# SINJINI BANERJEE

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

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## TECHNICAL SKILLS

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|---|---|
| Software tools | Matlab/Simulink \| Jupyter Notebook \| Eclipse \| Colab \| Tensorflow \| Pytorch \| Jax \| Atom/ Uber-Juno \| Gurobi Optimiser \| Android Studio \| Onshape |
| Programming Languages | Julia \| Python \| C \| SQL |
| Hardware Tools | Arduino \| Programmable Logic Controllers (PLC) |

## EDUCATION

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|---|---|---|---|
| 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,** (Utilized TensorFlow, Pytorch, Jax)
  - Developed a robust hypothesis testing framework to quantify model variability due to stochastic optimization in deep learning models, in collaboration with Pacific Northwest National Laboratory.
  - Introduced a novel model selection metric that goes beyond traditional accuracy measures to better capture model similarity and to identify the number of models to ensemble for reliable predictions.
  - Built, optimized, and fine-tuned over 1000 deep learning models (Feedforward Neural Networks, MLPs, CNNs, Vision Transformer, BERT) using high-performance computing (HPC) infrastructure provided by Rutgers' Office of Advanced Research Computing.
- **Mitigating risks associated with prediction inconsistency of equally accurate deep net models in machine learning model markets,** (Utilized TensorFlow, Pytorch, Jax)
  - Designed and developed a testing tool to identify clients negatively impacted by prediction inconsistency with 95% accuracy in high stakes application domains like credit-lending.
  - Minimized costs associated with providing human intervention by establishing high probabilistic guarantee on true positives.
  - Developed an algorithm to generate robust counterfactuals for clients negatively impacted by prediction inconsistency.

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

- Taught and supported 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 control flow, functions, vectorized operations, and data plotting in MATLAB.
- Guided students through debugging sessions and best practices for writing efficient, readable code, laying a strong foundation for future work in data science, machine learning, and computational modeling.

## INTERNSHIP

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

- Developed a novel outlier-robust Recursive Least Squares (RLS) algorithm by integrating sparsity-aware modeling of outliers with a hierarchical optimization framework (HO-RLS), enhancing robustness in noisy environments.
- Benchmarked performance against state-of-the-art robust RLS variants, showing superior estimation accuracy and faster adaptation in both stationary and non-stationary signal processing scenarios.
- Validated algorithm effectiveness and improved performance through extensive synthetic experiments and the implementation of parallel computing on clusters available at Center for Computation Research at 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. Jan 2020

## ACADEMIC PROJECTS

**Understanding tensor decomposition for spectral unmixing in hyperspectral images,** (Utilized 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 applications in remote sensing and environmental monitoring.

**Musical Instrument Recognition using harmonics** Oct 2017 – Dec 2017

- Used cepstral analysis to identify, study, and characterize individual notes of two different musical instruments, flute and piano, in the reverse frequency domain.

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

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

## WORKSHOPS

- 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