SINJINI BANERJEE

https://sinjini77.github.io/SinjiniBanerjee/

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TECHNICAL SKILLS

Programming Languages	Julia | Python | C | Matlab | SQL
Deep Learning Frameworks	TensorFlow | PyTorch | JAX | Keras
Software tools	Jupyter Notebook | Eclipse | Colab | Atom/Uber-Juno | Gurobi Optimiser | Simulink | Android Studio | Onshape |
Hardware tools	Arduino | Programmable Logic Controllers (PLC) | Raspberry Pi
Data Analysis and Visualization	NumPy | SciPy | Pandas | Scikit-Learn | Matplotlib | Seaborn | Plotly
Statistical Analysis	Hypothesis Testing | Regression Analysis | ANOVA | Statistical Modeling | Experimental Design

EDUCATION

Rutgers University, NJ	Ph.D. – Electrical Engineering (Specialization: Information & Signal Processing)	GPA 3.93/4	Sept 2020 – Present
University at Buffalo – SUNY	M.S. – Electrical Engineering, Thesis: Signal optimization	GPA 3.62/4	June 2019
Heritage Institute of Technology, Kolkata, India	B.Tech – Applied Electronics & Instrumentation Engineering	GPA 8.35/10	July 2016

WORK EXPERIENCE

Graduate Research Assistant, Department of Electrical and Computer Engineering, Rutgers University Sept 2020 – Present

- **Measuring training variability from stochastic optimization using robust nonparametric testing** (TensorFlow, Pytorch, Jax)
  - Formulated a robust hypothesis testing framework to quantify the top two critical instability factors in deep learning optimization, in collaboration with Pacific Northwest National Laboratory.
  - Delivered a novel model selection metric that surpasses traditional accuracy measures in capturing model similarity with 95% confidence, enabling identification of the optimal model ensemble size for a 10% improvement in reliable predictions.
  - Built, optimized, and fine-tuned over 1000 deep learning models (Feedforward Neural Networks, MLPs, CNNs, Vision Transformer, Large Language Models) using high-performance computing (HPC) infrastructure provided by Rutgers' Office of Advanced Research Computing, improving training time by 90%.
- **Mitigating risks associated with prediction inconsistency of equally accurate deep net models in machine learning model markets** (TensorFlow, Pytorch, Jax)
  - Designed a novel safety-critical audit tool to address the negative impacts of prediction inconsistency of deep learning models, achieving 99% accuracy across six datasets, in financial and medical risk mitigation applications.
  - Improved an algorithm to generate robust counterfactual explanations, providing actionable recourse to 95% of negatively impacted clients.

Graduate Teaching Assistant, Department of Electrical and Computer Engineering, Rutgers University Sept 2024 – Present

- Instructed over 90 first-year engineering students in developing core technical and analytical skills, including 3D CAD modeling (Onshape), MATLAB programming, and data analysis with Excel.
- Developed hands-on coding assignments and real-world engineering challenges that strengthened students' understanding of MATLAB control flow, functions, and data plotting.
- Guided students through 14 debugging sessions and best practices for writing efficient code.

INTERNSHIP

Intern, Department of Electrical Engineering, University at Buffalo (Julia) Aug 2019 – May 2020

- Developed a novel outlier-robust Recursive Least Squares (RLS) algorithm by integrating sparsity-aware modeling of outliers within a hierarchical optimization framework (HO-RLS), enhancing robustness in noisy environments by 20%.
- Benchmarked performance against eight state-of-the-art robust RLS variants, showing superior estimation accuracy and faster adaptation in stationary and non-stationary signal processing scenarios.
- Improved algorithm performance by 30% through parallel computing implementation on clusters available at the Center for Computation Research at the University at Buffalo.

PAPERS

- Banerjee, S., Marrinan, T., Cannon, R., Chiang, T., & Sarwate, A. D. (2024). Measuring training variability from stochastic optimization using robust nonparametric testing. arXiv preprint arXiv:2406.08307 (To appear in IEEE Journal of Selected Topics in Signal Processing). June 2025
- Slavakis, K., & Banerjee, S. (2019). Robust hierarchical-optimization RLS against sparse outliers. IEEE Signal Processing Letters, 27, 171-175. Dec 2019

POSTER PRESENTATIONS

- Bellairs Workshop on Machine Learning and Statistical Signal Processing for Data on Graphs. Jan 2023
- DIMACS Workshop on Modeling Randomness in Neural Network Training: Mathematical, Statistical, and Numerical Guarantees. June 2024

ACADEMIC PROJECTS

Understanding tensor decomposition for spectral unmixing in hyperspectral images (Matlab) Sept 2021 – Sept 2022

- Applied spectral analysis techniques to process and analyze high-dimensional hyperspectral image data.
- Implemented efficient spectral unmixing through low-rank tensor decomposition to extract endmembers and generate abundance maps with 15% improvement over traditional methods, when applied to remote sensing and environmental monitoring applications.

Musical Instrument Recognition using harmonics Oct 2017 – Dec 2017

- Extracted harmonic profiles of flute and piano recordings using cepstral analysis, identifying over 10 key distinguishing features in timbre and frequency response with 95% accuracy, which enabled enhanced instrument classification.

Classification of cancer subgroups using microarray gene expression data Sept 2016 – Mar 2017

- Implemented particle swarm optimization and adaptive K-nearest neighborhood technique on lung cancer data to classify cancer subgroups.
- Extracted 14 genes that can be efficiently exploited for high-accuracy diagnostic prediction through the t-test method for dimensionality reduction.