Devashri Deulkar

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Education

Indian Institute of Technology, Kharagpur	**Dec 2021 – Present**
Bachelor's Degree (B.Tech) in Computer Science and Engineering	*CGPA: 8.32/10*
Jawahar Navodaya Vidyalaya, Amravati	**Sept 2015 – Mar 2019**
Class X, CBSE	*Percentage: 97.00%*
Sant Tukaram National Model School, Latur	**Aug 2019 – Mar 2021**
Class XII, CBSE	*Percentage: 95.60%*

Experience

Undergraduate Researcher | Indian Institute of Technology | Kharagpur, India May 2025 – Present
Spiking Neural Networks (LSM) under Prof. Soumik Bhattacharya

- Conducted a **systematic literature review** of 30 research papers on Spiking Neural Networks (SNNs), reservoir computing, and learning rules such as STDP and reward-modulated plasticity.
- Identified gaps in existing architectures and formulated a research direction on **Reinforced Liquid State Machines (RLSM)** for temporal sequence learning.
- Built the entire **Liquid State Machine pipeline from scratch** in Python, including LIF neurons, synaptic plasticity, reservoir connectivity, and WTA readout mechanism.
- Designed and evaluated models on **temporal classification tasks (SHD/N-MNIST)**; currently benchmarking RLSM against LSTM/GRU baselines and performing ablation studies.

Research Intern | Indian Institute of Science | Bengaluru, India May 2024 – July 2024
Distributed ML on heterogeneous setup under CNI Lab

- Trained a **GPT-2 (124M) model using DeepSpeed** ,exploring how frameworks like ZeRO (Zero Redundancy Optimizer) can minimize memory redundancy across GPUs and improve training efficiency of clusters.
- Conducted a **literature review** of existing model parallelism, alongside optimizations like ZeRO and used in training
- Developed a **pipeline** to profile, with custom modifications introduced to track **communication** and **computation time**
- Achieved a speed of **80k tokens/sec** with **2 GPU- RTX 4060ti** to train **GPT-2 (124M) model**

Research Trainee | Neuromatch Academy | Oregon,United States Feb 2024 – March 2024
Computational Neuroscience: Pupil Decoder ⭘

- Developed a **GLM** predicting different aspects of occular motion from neural activity of a mouse's primary visual cortex recorded while in the dark **(Stringer et al. 2019)**
- Built a **decoder** for the pupil's position/ change of posititon / magnitude of the movement and the direction of movement
- Analyzed neural activity across **nine cortical depths** and **three time gaps** to investigate the temporal relationship between V1 neural information and behavior, determining whether neural information **precedes or follows behavior**
- Best performance was achieved for **synchronous activity 46%**,with future neural spike counts better at decoding present pupil information compared to past spike counts

Projects

Generative Modeling Benchmark on MNIST: VAE vs GAN (FID/IS Evaluation) Nov 2025
Advanced ML (CS60073)

- Implemented an MLP-based **Variational Autoencoder (VAE)** with reparameterized latent sampling; logged **reconstruction**, **KL**, and ELBO trends per epoch
- Implemented an MLP-based **GAN** (Generator/Discriminator) with non-saturating objective, label smoothing, and stable training loop (1D-step + 1G-step per iteration)
- Generated fixed-grid samples per epoch to qualitatively track **training progression** and diagnose **mode collapse**/diversity issues
- Built a CNN feature extractor and computed quantitative metrics: **Inception Score (IS)** and **Fréchet Distance (FID)** for VAE vs GAN comparisons
- Enforced controlled experimental settings (CPU-only, fixed splits, fixed hyperparameters, fixed noise batches) for fair model comparison

Probabilistic Inference: Gaussian Processes, EM & Variational Inference Oct 2025 – Nov 2025
Advanced Machine Learning (CS60073) | Full Score

- Implemented **Gaussian Process Regression** (RBF kernel) from scratch, computing posterior **predictive mean** and **uncertainty bands** for noisy function observations

- Developed a full-covariance **Gaussian Mixture Model** and implemented the **EM algorithm** (responsibilities + parameter updates), verifying monotonic log-likelihood ascent
- Implemented **EM for Bayesian Linear Regression** to estimate prior/noise precisions (λ, β) and analyzed **evidence vs iterations** under polynomial feature expansions
- Built **mean-field Variational Inference** for Bayesian Logistic Regression in **PyTorch** using the **reparameterization trick**; evaluated predictive calibration via **Brier score** against MAP baseline
- Ensured numerical correctness via **Cholesky-based solves**, **log-sum-exp** stabilization, diagonal jitter/regularization, and fixed random seeds for reproducibility

Robust Image Captioning: ViT–Transformer & SmolVLM Benchmarking　　　　　**Feb 2025 – Apr 2025**
Deep Learning (CS60010)

- Implemented an end-to-end **image captioning pipeline** with a **ViT-based image encoder** and a **Transformer text decoder**, trained under a strict **15GB GPU memory** constraint
- Benchmarked zero-shot captioning using **SmolVLM** and reported standardized captioning metrics (**BLEU, ROUGE-L, METEOR, BERTScore**) for a strong baseline comparison
- Designed and implemented a robustness suite using **patch-wise occlusion** (16×16 grid) at **10%, 50%, 80%** masking; measured metric deltas to quantify performance degradation
- Logged and serialized **(original caption, generated caption, occlusion level)** tuples to create a controlled dataset for downstream analysis and model attribution
- Built a **BERT-base** classifier to identify whether a caption was produced by **SmolVLM vs custom model**; enforced a strict **image-disjoint 70:10:20 split** and reported **macro Precision/Recall/F1**

Achievements

- Secured an **All India Rank of 199*** in Joint Entrance Exam (JEE) Advanced 2021 among more than 160,000 reserved candidates
- Qualified for the Indian Institute of Science fellowship in 2021 by securing an **All India Rank of 221*** reserved category

Relevant Coursework

Theory:

- Advance Machine Learning
- Social Computing
- Linear Algebra, Numerical and Complex Analysis
- Probability and Statistics

- Deep Learning
- Machine Learning
- Advanced Calculus
- Algorithms

Certifications:

| BCI &Neurotechnology Spring School 2023, 140 hours 14 Credit course by Top researchers

| Cyber-Physical Systems Summer School 2022, IIT Kgp

Technical Skills

Languages: *Proficient* - C, C++, Python | *Familiar* - Bash, Html,Matlab, LaTeX
Libraries/Frameworks: OpenCV, NumPy, Matplotlib, PyTorch, TensorFlow, HuggingFace
Software Skills: Git, GitHub, VS Code, Google Colab