Harsha Vardhan Tetali

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LinkedIn, Google Scholar

EXPERIENCE

Postdoctoral Researcher May 2024 - Present
Department of Computer Science, University of Helsinki
Multi-source probabilistic inference research group
Advising and working along students in:

- Machine learning models for Metabolic modeling.
- Physics-informed machine learning for wave propagation.

Staff Engineer - DSP Architecture Team May 2023 - Dec 2024
Marvell Technology, Inc.
Generative Modeling of NAND Flash

- **Spatio-temporal Channel Modeling** (includes modeling for different wordlines and blocks within SSD at different strain conditions) for SSD NAND Channel using data collected from physical NAND chips.
- **Demonstrated** the relevance of using Gaussian Processes for Spatio-temporal modeling of SSD NAND Channel Modeling.
- **Developed** a **Spatio-temporal** generative model for SSD NAND using **Gaussian Processes** and implemented it in *PyTorch*.
- **Developed** and **distributed** the functional module for the above to others in the team to use it directly and **simulate NAND Flash behavior at the voltage level**.

LLMs (GenAI) work

- **Evaluated** multiple leading **LLMs**, developed metrics, to suggest to use within the company.
- **Evaluated Embedding models** for code and text and **developed** metrics and experiments for the same.
- **Implemented** a local **RAG** for internal use within the company.

Data Collection for NAND Flash Modeling

- Wrote scripts to run python programs to collect Voltage level data to extract histograms of voltage (probability distributions) of NAND Flash
- Ran various experiments to exert different stress conditions (program erase cycling, read disturb, and high temperature data retention) on SSD NAND Flash and collect the voltage distribution data.

Skills Associated: Python, Pytorch, Scikit-learn, Numpy, Algorithms and Data Structures, Mathematical Modeling, Signal Processing, Machine Learning, Deep Learning, Scripting.

Channel Modeling DSP Engineer Intern May 2022 - August 2022
Marvell Technology, Inc.

- **Developed** Spatio-temporal models for SSD NAND channels (estimation of probability densities) with special emphasis in **modeling the tail part** of the distribution to **obtain better error characteristics**.

- **Processed** huge datasets of SSD NANDs at the voltage level and **developed** algorithms that work on producing results from the entire dataset within reasonable time.

Research & Teaching Assistant August 2018 - May 2023
University of Florida, Gainesville

- Digital Signal Processing (Teaching Assistant, Fall 2018, Fall 2021) & Computer networks (Summer 2021)
- **Introducing** physics based constraints into unsupervised machine learning models (dictionary learning and matrix factorization) and **bridging machine learning with mathematical physics** through means of **optimization theory** and ultimately using them for **Structural Health Monitoring** applications.
- This work is mostly based on ideas from **discretization of differential equations** and **non-convex optimization**.
- Made **significant contributions** to enhancing **interpretability** in scientific machine learning, particularly **physics-informed machine learning**.
- Dealt with huge acoustic wave (traveling in solids) datasets and obtained fast algorithms for **data completion/imputation** and similar other processing of signals.
- Published in **IEEE Transactions on Signal Processing (TSP)**, **IEEE Sensors**, **IEEE Machine Learning for Signal Processing (MLSP)**, **Acoustic Society of America (ASA)**, **NeurIPS workshop for Machine Learning in Physical Sciences**, etc.

Skills Associated: Signal Processing, Mathematical Modeling, Numerical Optimization, Physics-informed machine learning, MATLAB.

Teaching Assistant August 2016 - May 2018
Indian Institute of Technology, Gandhinagar (IITGN)

- Probability and Random Processes, Control Theory, Pattern Recognition and Machine Learning, The Art and Science of Photography (short course)

EDUCATION

Graduate, **Doctor of Philosophy** August 2018 - May 2023
Electrical and Computer Engineering
University of Florida, Gainesville (GPA: 3.93/4.0)
Thesis: **Physics-Informed Matrix Factorizations and Approximate Eigendecompositions in Structural Health Monitoring**
Advisor: Prof. Joel B. Harley.

Graduate, **Masters of Technology** August 2016 - June 2018
Electrical Engineering
Indian Institute of Technology, Gandhinagar (CPI: 8.94/10)
Thesis: **Estimation of Scene-Flow from Optical-Flow for Rigid Body Translations**
Advisor: Prof. Shanmuganathan Raman.

Undergraduate, **Bachelors of Technology** July 2012 - May 2016
Electronics and Communications Engineering
Sardar Vallabhbhai National Institute of Technology, Surat (CGPA: 7.96/10)
Thesis: **Tracking of Fingers in Sixth-Sense Technology**
Advisor: Prof. Prashant K. Shah.

INTERESTS Physics-informed machine learning, Computational Physics, Numerical methods, Signal Processing, Large Language Models (LLM), Retrieval Augmented Generation (RAG), Theoretical machine learning, Optimization theory.