Nandini Bhattad

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Education

Bachelor of Science, Statistics and Data Science 2022 - 2026
Indian Institute of Technology Kanpur | GPA: 8.1/10 *Kanpur, India*
Minors (retrospective): Machine Learning, Cognitive Science

Higher Secondary Certificate Examination (Grade 12) 2022
Arham School and Junior College, MSBSHSE | Percent: 87.8/100 *Pune, India*

Indian Certificate of Secondary Education Examination (Grade 10) 2020
The Bishop's Co-Ed School Undri, ICSE | Percent: 98.4/100 *Pune, India*

Scholastic Achievements

- Awarded the Innovation in Science Pursuit for Inspired Research Scholarship (**INSPIRE**) for 2023, 2024 and 2025.
- Secured **All India Rank 3018** in the Join Entrance Examination (JEE Advanced 2022) amongst 150K candidates.
- Secured a percentile of **99.49** in the Join Entrance Examination (JEE Mains 2022) amongst over 1.1M candidates.

Research Projects

Approximate Thompson Sampling for Contextual Bandits

Prof. Dootika Vats, IIT Kanpur *Jul '25 – Present*

- Reviewed literature on contextual **multi-armed bandits** and approximate Bayesian methods for **Thompson Sampling**, including **Langevin Monte Carlo**, Feel-Good variants, **Moreau–Yosida envelopes**, and **Barker dynamics**.
- Formulated a Moreau–Yosida envelope–based smoothing of the non-differentiable Feel-Good Thompson Sampling (FGTS) objective and benchmarked it against the existing Softplus-based Smoothed FGTS.
- Implemented Barker dynamics as an alternative to Langevin Monte Carlo for posterior sampling, demonstrating **improved computational efficiency** and **minimized cumulative regret** in linear contextual bandits.

Probabilistic Assignment Rules with Restricted Fractional Endowments

Prof. Soumyarup Sadhukhan, IIT Kanpur *Jul '25 – Present*

- Reviewed literature on **utility theory**, **matching theory** and the **top trading cycle(TTC)** mechanism with deterministic & fractional endowments and desirable characteristics of probabilistic assignment rules.
- Proved that convex combinations of TTC allocations simultaneously satisfy **SD-efficiency**, **SD-strategy-proofness** and **SD-individual rationality** for 3-agent house exchange, addressing an open problem in probabilistic matching theory.
- Characterized feasible mechanisms through **Birkhoff-von Neumann decomposition** of fractional endowments, showing that any 3-agent probabilistic assignment can be expressed as a convex combination of deterministic TTC allocations.

Personalized Recommendation for Transport Itinerary (Poster)

Prof. Shankar Prawesh, IIT Kanpur | Students-Undergraduate Research Graduate Excellence Program *May '24 – Jul '24*

- Reviewed literature on **discrete choice modeling** to understand decision-making in transport behavior.
- Applied **Multinomial** and **Mixed Logit** frameworks in R to Boeing airlines & Swissmetro datasets to evaluate the impact of cost, time, and comfort on travel mode selection. **Optimized travel choice offerings** based on customer preferences which helped **increase revenue** in the transport industry.
- Demonstrated that mixed logit models provide a superior fit by capturing individual preference heterogeneity, assessed through log-likelihood.

Study of Non-Parametric Regression

Prof. Suprio Bhar & Prof. Subhra Sankar Dhar, IIT Kanpur *Jan '24 – Apr '24*

- Implemented **non-parametric regression** models using the **Nadaraya–Watson estimator** with kernel smoothing and Legendre polynomial basis to estimate functional relationships between $(L^2[0,1])$ spaces.
- Analyzed convergence behavior across different bandwidths and kernels like Normal & Epanechnikov to study **bias–variance trade-offs** in functional data settings.

Key Projects

Generative AI for Hardware Architecture

Prof. Vijay Janapa Reddi, Harvard University *May '24 – Jul '24*

- Contributed to developing a **query retrieval model** for computer hardware design using **Large Language Models**.
- Segregated over 50 years of data through detailed labels for enhancing the **guidance for learning algorithms** and crafted prompt templates to evaluate both model comprehension skills and expertise in computer hardware.
- Implemented a pipeline for model evaluation using the **EleutherAI evaluation harness** and evaluated LLMs like **Claude**, **GPT-4**, **Llama2-7b** on the **QuArch dataset** for accuracy, F1 score and exact match metrics.

Bayesian Inference Based on Expected Evaluation

Prof. Arnab Hazra, IIT Kanpur | Course Project *Jan '25 – May '25*

- Implemented a modern Bayesian inference approach for cases where the likelihood is unknown or intractable, improving over **ABC** and **BSL** by avoiding threshold and Gaussian assumptions.
- Designed an unbiased approximate likelihood estimator using **classification-based discrepancy** & **Hermite polynomial expansions**. Executed **MCMC simulations** and validated the method's consistency through experiments on synthetic data, showing decreasing error with more iterations.

Abstractive Text Summarisation

Prof. Subhajit Dutta, IIT Kanpur | Course Project *Jan '24 – Apr '24*

- Curated a large dataset with **80 million data points** for training the model to generate original abstractive text summaries. Formulated **word2vec** for generating word embeddings to represent the entire vocabulary and capture semantic relationships.
- Engineered a multi-level **LSTM** network with **48 million** parameters to enhance overall coherence of the generated text.

Sentiment Analysis

Brain and Cognitive Society, IIT Kanpur *Dec '24 – Feb '24*

- Developed **binary** and **multiclass classifiers** to detect sentiment, distinguish AI vs. human text, and categorize 30+ emotions and topics including politics, entertainment, sports, and economy.
- Finetuned **ROBERTa base**, **DistilBERT** and **deberta** on datasets like GoEmotions, IMDB, NEWMTS and outputs of GPT2 model. Provided an user-friendly interface to interact with the models by developing a **Gradio** application.

Work Experience

FX Quant Analyst *Received a Pre-Placement Offer*

Deutsche Bank, India *May '25 – Jul '25*

- Developed **trading strategies** for optimal holding periods of **currency pair swaps** by applying **hypothesis testing** to compare carry across tenors. Identified currency pairs that **maximize returns** over longer durations and those better suited for early shorting.
- **Backtested** the ranking system for interest rate assets by categorizing them by rank and evaluating performance using metrics such as average win, win rate, expectancy ratio, and drawdown. Conducted a sanity check of the system, enabling its proposal to traders for **improved portfolio management**.

Relevant Coursework

(: Excellent Performance, † : Ongoing)*

Statistics/ML: Probability and Statistics, Time Series Analysis, Introduction to Machine Learning*, Statistical Computing, Statistical & AI Techniques in Data Mining*, Foundation of Modern AI†, Introduction to Bayesian Analysis, Elementary Stochastic Processes, Linear Regression & ANOVA, Theory of Statistics, Multivariate Analysis, Data Science Lab I, II, III*

Mathematics: Linear Algebra, Real Analysis, Single & Several Variable Calculus, Ordinary Differential Equations

Programming: Data Structures and Algorithms, Fundamentals of Computing

Technical Skills

- **Programming Languages:** R | Python | C | C++
- **Tools & Utilities:** Git | GitHub | Linux | HuggingFace | LaTeX
- **Libraries:** PyTorch | TensorFlow | NumPy | Pandas | Scikit-Learn

Leadership/Volunteering

Coordinator

English Literary Society, IIT Kanpur *Apr '24 - March '25*

- Led a **2-tier** team of **30 secretaries** to conduct diverse literary events for a community of **9000+ people**
- Curated content for **Dandelion**, a bi-monthly newsletter with an overall readership of **500+ campus residents**
- Organized a **Poetry Week** featuring **30+** artists and garnering **80%** increase in online post impressions

Volunteer

NITI Aayog, Bareilly *Jan '24*

- Led a **30-day online fundraising campaign**, mobilizing donations from **over 50** individuals to support the underprivileged in Bareilly.
- Initiated a **tree plantation drive** to encourage **sustainable environmental improvements**, promoting the event through impactful posters.