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Shreyas Grampurohit

Research interests

My research interests lie at the intersection of deep learning and signal processing, including learning-based inverse problems, compressive sensing, and interpretable recovery, as well as ML for systems and computer architecture.

Education

Indian Institute of Technology Bombay *Nov 2021 - Jun 2026*

B.Tech. and M.Tech. in Electrical Engineering (Communication and Signal Processing) *CPI: 8.99/10*
Minor Degree in Computer Science and Engineering

Honors and Awards

- IEEE Computer Architecture Letters publication selected for the **Best of CAL** session at HPCA 2026 *(2025)*
- Received the **Best Poster Presentation Award** at the RISC Symposium conducted by IIT Bombay *(2025)*
- Awarded the Kishore Vaigyanik Protsahan Yojana (KVPY) fellowship with an **All India Rank 198** *(2021)*
- Achieved **All India Rank 495** in JEE Advanced | 99.89 percentile in JEE Main among Million candidates *(2021)*
- Secured an **All Maharashtra Rank 13** in the MHT-CET examination among 200,000 aspirants *(2021)*

Publications

Accepted / Published

- S Prakash et al. **"QuArch: A Question-Answering Dataset for AI Agents in Computer Architecture."** *IEEE Computer Architecture Letters (CAL)*. [PDF] *(2025)*
  Selected for the Best of CAL session at HPCA 2026 (one of 3 papers selected from 90+)
- SJ Grampurohit, S Mulleti, A Rajwade. **"Two-Dimensional Tomographic Reconstruction From Projections With Unknown Angles and Unknown Spatial Shifts."** Under Review at IEEE ICASSP 2026 [PDF] *(2025)*

Preprints / Under Review

- SJ Grampurohit, S Mulleti, A Rajwade. **"Verifiable Deep Quantitative Group Testing."** [PDF] *(2025)*

Research Experience

Deep Learning for Group Testing *(Apr 2025 – Present)*

Dual Degree Thesis | Guide: Prof. Ajit Rajwade and Prof. Satish Mulleti

- Designed a noise-robust Deep Learning solver for **Quantitative Group Testing**, achieving reconstruction performance matching state-of-the-art combinatorial algorithms across varying sparsity levels
- Established **structural verifiability** by introducing novel Jacobian analysis, showcasing that the network implicitly internalizes the combinatorial structure of the problem rather than merely memorizing statistical patterns of the training data
- Conducted extensive comparisons against model-based solvers like **Approximate Message Passing**, demonstrating the framework's superior signal recovery resilience in regimes with sparse measurement noise
- Extending the framework to recover real-valued signals for applications like viral load estimation, and establishing rigorous theoretical guarantees for data-driven solvers

Archipedia: Generative AI for Hardware Design *(Jan 2024 – Present)*

In-semester Research | Guide: Prof. Vijay Janapa Reddi, Edge Computing Lab, ***Harvard University***

- Spearheaded the development of "Archipedia," a **one-billion-token** dataset covering 50 years of premier computer architecture research, **leading** a team of ten students to execute large-scale data scraping strategies
- Co-authored **QuArch**, a benchmark utilizing the dataset to evaluate LLMs in computer architecture; paper accepted to IEEE CAL and selected for '**Best of CAL**' session at HPCA 2026.
- Architected metadata extraction and validation pipelines on AWS to parse thousands of academic manuscripts, creating a structured knowledge base designed to answer research questions regarding hardware design evolution

- Collaborating on research questions to answer with Archipedia and on broader directions for **foundation models** for computer architecture in general

ArchGym: Open-Source Gymnasium for ML-Assisted Architecture Design *(Jun 2023 – Aug 2023)*

Research Internship | Guide: Prof. Vijay Janapa Reddi, Edge Computing Lab, ***Harvard University***

- Contributed to ArchGym, an open-source framework connecting diverse ML algorithms to architecture simulators
- Developed ML-based **proxy models** to mitigate simulator latency, optimizing the accuracy-speed trade-off
- Led automated documentation generation and authored comprehensive guides to ensure research reproducibility

Tomography Under Unknown Angles and Spatial Shifts *(Aug 2024 – Mar 2025)*

Research Project | Guide: Prof. Ajit Rajwade and Prof. Satish Mulleti

- Developed a robust reconstruction framework for Cryo-EM Tomography to address the ill-posed inverse problem of recovering 2D images from projections corrupted by both unknown viewing angles and arbitrary spatial shifts.
- Formulated a **three-way alternating minimization** algorithm that jointly refines the image and geometry, utilizing a shift-aware **modified Graph Laplacian** initialization to prevent local minima.
- Proved the theoretical non-feasibility of spectral invariant estimators for arbitrary translational shifts, establishing the necessity of the proposed iterative refinement approach
- Achieved **2.36** times lower RRMSE compared to baselines that neglect shifts; received Best Poster Presentation Award at RISC 2025 (IIT Bombay) and manuscript is under review at ICASSP 2026

Professional Experience

Digital Electronics Intern, Texas Instruments *(May 2024 – Jul 2024)*

Radar Business Unit | Bengaluru, India

- Conducted comprehensive performance benchmarking of radar chip architectures using **Coremark** and **Dhrystone** suites, generating critical data to guide architectural trade-offs and design specifications
- Analyzed cache utilization metrics on a **QuickTurn emulator**, implementing modifications to cache interactions to accurately simulate subsystem algorithms and identify performance bottlenecks
- Extracted key performance metrics which enabled the team to project a **30% reduction in power** and **40% lower area utilization** for the optimized architecture

Teaching and Mentorship

Teaching Assistant | Signal Processing *(Aug 2025 – Nov 2025)*

Prof. Preeti Rao, Department of Electrical Engineering, IIT Bombay | 100+ students

Summer of Science Mentor | Image Processing *(May 2025 – Jul 2025)*

Maths and Physics Club, IIT Bombay | Designed the curriculum and guided seven students

Academic Projects

Human-Feedback-Boosted Generation of Neutrophil Images *(Jan 2024 – May 2024)*

Machine Learning and Statistical Methods in Healthcare | Prof. Kshitij Jadhav

- Trained **diffusion model** from scratch to generate synthetic histopathology images to tackle medical image scarcity
- Designed multi-label reward model to guide clinically plausible image generation from expert **pathologist feedback**
- Improved plausibility from **82% to 90%** via fine-tuning with feature-weighted feedback obtained via Label Studio

Embedded DSP System Design *(Jan 2025 – Apr 2025)*

Digital Signal Processing Software and Hardware Lab | Prof. Preeti Rao

- Optimized real-time FIR & IIR filter implementation on TI ezDSP5515 using C and Assembly with **circular buffers**
- Accelerated spectrum analysis by using DMA with **ping-pong buffers** to feed dedicated FFT hardware accelerator
- Designed a hardware-based **DTMF decoder** and developed multirate filters for DSP systems in GNU Radio

Markov Decision Processes and Reinforcement Learning *(Jan 2025 – Apr 2025)*

Foundations of Intelligent and Learning Agents | Prof. Shivaram Kalyanakrishnan

- Implemented UCB, KL-UCB, Epsilon-Greedy, Thompson Sampling on **multi-armed stochastic bandits**
- Built MDP planner (Policy Iteration & LP) and encoder/decoder to solve stochastic gridworld game optimally
- Designed RL agent with CMA-ES **policy search** for high-speed autonomous driving across unseen racetracks

Denoising Diffusion Probabilistic Models *(Aug 2023 – Nov 2023)*

Advanced Topics in Machine Learning | *Prof. Amit Sethi*

- Implemented **DDPM** framework with a custom U-Net architecture to synthesize realistic images from noise
- Explored and optimized **noise scheduling** strategies (linear vs cosine) to improve training stability
- Extended the model to color image generation in HSV space, achieving higher quality and diversity of outputs

Energy-efficient Spatial Data Prefetcher *(Aug 2024 – Nov 2024)*

Advanced Computer Architecture | *Prof. Biswabandan Panda*

- Improved energy-efficiency of Bingo Spatial Data Prefetcher by achieving **90%** accuracy while maintaining speedup
- Used a confidence-based prefetch filtering mechanism to improve accuracy and evaluated IPC and other metrics using the **ChampSim simulator**

Parallel Simulation of Retinal Neuron Networks *(Aug 2024 – Nov 2024)*

High Performance Scientific Computing | *Prof. Shivasubramanian Gopalakrishnan*

- Accelerated neuron network simulations in C++ with OpenMP, achieving **4.6× speedup** on multi-core processors
- Implemented inter- and intra-neuron parallelization strategies to scale efficiently to 1000+ computational units
- Conducted detailed **profiling** and performance analysis to identify bottlenecks and validate scalability

FPGA-based RRAM Characterization Instrument *(Jan 2024 – May 2024)*

Electronic Design Lab | *Prof. Siddharth Tallur*

- Led design of analog frontend (amplifiers, ADC/DAC interface) for FPGA-based RRAM characterization system
- Developed Python GUI to interface FPGA with laptop, enabling real-time control, data acquisition, and visualization
- Delivered end-to-end hardware pipeline, from schematic and PCB design to prototype testing, achieving $<5\%$ error

Stereo Vision and Shape from Shading *(Jan 2025 – Apr 2025)*

Computer Vision | *Prof. Subhasis Chaudhuri*

- Implemented stereo vision algorithms on Middlebury dataset to recover **depth maps** with quantitative evaluation
- Developed shape-from-shading to reconstruct **3D geometry** from single image under varying noise and illumination

Technical Skills

Softwares/Languages	Python, C, C++, MATLAB, VHDL, Assembly, GNURadio, Quartus Prime, Keil μVision
Libraries	PyTorch, NumPy, Scikit-Learn, Pandas, Matplotlib, SciPy, OpenCV, Selenium, OpenAI Gym
Miscellaneous	OpenMP, MPI, CUDA C, LaTeX, NgSPICE, Google Cloud Platform, AWS

Relevant Coursework

Electrical Engineering	Digital Signal Processing, Computer Vision, Markov Chains, Communication Systems, Applied Linear Algebra, Communication Networks, Control Systems, Microprocessors, Digital Systems, VLSI Design
Computer Science	Advanced Image Processing, Medical Image Computing, Foundations of Intelligent and Learning Agents, Advanced Computer Architecture, Operating Systems, Data Structures and Algorithms
Machine Learning	Data Science, Advanced Topics in Machine Learning, Machine Learning and Statistical Methods in Healthcare

Extracurricular Activities

- Volunteered for management and leadership for various treks conducted by the Adventure Club at IIT Bombay
- Successfully completed one year of professional training under the National Sports Organization (NSO)
- Attained A2 level proficiency in the German examinations conducted by Goethe Institut, Max Mueller Bhavan
- Completed two levels of the Akhil Bharatiya Gandharva Harmonium exams