Siddhant S. Singh

Fourth Year Undergraduate
B.S Mathematics, M.S Statistics & Data Science
Indian Institute of Technology, Kanpur

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EDUCATION

Examination	University	Institute	Year	CPI/%
Graduation	IIT Kanpur	IIT Kanpur	2025	8.20/10.0
Intermediate/+2	CBSE	Shivjyoti Convent School	2020	95.4
Matriculation	CBSE	Dr.KKR Gowtham's International School	2018	86.8

ACHIEVEMENTS

- **All India Rank 1363** in **JEE Mains 2020** among 1.25 million candidates from across the country 2020
- **All India Rank 680** in **JEE Advanced 2020** among 150,000 shortlisted candidates from across the country 2020
- **Awarded INSPIRE** Scholarship by the Dept. of Science & Tech, **Govt.of India** 2021
- Ranked **3rd** among 300+ participants in IITK Alphathon conducted by **Worldquant** 2023

WORK EXPERIENCE

Wells Fargo | Summer Internship Hyderabad,India May 2023 - July 2023

- Used **front-end developement** technologies such as **React, Javascript** to create a web application for the company
- Created a **web interface** for users to help manage and track their credit card activities along with creating the **database schema** for an H2 database system, solving the problem of potential **security and identity threat**
- Performed **automated unit tests** for unit testing every functionality such as Hooks, APIs, forms etc using **RTL and Jest**
- Received a **Pre-Placement Offer (PPO)** from the company for **excellent performance** during the internship

ONGOING RESEARCH EXPERIENCE

Portfolio Optimization using Deep Learning & Reinforcement Learning | Under Graduate Project *finance* | July 2023
Mentor - Prof. Amit Mitra

- Solved for the **efficient frontier** in various cases like **short sales allowed/disallowed**, presence/absence of **risk free rate** through methods involving **ODE** and **quadratic optimization** in R
- Estimated the adjusted **portfolio betas**, correlation structure using models such as **single-index** model, **multi-index** models
- Used Deep Learning seq2seq models such as **LSTM**, **Transformer**, etc to classify the price movement and predict future returns. Achieved an **accuracy of 89.7% on OOD** price classification using **attention with LSTM decoder** network.
- Performed literature review on **Discrete Wavelet Transform**(DWT), **technical indicators** as part of **feature engineering**.
- Future work involves using **Reinforcement Learning** for **portfolio allocation & optimization**, risk management

EtiCor: Towards Analyzing LLMs for Etiquettes (Accepted at EMLNP) Jan 2023 - May 2023
Mentor - Prof. Ashutosh Modi

- Analysed **Delphi, Falcon40B and GPT-3.5** to investigate the cultural bias around the world
- Introduced a new corpus, **EtiCor**, integrating a total of **35K etiquettes** from **5 major regions** around the world, namely, Japan and Taiwan, Latin America, India, Middle East, etc
- **Evaluated the LLM's** on a new task of **etiquette sensitivity** in a zero-shot setting, comparing the f1 score and accuracy
- **Fine-tuned BERT** on EtiCor in a supervised setting increasing the accuracy by 8% on an average
- Further work is being carried out to propose a **novel architecture** for the pertaining task

PAST RESEARCH EXPERIENCE

Multi-agent Game Theoretic Simulation Using RL | Self Project *Siddhant7876/RLproject* | Aug 2021

- Conducted **comprehensive literature review** on Reinforcement Learning techniques, Game Theoretic approaches in evolutionary biology, economics, and altruistic traits across diverse animal species.
- Derived insights into natural **altruism** and diverse agent strategies.
- Constructed a **Deep Q-network** with **Leaky ReLU** activation function in the **Pytorch** framework for agent decision-making using Reinforcement Learning in simulations.
- Conclusively established the value of altruistic behavior through extensive simulations across various animal kingdoms, with key references available in these RL papers and Game Theory.

Statistical Simulation and Data Analysis | Course Project, MTH511
Mentor - Prof. Arnab Hazra

- Implemented a research paper introducing **OLLLTN**, a distribution to fit all types of **bimodal data** in the interval (0,1)
- Coded up **sampling methods** for the distribution and then demonstrated that OLLLTN distribution parameters can be accurately estimated through **Monte Carlo simulations**.
- Used various **optimization techniques** and **link functions** for better convergence
- Extended the **LTN regression** to the OLLLTN and applied it on real-world data, **Human Development Index**(HDI) data
- Analysed the **AIC and GD** metrics which proved better performance than **SIMPLEX, LTN** and other bimodal models

Modeling real data with a Bayesian bivariate geometric mixed-effects model | Course Project, MTH 535
Mentor - Prof. Arnab Hazra

- Analysed the **dragonfly population data** to find the property of zero inflation and correlation between response variables justifying the logical choice of **Zero-Inflated Bi-variate Geometric** (ZIBGe) distribution as the **GLMM model**
- Implemented **MCMC**, using **JAGS software**, for parameter estimation and posterior sampling in synthetic data
- Analysed the **Trace plots** and **autocorrelation plots** of the parameters indicating the convergence of the MCMC chains.
- Compared the fitting of **ZIBGe** with **BZIP** using **DIC** as metric proving superiority of ZIBGe

MISCELLANEOUS

Bitcoin's Lightning Network Research | Self Project Feb 2022 - March 2022

- Explored Bitcoin and Lightning Network fundamentals through sources like *Mastering Bitcoin* and *Mastering Lightning Network* by Andreas M. Antonopoulos.
- Studied concepts such as shortest paths, residual networks, path augmenting, and max flow-min cut problems.
- Analyzed the lightning network graph for potential anarchy due to selfish routing, applying game theory including Nash equilibrium. Modeled the network as Braess's paradox to establish a Price of Anarchy bound.
- Compared network variables (traffic congestion, routing fees, time, security) under a policy to reduce the price of anarchy against current values.

Object detection with Faster RCNN | Self Project *siddhant7876/Faster RCNN* | Aug 2021

- **Reviewed State-of-the-art papers** in the field of **object detection** specifically focusing on **R-CNN and Faster R-CNN**, **analyzed time complexities and computational efficiency** of both the aforementioned methods
- **Trained and fine-tuned** a faster R-CNN model on Kaggle's fruit detection dataset with **88% accuracy using pytorch**

Algo 101x | Stamatics, IIT Kanpur Feb 2022 - June 2022

- Implemented algorithms covering **binary search, hashing, collision handling, Sieve of Eratosthenes, factorization**, and **Dynamic Programming with bitmasking**.
- Explored range query techniques like **sqrt decomposition, segment trees, sparse tables**, and **binary indexed trees**, alongside **variations of the Knapsack problem, binary lifting,** and **Union-Find**.

POSITIONS OF RESPONSIBILITY

- **Secretary**, Brain and Cognitive Society, IIT Kanpur
  - **Organised lectures, workshops, and assignments** for freshmen on the use of **RNN to model the dynamical nature of neurons** while receiving current signals and its effects on the firing rate activity
- **Senior Technical Member**, Team VISiON, IIT Kanpur
  - Led a team of 5 students in Amazon Deep Racer Challenge & ranked **under 30 internationally** among 3000+ participating teams

SKILLS

- **Languages:** C/C++, Python, HTML, Javascript
- **Libraries:** Numpy, Pandas, Pytorch, Tensorflow, Seaborn, OpenCV, NLTK, Scikit-Learn, Spacy, Huggingface, React
- **Utilities:** Git, GitHub, Bash, Ubuntu, ROS, Docker, LaTeX
- **Soft Skills:** Time Management, Teamwork, Communication, Problem Solving, Leadership, Hard Work
- **Competitive Programming:** competitive programmer on Codeforces and **4star** rating on **Codechef (max 1999)** UserID - siddhant7876

RELEVANT COURSES

Time Series Analysis	Statistical NLP	Stochastic Processes
Data structures & Algorithms	Intro to ML	Image Processing
Statistical Simulation & Data Analysis	Bayesian Analysis	Probability & Statistics
Adv. Linear Algebra & ODE	Game Theory	Adv. Real Analysis