

Debdut Mandal

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Education

University of Southern California, Los Angeles, USA

M.S. in Electrical Engineering

- Completed 3.5 years of PhD-track research in quantitative modeling, optimization, and inverse problems.

Dec 2025

MS GPA: 3.7/4, Overall GPA: 3.54/4

Indian Institute of Technology (IIT) Kharagpur, India

Integrated B.Tech + M.Tech in Electronics and Electrical Communication Engineering

2017 – 2022

CGPA: 9.18/10

Research Experience:

Multi-Modal Survival Analysis for Blood Cancer Risk Stratification

Jan'26

Personal Project (QRT challenge'26)

- Built an end-to-end **survival analysis** pipeline for adult myeloid leukemia prognosis using multi-center clinical and somatic mutation data, engineering patient-level features (cytogenetics tokenization, Variant Allele Frequency summaries etc)
- Trained and validated censoring-aware models (Cox / XGBoost-Cox) with 5-fold CV, tuning hyperparameters against IPCW C-index at $\tau=7y$.

Optimization & Probabilistic Modeling of Multidimensional Magnetic Resonance (MR) image

2022 – 2025

University of Southern California, Electrical Engineering (Advisor: Prof. Justin Haldar)

- Lead developer of open-source Diffusion-Relaxation MRI software (DRSuite) for multidimensional MRI: phantom generation, spectral estimation (via Non-negative least square, Alternating Direction Method of Multipliers (ADMM) and Linearized ADMM), visualization, and Cramer Rao Lower Bound (CRLB)-based acquisition analysis
- Built reproducible benchmarking and validation tooling (synthetic phantoms + metrics) to compare estimators acquired from multidimensional MR dataset and enable collaborator adoption
- Developed and benchmarked a **Linearized ADMM solver** to recover spatial-spectral maps from indirect, noisy measurements; modeled linearly predictable signals (autoregressive moving-average) as mixtures of exponentials with structural regularization (finite difference prior), delivering **3–50x** speedups and **2–15x** memory efficiency over prior baselines
- Designed **structured low-rank regularized estimators (non-convex)** to resolve closely spaced spectral components (highly ill-posed) from multidimensional MR data; demonstrated improved component separability on real datasets.
- Analyzed uncertainty in **joint spectral estimation**, showing theoretically and empirically that spectral amplitude uncertainty decreases approximately as **O(1/N)** with the number of measurements N.

Neural Coding of Two-Tone Harmonic Complexes (TTHC) in Mouse Auditory Cortex

2021 – 2022

IIT Kharagpur, Information Processing Lab (Advisor: Prof. Sharba Bandyopadhyay)

- Quantified cortical encoding of TTHCs by modeling tuning to fundamental frequency (BF0) and measuring **enhancement/suppression** relative to matched pure tones across neuron types
- Performed population-level statistical tests and correlation analysis (**BF/BF0 distributions, noise correlations**) to characterize sex-specific signatures and harmonic selectivity vs matched nonharmonic controls.

Axon Radii Estimation from Clinical diffusion Magnetic Resonance Imaging (dMRI)

2020 – 2021

Harvard Medical School, Psychiatry Neuroimaging Lab (Advisor: Prof. Yogesh Rathi)

- Developed a predictive estimator for high-b diffusion MRI signals from clinical low-b acquisitions by combining a **sparse spherical ridgelet angular** model with a **bi-exponential radial decay** model, solved via **ADMM**
- Built a stress-test + benchmarking suite on synthetic and in-vivo Prisma data; demonstrated **lowest** high-b prediction error under realistic noise.
- Demonstrated consistent axon radii estimates against histology and high-gradient MRI references, despite fitting only on low-b acquisitions.

Achievements

- Selected as an **Annenberg Fellow** for graduate studies at the University of Southern California, 2022
- IITKGP–GKF Scholarship** (USD 5000) by Guru Krupa Foundation & IITKGP Foundation (USA) to support summer research internship at Harvard Medical School, 2020, total 6 awarded (among ≈ 1000 students) in a calendar year.
- Batch of 1985 Scholarship** (USD 1500) for excellent academic performance among a cohort of 120 students, IIT Kharagpur, 2018.

Additional Information

- Languages:** Python (NumPy, SciPy, pandas, scikit-learn, PyTorch), MATLAB
- Software:** Git, unit testing, profiling, benchmarking, reproducible pipelines
- Signal/Image processing:** filtering, FFT/DCT/wavelets, time-frequency analysis, estimation & inverse problems, quantization, uncertainty/CRLB, low-rank models, PCA, probabilistic noise modeling

Relevant Courses

A deep understanding of AI LLM mechanisms, Probability for Electrical and Computer Engineers; Estimation theory; Computational Methods for Inverse Problems; Random Processes in Engineering; Geometry of Deep Learning; Convex Optimization, Digital Signal Processing

Publications

- Y. Liu, **D. Mandal***, C. Liao, K. Setsompop, J. Haldar, “An Efficient Algorithm for Spatial-Spectral Partial Volume Compartment Mapping with Applications to Multicomponent Diffusion and Relaxation MRI”, 2025. *->equal contribution
- A. De, S. Agarwalla, R. Kaushik, **D. Mandal**, S. Bandyopadhyay, “Differential encoding of two-tone harmonics in the male and female mouse auditory cortex”, *Journal of Neuroscience*, 2024.
- D. Mandal**, L. Ning, Y. Rathi, “In-vivo estimation of axon radii from clinical scanners”, IEEE ISBI, 2023.