex Approximation (SCA) and Sequential Non-Convex Approximation (SNCA) techniques to improve results compared to gradient descent; addressed Difference of Convex (DC) minimization challenges for robust critical point optimality
- Demonstrated convergence to coordinate-wise stationary points offering superior optimality conditions compared to standard critical point criteria with mild assumptions

EEG Based Biometric Identification | **Course Project**   *(Feb '22 - Apr '22)*
Digital Signal Processing, IIT Bombay | Guide: Prof. Vikram Gadre
- Conducted in-depth analysis of EEG data patterns to determine most valuable frequency bands and utilized band-pass filters like Chebyshev and Butterworth to extract specific the specific band of frequencies
- Identified Delta pattern to be most informative for biometric identification of individuals' mental states and differentiations between individuals
- Developed attention-based encoder-decoder recurrent neural network model for biometric identification using EEG (Electroencephalograph) data, specifically the Delta wave, and is used to identify the person/user ID.

Temporary Memory(Silicon On Insulator) Based Learning Systems | **Course Project**   *(Aug '21 - Dec '21)*
Neuromorphic Engineering, IIT Bombay | Guide: Prof. Udayan Ganguly
- Implement an Artificial Neural Network with 2 hidden layers with back propagation from scratch using Python; tuned hyper-parameters to achieve a high accuracy (~96%) in the MNIST digit image dataset model
- Modelled exponential decay of temporary memories to achieve regularization in ANN and solved the problem of over-fitting; improved model performance by 1.5% and achieved test accuracy of 97.5% for MNIST digit image dataset after hyperparameter tuning

Faithful Image Reconstruction and Semantic Segmentation | **Course Project**   *(Oct '21 - Nov '21)*
Image Processing, IIT Bombay | Guide: Prof. Amit Sethi
- Applied Multi Wavelet CNN (MW-CNN) for image reconstruction using Haar wavelets instead of pooling layer
- Compared Multi Wavelet CNN against standard U-Net to establish superior results of image reconstruction
- Explored the applications of MW-CNN U-Net architecture for semantic segmentation for object detection

Solar-Powered Street Light LED Intensity Control | **Course Project**   *(Jan '22 - Apr '22)*
Electronics Design Lab, IIT Bombay | Guide: Prof. Joseph John
- Addressed the issue of LED malfunction in solar-powered street lights due to poor battery management and load control, aiming to reduce government expenditure on annual unit replacements
- Designed a Pulse Width Modulation (PWM) control circuit for LED intensity control to improve battery management and enhance overall system performance for better load control
- Conducted comprehensive literature analysis and implemented the PWM control circuit and LED dimming interfacing circuit on breadboard
- Designed State of Charge (SoC) circuits and Arduino interfacing codes in software allowing for better system control and automation.

TEACHING EXPERIENCE

Neuromorphic Engineering (EE 746) | Graduate-Level Course (IIT B) | *Teaching Assistant*
Provided tutoring and mentoring to 120 grade students on concepts like modelling neurons, liquid state machines, plasticity and other neuromorphic concepts; supported professor to grade assignments and organize collaterals for the curriculum such as planning assignments, planning and checking quizzes, and setting project guidelines

TECHNICAL SKILLS

Softwares/Languages	Python, MATLAB, C++, NGSpice, LaTeX
Libraries/Frameworks	Pytorch, Scikit-Learn, NumPy, Pandas, Matplotlib

KEY COURSES UNDERTAKEN

Mathematics and Statistics

- Calculus, Probability and Random Processes, Markov Chains and Queuing Systems, Applied Mathematical Analysis in Engineering, An Introduction to Number Theory and Cryptography, Optimization in Machine Learning

Computer Science

- Computer Programming and Utilization, Data Structures and Algorithms

POSITIONS OF RESPONSIBILITY

Marketing Coordinator, TechFest, IIT Bombay   *(Aug '19 - Dec '19)*

- Collaborated with Marketing Heads of Techfest to achieve a budget of INR 33 million to organize the Techfest with over 50 events
- Created a data base of 30 potential sponsors across sectors like healthcare, tech, startups; reached out firms via mass mailing software Streak on Gmail