Pursuing a **Minor** in **Computer Science & Engineering**

Scholastic Achievements

- Awarded **Scholarship for Higher Education (SHE)** under **INSPIRE** program on the basis of **JEE Advanced** ('22)
- Awarded Certificate of Merit for being among the **Statewise top 1%** in the **Indian Olympiad Qualifier in Astronomy (IOQA)** in 2021 and was among top **400** students who qualified for **IOQA Part B** in **2020** and **2021** ('21)
- Among top **300** students in India who qualified the **Indian Olympiad Qualifier in Chemistry (IOQC) Part A** ('21)
- Recipient of **Kishore Vaigyanik Protsahan Yojana (SA)** Scholarship with **AIR 388** amongst **50,000+** candidates ('20)
- Among top **540** candidates in India selected to appear for **Indian National Mathematics Olympiad (INMO)** ('20)
- Among top **2000** students in India selected for the **National Talent Search Examination (NTSE)** scholarship ('20)

Research Projects and Internships

Generative Machine Learning Models for Data Assimilation | **Polymath Jr. REU** (May '24 - Present)
Guides: Prof. Ricardo Baptista (CalTech), Giulio Trigila (Baruch College, CUNY), Tanya Wang (NYU)
- Developing new **generative models** using **data-driven optimal transport flows**, advanced kernel methods, and normalizing flows in high-dimensions approximating functional derivatives in a reproducing kernel Hilbert Space
- Implementing **adaptive bandwidth kernel gradients** and improving convergence using **JAX** and NumPy libraries
- Evaluating models on 2D benchmarks, image generation, **Bayesian inference** using gradient descent optimization

Industrial Research and Consultancy Centre | **Intern** (May '24 - Present)
Research & Development | IIT Bombay
- Collaborated with **10+** professors and Dean R&D office for information dissemination to industry and stakeholders
- **Authored** non-technical **documentation** for **40+** patents contributing to creating a compendium of granted patents
- Worked with **20+** students and utilized research writing skills to compile and present comprehensive information

Key Projects

Reinforcement Learning in Cybersecurity | **Seasons of Code** (Jun '24 - Present)
Web and Coding Club | IIT Bombay
- Developing **Intrusion Detection Systems (IDS)** with Reinforcement Learning for **automated anomaly detection** in closed networks by leveraging approaches like **Deep Q-Network** and **Proximal Policy Optimization** strategies
- Learning **Wireshark** to work with features in the network like protocols, type of communication, and transfer rates
- Creating a secure **test environment** to simulate different network scenarios and validate the performance of IDS

Option Pricing Models and Their Accuracy | **FinSearch** (Jun '24 - Present)
Finance Club | IIT Bombay
- Implemented the **Black-Scholes** and **Cox-Ross-Rubinstein Binomial** models to predict option prices of **Apple Inc.**
- Researched Options; **Option Greeks**, their influence and cross-interaction; pricing models and their inaccuracies

Out-of-distribution (OOD) detection | **Course Project** (Apr '24 - May '24)
Guide: Prof. Abir De | Course: Introduction to Machine Learning
- Added Out-of-Distribution detection capabilities into a naive classifier using **ODIN** method for better accuracy
- Developed a CNN using **TensorFlow Keras** for image classification with Conv2D, MaxPooling, and Dense layers
- Evaluated the model on relevant metrics for out-of-distribution detection like Area under ROC curve **(AUROC)** and True Negative Rate at True Positive Rate 95% **(TNR@TPR95)** to handle the skewed distribution of the dataset

Quantitative Analysis for Derivatives Trading Strategy | WiDS (Dec '23 - Jan '24)
Analytics Club | IIT Bombay
- Analyzed **candlestick** patterns like Doji and **indicators** like MACD, Relative Strength Index, and Bollinger Bands
- Developed an indicator in **Pine Script** to identify the **Doji** candlestick pattern in **TradingView** platform dataset
- Handled **live data** for high-frequency trading and used Doji candlestick pattern for decision-making strategies

Robot Chasing a Moving Target Using Grid-Based Planner | **Course Project** (Mar '24 - Apr '24)
Guide: Prof. Arpita Sinha | Course: Motion Planning and Coordination of Autonomous Vehicles
- Developed and optimized a **2D grid-based path planning** algorithm using the **A* search** and **Dijkstra's** algorithm
- Implemented **collision detection** using **custom heuristics** and algorithms to ensure safe navigation in 9 complex environments with up to **2000x2000 cells**, achieving real-time pathfinding for a point robot chasing a moving target

Graph Machine Learning | **Summer of Science** (May '24 - Present)
Maths and Physics Club | *IIT Bombay*
- Explored theoretical foundations of **GNNs**, emphasizing applications in **node classification** and **graph analysis**
- Studied **Graph Convolutional Networks** and **Variational Autoencoders** techniques to analyze graph structures

Combinatorial Computing | **Seasons of Code** (May '23 - Jul '23)
Web and Coding Club | *IIT Bombay*
- Solved various problems on **partitions** and Ferrer diagrams, using enumeration and **backtrack programming**
- Used **z3 SAT Solver** in **Python** to make a **sudoku solver** by formulating the problem in Conjunctive Normal Form
- Implemented a solution for the **bipartite matching problem** by employing algorithmic solution of **Hall's Theorem**
- Explored Latin squares, Delaunay triangulation, posets, lattices, matching theory, and other combinatorial topics

Mountain Cargo | **Course Project** (May '23 - Jun '23)
Guide: Prof. Ankit Jain | *Course: Makerspace* | *IIT Bombay*
- Engineered a pre-programmed **line following bot** to navigate a complex track and deliver the payload at the end
- Employed **Arduino** programming, **L298N motor drivers**, and **IR sensors** for precise line-following on the track
- Used **3D printing** and servo motors to design and develop an autonomous payload delivery mechanism in the bot

Positions of Responsibility

Motion Planning Engineer | **Team AeRoVe** | **Unmesh Mashruwala Innovation Cell** (Oct '23 - Mar '24)
- Ranked **7th worldwide** among 23 international teams in **simulation round** of the prestigious **International Conference on Unmanned Aircraft Systems'24 UAV competition**, organized by LARICS from the **University of Zagreb**
- Created a **custom algorithm** using heuristics and compartmentalization on the well-known **two-opt algorithm**
- Incorporated **velocities** and **yaw** into the heuristic to create paths that traverse all the waypoints in the **least time**
- Used **OpenCV** to count fruits and avoid double counting through a drone in a greenhouse environment in **Gazebo**

Teaching Assistant | **CS228** | **Department of Computer Science & Engineering** (Jul '24 - Present)
- Selected as a teaching assistant for **Logic for CS**, a core course for second year undergraduates in CSE department
- Responsible for conducting regular tutorial sessions for a class of **100+ students** and evaluating their answer scripts

Web and Design Secretary | **Mathematics Association** (Aug '23 - Jun '24)
- Responsible for maintaining the official **website** for the **Mathematics Association** and ensuring an online presence
- Increased **user engagement** and retention through designing creative posts on social media handles like **Instagram**

Department Academic Mentor | **Student Mentorship Program** (Jun '23 - Present)
- Guiding **4** students, contributing to their **academic counselling**, and organising departmental information sessions
- Serving the student community in supporting sophomores in their overall development and academic progress

Mentor | **Seasons of Code** | **Web and Coding Club** (Jun '24 - Present)
- Mentoring students for an eight-week-long project on **Computational Graph Theory** involving graph algorithms
- Delivered weekly resources and problems on topics like BFS, DFS, Dijkstra, Binary Trees, and Bipartite matching
- Guiding students in exploring **graph colouring algorithms** to build a Sudoku solver by modelling it as a graph

Technical Skills

Programming	C++ | Python | ROS | HTML | CSS
Software	Docker | Fusion360 | Arduino | Gazebo | ArduPilot | GitHub | LaTeX | Canva
Libraries	NumPy | Pandas | Scikit-Learn | Jax | PyTorch | TensorFlow | Keras | Matplotlib

Key Courses Undertaken

Mathematics	Linear Algebra, Probability I, Optimization, Differential Equations, Numerical Analysis*
Computer Science	Introduction to Machine Learning, Computer Programming & Utilization, Logic for CS
Engineering	Motion Planning and Coordination of Autonomous Vehicles, Makerspace

**Ongoing courses*

Extra-Curriculars and Accolades

- Ranked **93** in India in the **IMC Prosperity** Challenge in manual trading division, showing trading excellence ('24)
- Secured **AIR 37** in **Technothlon**, a logic exam organised by **IIT Guwahati** and qualified for the second stage ('18)
- **Finalist** in **BotBrains Battle** competition organized by Robotics and Intelligent Society Club, IIT Bhubaneswar ('24)
- Mentored a student in Topology in the Summer of Science initiative by Maths and Physics Club, IIT Bombay ('24)
- Proficient at drawing photo-realistic pencil **portraits** of people, and **Copperplate** and **Spencerian Calligraphy**
- Shared **1st** rank among 150+ students in a **Hackerrank** contest conducted under Learners' Space, IIT Bombay ('23)
- Built a Wi-Fi-controlled racing bot by integrating ESP32 and L293D motor drivers using Arduino IDE in **XLR8** ('23)
- Among **top 4** finalists in the **Parikrama Board Games Competition** organised by Literati Club in IIT Bombay ('23)