DWIJA KAKKAD

Senior undergraduate

Indian Institute of Technology, Kanpur

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Education

**Bachelor of Science	Mathematics and Scientific Computing**	**2021 - 2025(expected)**
Indian Institute of Technology, Kanpur	**CPI:** 8.2/10

Minors (retrospective): Machine Learning and Applications, Philosophy

**Grade XII	Puna International School**	85%	**2021**
**Grade X	Udgam School For Children**	98.6%	**2019**

Publication

Dwija Kakkad and Dootika Vats, Exact MCMC for Intractable Proposals, *arXiv preprint* (submitted)

Conferences

Exact MCMC for Intractable Proposals. Presented at : *Data Science Summit 2024*, Indian School of Business, Hyderabad, India. [*poster*]

Research Experience

Multiple Try Metropolis with Bernoulli Factories
Jan'23 - Apr'23

Prof. Dootika Vats, IIT Kanpur — [report] ⌨

- Reviewed literature on the **Metropolis-Hastings algorithm**, its variants, and **Bernoulli factories**.
- Proposed a new algorithm using Multiple Try Metropolis with Bernoulli factories to sample from intractable posteriors.
- Compared the performance of this new algorithm to the standard **Barker's algorithm** with Bernoulli factories.
- Showed that increasing the number of proposals reduces Bernoulli loops and **improves** the **mean execution time**.

Effects of Acute Stress and Trait Anxiety on Decision Making
Sep'22-Apr'23

Prof. Arjun Ramakrishnan, IIT Kanpur — [report]

- Reviewed literature on **Neuroeconomics**, **Gaussian Process models**, **EEG analysis** and Game Theory.
- Assisted in the **experiment design** and **data collection** of the pilot trials of a dynamic **Penalty Shot** game.
- Performed data cleaning of behavioral data collected and used **linear mixed effects models** and **non-parametric tests** in **R** to analyse the relationships between the affective states of arousal and valence and various decision variables.

Projects

Importance Sampling kernel density estimator
Nov'24-present

Prof. Sakshi Arya, *Prof. Dootika Vats*

- Proved **pointwise consistency**, **asymptotic normality**, and verified the expression and convergence rate of the **asymptotic mean squared error** for an **importance sampling Kernel Density Estimator**.
- Working on analysing the asymptotic properties of a **self-normalized importance sampling estimator**.

Slice Sampling
Aug'23 - Nov'23

Prof. Dootika Vats, IIT Kanpur — ⌨

- Reviewed literature on **Slice Sampling** and **Elliptical Slice Sampling** for continuous and discrete distributions.
- Implemented slice sampling and elliptical slice sampling algorithms for **univariate standard normal** and **multivariate Bayesian logistic regression** and compared the performance to the standard Metropolis Hastings algorithm.
- Reviewed literature on **parallel MCMC** using **generalized elliptical slice sampling** for Bayesian posteriors.

Analysis and Prediction of Stock Market Data
Nov'23

Prof. Amit Mitra | *Course Project*

- Analysed NIFTY50 data using time series methods and implemented **ARIMA** modeling for trend forecasting.
- Applied **Keltner Channel Trading Strategy** to interpret and generate buy and sell signals based on market data.

Scoring a company based on ESG factors
Prof. Suman Saurabh | Finance and Analytics Club
Dec'22-Jan'23

- Performed data extraction and analysis of **annual reports** of companies from 2011-2022 on **S&P BSE500** index.
- Used an **NLP model** to analyze the Environmental, Social and Governance **(ESG)** disclosures in the annual reports.
- Categorized the companies as having high or low ESG disclosure, **developed a portfolio** of high ESG and low ESG firms and compared the portfolio performance on historical data using **ratios and other indicators**.

Portfolio Optimization and Risk Analysis
Self Project
Jun'22

- Constructed a portfolio of 10 stocks from the NSE500 index and **implemented Markowitz Optimization** on this portfolio to plot the efficient frontier and locate the portfolio having **maximum Sharpe Ratio**.
- Implemented **constant proportion portfolio insurance (CPPI)** trading strategy on this and tested it against historical data to see how well it performs in terms of **returns**, **volatility**, **value at risk** and **drawdown**.
- Created a **risk module** with functions to calculate risk measures like **VaR, CVaR, drawdown** and **semi-deviation**.

Work Experience

Summer Associate
Finmechanics, India
May'24 - Jul'24

- Developed Excel validation sheets for mark-to-market pricing of **basket vanilla equity options** using **Monte Carlo simulations**, incorporating **implied stock correlations** to accurately model the stock path evolution.
- Gained an understanding of structured products such as **autocallables** and **softcallables** through term sheets, and developed **Python validations** to align system outputs with market standards, reducing the error to **0.1%**.

Relevant Coursework

Statistics/ML: Probability and Statistics, Time Series Analysis, Introduction to Machine Learning, Statistical Computing, Statistical & AI Techniques in Data Mining, Inference 2

Mathematics: Linear Algebra, Set Theory and Logic, Real Analysis, Abstract Algebra, Complex Analysis, Several Variable Calculus, Ordinary Differential Equations, Partial Differential Equations

Programming: Data Structures and Algorithms, Numerical Analysis & Scientific Computing, Fundamentals of Computing

Technical Skills

Programming Languages: R, Python, C/C++, Matlab, Java
Software/ Utilities: Git, LaTeX, SQL, Excel-VBA

Scholastic Achievements

- Secured **All India Rank 2426** in **JEE Advanced 2021**, among 1,50,000 shortlisted candidates.
- Secured a percentile of **99.87** in **JEE Mains 2021**, conducted by **NTA** among 1 million candidates.
- Awarded the Innovation in Science Pursuit for Inspired Research Scholarship **(INSPIRE)** for **2021-22 and 2022-23**.

Leadership /Volunteering

Academics and Career Council
Academic Department Mentor
Aug'23- present
IIT Kanpur

- Responsible for providing **academic mentorship** to the junior batches of the mathematics and statistics department.
- Conducted sessions to familiarize students with the professors, courses and the workings of the department.

Stamatics
Coordinator
Aug'22- Aug'23
IIT Kanpur

- Recruited and headed a team of 15 executives to assist with the conduction of talks and sessions in the department.
- Ideated and conducted an **online pan-India math contest** 'Mathemania' with participation of over 900 students.
- Mentored a project with 50 mentees on building a Computer Vision library using the C programming language.

Counselling Services
Student Guide
Sep'22- Sep'23
IIT Kanpur

- Mentored a group of 5 freshmen academically and emotionally to get acclimatized to the new college environment.
- Assisted the counselling servies team in flawless execution of **UG Orientation** for 1200 students of the class of 2022.