Himadri Mandal

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in quirtt

Education

Indian Statistical Institute, Kolkata **August 2023 — present**
Statistics Undergraduate, Incoming 3rd year — 85% cumulative (2nd year)

Programming experience
Python: PyTorch, Numpy, Pandas, Bash, R, Next.js + TailwindCSS, LaTeX, Linux (Arch Linux on i3)

Selected fellowships and awards

ISI K. Outstanding Performance: awarded January 2024, received ₹1500
ISI Kolkata B.Stat. Entrance: awarded August 2023, ranked 11th
Indian Olympiad Qualifier for Mathematics, KV: awarded February 2021, rank 4 in my region
Atlas Fellowship India Finalist: awarded September 2022, received 1000$, top 200 in a rationality fellowship
IISc Enumeration Finalist: awarded October 2022
CMI Tessellate Finalist: awarded October 2021

Projects

Research

Active Simple Hypothesis Testing: w/ Sushant Vijayan, **TIFR** *July 2025 — Ongoing*
Ongoing research project on creating theory to better understand the Fixed Confidence problem by understanding the Active Simple Hypothesis Testing problem. Building on top of PDE + Game Theoretic ideas introduced by Sushant in this problem.

Sample Complexity Lower Bounds: w/ Sandeep Juneja et. al. @ **CDLDS** *May 2025 — Ongoing*
On-going research project on understanding fixed confidence sample complexity lower Bounds in the Tabular Reinforcement Learning setup, creating algorithms and building on ideas from Garivier et. al.

Diffusion Models for Rare Events: w/ Sandeep Juneja et. al. @ **CDLDS** *February 2025 — Ongoing*
Submission. On-going research project on using Diffusion Models to perform rare event sampling. Experimented and discussed many ideas, built algorithms and managed to prove strong bounds justifying the experimental results. Through the project I learnt everything about the recent research in Diffusion Models. Also, I learnt Stochastic Calculus from Michael Steele.

Circuit Phenomenology Using Sparse Autoencoders: w/ David Udell *June 2024 — July 2024*
Preprint. Sparse autoencoders enable interpretable representations of model activations, aiding mechanistic interpretability by uncovering causal circuits. We went through the literature, independently implemented circuit discovery for GPT-2-small and ended up finding big errors in the implementation of the algorithm in the latest paper by David Bau. We solved those issues, and experiemented with newer ideas, improving circuit discovery in GPT-2-small.

Selected Courses/Workshops

DS: Probability and Optimization Methods: ICTS, Bangalore *4th August 2025 — 15th August 2025*
Highly rigourous sessions on Game Theoretic MARL, Reinforcement Learning, Learning Theory, Diffusion and Flow Matching, Optimal Transport, Data Assimilation, Posterior Sampling, and Theory for Overparamterized Learning for faculties, graduate students and advanced undergraduates.

exSPLORe2025 Workshop: **SCDLDS**, Ashoka University *14th January 2025 — 18th January 2025*

This workshop in Statistics, Probability, Learning and Optimization Research had two days of basic tutorials for graduates and advanced undergraduates, offering 3-hour sessions each on the basics of probability, learning, and optimization, led by leading experts. The following three days had a research workshop, with talks by leaders in the field.

CaMLAB: Cambridge AI Safety Hub *8th April 2024 — 21st April 2024*

Course to build ML engineering fundamentals for AI Safety research. Includes basics of PyTorch, training and tuning GPTs and ResNets, interpreting models with TransformerLens, and an introduction to RL, RLHF.

Deep Learning: ISI Kolkata *January 2024 — March 2024*

A winter course on deep learning covering Autoencoders, CNNs, GANs, GNNs, Diffusion models, RNNs, Attention mechanics, Transformers, etc.

Measure Theory: Maths Club, ISI Kolkata *December 2023 — February 2024*

Introductory course on Measure Theory which helped me understand all the details in our Probability courses.

Theoretical

Ideas on DNA Storage:

Blog. I go through the current SoTA on the DNA Storage problem, and introduce ideas to improve DNA sequencing techniques with AI.

Universal Source Coding:

Report. The broad setup is the following: there's data coming in from some source. If the source distribution is known, then Huffman Encoding gives the optimal encoding scheme. This project tries to figure out a good encoding scheme (in multiple contexts!) that guarantees performance against all source distributions!

Independence Is Almost Dependence:

Blog. My independently discovered proof to a theorem: given two independent random variables X, Y you can come up with two new random variables U, V which have the same marginals and ϵ-close joints but are deterministically dependent.

Axiom of Choice, the Zorn's Lemma and their equivalence:

Blog. An expository article on Axiom of Choice, Zorn's Lemma and their equivalence.

Cold Reflections:

Link. My blog on Mathematics, Statistics, Philosophy and everything else that interests me. I add some of my work there.

Empirical/Programming

Ponderings on OthelloGPT:

Blog. Mechanistic Interpretability project. OthelloGPT is a GPT model trained on Othello games to predict all the possible legal moves. I look into how the model computes how a certain cell is blank.

ORIGAMI:

Repo. Implements arXiv:2303.17062, AISTATS 2023. A paper on dimensionality reduction of the support to improve computational efficiency in downstream decision making.

Bibilometric Analysis of Psychology:

Report. A scalable, data-driven bibliometric analysis of psychology and related fields over 2000–2025, using author-assigned keywords from the top 20 h5-index journals in SCOPUS. We further quantify divergences between popularity and impact rankings to highlight emerging research areas, and demonstrate a replicable workflow for mapping disciplinary evolution through simple yet powerful computational methods.

Predicting Liver Disease With Logistic Regression:

Report. We use Logistic Regression to predict if patients have Liver Disease. We also look into the reliability of the and try to understand what parameters are the most important in the model.

Economic Behavior in two different Political Regimes:

Report. Investigating the economic behavior of the top large cap and top mid cap companies during the political tenures of UPA and BJP.

Shannon's Mind Reading Game:

Blog. Repo. The magician sends you a deck of cards. You riffle shuffle it three times. You pick the card from the top and put it back in the deck, somewhere. You send the deck back to the magician. Can he find the chosen card?

Selected work experience

Research

Student Researcher: SCDLDS, Ashoka University *May 2025 — Ongoing*

Working as a Student Researcher on building Diffusion Models to better estimate exponentially twisted probability distributions, Fixed Confidence Sample Complexity Lower Bounds in Tabular RL, etc.

Software

Website Lead: MTRP, Integration *November 2023 — January 2024*

Repo. Preview. Deployed a website for the university's fest's annual mathematics competition after learning Next.JS and TailwindCSS, all of it took a week. Maintained it for efficiency and bugfixes.

Volunteer and outreach

Owner: awas *October 2020 — October 2022*

Served as the **organizer and mentor** for daily math problem solving sessions, philosopical debates, and programming discussions for over two years on **Discord**. Mentored smart math enthusiasts, from all over India, learn hard math, and guided a few of them to get into the Indian training camp of IMO.