

Pursuing **Honours** in Computer Science & **Minor** from the Centre for Machine Intelligence and Data Science

## Scholastic Achievements

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- **Department Rank 5** in a batch of 190+ students, displaying consistent academic proficiency 2023
- Secured **All India Rank 14** in the **Joint Entrance Exam** (Advanced) amongst  $\sim 150,000$  candidates 2021
- Won a **Gold Medal** for India at the **International Junior Science Olympiad** held in Botswana 2018
- Selected as part of the 5-member Indian contingent for the 51st **International Physics Olympiad** 2021
- Awarded IIT Bombay's **Institute Academic Prize for 1st place** among 1400+ first year students 2022
- Received the **AP grade** for exceptional academic performance (**top 1%**) in 4 courses at IITB 2021-22
- Granted the prestigious **KVPY Fellowship** by achieving **All India Ranks 2 (SA)** and **4 (SX)** 2019, 20

## Research Experience and Projects

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### Partial Order methods for concurrent program verification

Summer '23

Prof. Andreas Pavlogiannis, Aarhus University

Research Internship

- Extended a large, existing Java codebase for the M2 algorithm, to detect memory bugs in **multithreaded programs**
- Reviewed literature for efficient **consistency checking** of an execution with applications in the **design of microprocessors**
- Implemented the algorithms utilising a suffix-minima based data structure for storing dynamic, low-width partial orders

### Quantum Computing, Quantum Machine Learning

Summer '22

Web and Coding Club, IITB

Summer Project

- Designed a QML circuit for a **Single Qubit Classifier**, labeling points in a 2D-region with 92.3% accuracy
- Implemented Quantum Circuits using IBM's Qiskit SDK to solve a **3 SAT problem with Grover's search algorithm**, and simulated quantum teleportation, superdense coding, **quantum fourier transform**, phase estimation, Shor's algorithm

### Robust Optimization for ML & Optimal Learning

June '23-Present

Prof. Debasish Chatterjee, IITB

Ongoing Research Project

- Attempting to extend techniques for near-optimal solutions of **convex SIPs** to function recovery from *noisy* data
- Exploring **Hamiltonian Monte Carlo** to employ targeted sampling for faster optimization in higher dimensional spaces

### Linear time decodable Graph Codes

Autumn '23

Prof. Nikhil Karamchandani, IITB

Course Project

- Studied the properties of **expander graphs**, and the rate, distance metrics of **error correcting codes** derived from them
- Presented the algorithm for  $\mathcal{O}(N)$  recovery from upto  $\sim D/4$  bit flips for an  $[N, K, D]$  code, and its complexity analysis

### Super-Resolution of face images with a k-PCA prior

Spring '23

Prof. Suyash Awate, IITB

Course Project

- Extracted higher order, **non-linear correlations** in face images by constructing a prior model using **Kernel PCA**.
- Combined it with a noise model based on known blur-matrices to obtain the **Bayesian posterior probability** model
- Implemented gradient descent to obtain the MAP estimate and super-resolved a set of low-resolution face images

### FastChat

Autumn '23

Prof. Kavi Arya, IITB

Course Project

- Built a **messenger service from scratch** with file transfer, group messaging, encryption, password authentication
- Implemented a network with multiple inter-communicating servers using the 'socket', 'select' python libraries, and a **PostgreSQL** database on the server side for storing user public keys, encrypted messages, passwords
- Used **bash scripting** to collect throughput and latency data, and optimized those by varying **load balancing** strategies

### Group Theory

Summer '22

Maths and Physics Club, IITB

Reading Project

- Read **Group Theory** from *Abstract Algebra, Dummit & Foote* and summarised the results in a comprehensive report
- Covered topics including Homomorphisms, Group Actions, Cosets, **Lagrange's Theorem**, the **Sylow Theorems**

## Extracurricular Activities

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- Part of the city's runner group since 2018 and ran the **Aarhus Half Marathon**, Denmark in 1:43:21 2023
- Elected as **Head Boy** in the High School Council, and assisted in organizing events for  $\sim 1200$  students 2018-19