Scholastic Achievments

- Bagged **All India Rank 57** in Joint Entrance Examination Advanced among **0.15 million+** candidates *('22)*
- Achieved **AIR 166** with centums in Maths and Physics in **JEE Main**, outperforming **1 million+** entrants *('22)*
- Secured **All India Rank 269** and was awarded the prestigious **KVPY** fellowship by Government of India *('22)*
- Achieved an **AP** (Advanced Performer) grade in Multivariable **Calculus**, given to the **top 1%** of students *('23)*
- Ranked within the **top 1% national students** among the **20,000+** participants in **IOQP** part 1 by IAPT *('22)*
- Selected for the **Amazon** ML School Program among **3,000** students from a pool of **85,000** applicants *('24)*
- Achieved a maximum rating of **1580** on **Codeforces** thereby attaining the prestigious title of **Specialist** *('24)*
- Achieved **All India Rank 112** in FIITJEE Talent Reward Examination among **0.15 million+** students *('19)*

Key Projects

Emotion Detection using CNN *(June '24 - July '24)*
Self Project *IIT Bombay*

- Developed an advanced emotion detection system utilizing a custom CNN model built from scratch with **TensorFlow** and **Keras** API capable of performing multi-class classification across 7 distinct categories on **FER-2013 Dataset**
- Implemented **image augmentation** techniques to address data imbalance & insufficiency enhancing model performance
- Leveraged transfer learning to fine-tune **VGG16** and **ResNet50** achieving a top accuracy of **66%** with ResNet50
- Conducted comprehensive model evaluation using F1 score, recall, and precision metrics for detailed analysis
- Successfully **deployed** the emotion detection model using **Gradio** for user-friendly accessibility and integrated **OpenCV** to capture and process real-time video streams enabling dynamic emotion detection in live scenarios

Automatic Index Creator in PostgreSQL Extension *(Mar '25 - Apr '25)*
Guide: Prof. S. Sudarshan | CSE Dept. | DBMS Course Project *IIT Bombay*

- Built an extension that hooks into the **planner** to detect **sequential scans** and identify indexing opportunities
- Applied **SPI** (Server Programming Interface) for executing DDL operations (e.g., CREATE INDEX) from within the extension codebase and advanced internal PostgreSQL APIs like **GUC**(Grand Unified Configuration) variables
- Designed a **benefit-cost analysis** using internal planner estimates to determine when index creation is justified
- Used **background workers** to create indexes asynchronously, avoiding disruption to query performance
- Maintained a tracking table aidx_queries to monitor indexing candidates, query frequency for the cost-benefit analysis

Operating System Snippets *(Jan '24 - Apr '24)*
Guide: Prof. Mythili Vutukuru | CSE Dept. | OS Course Project *IIT Bombay*

- Developed a custom shell in C++ with functionalities including **background/foreground** execution, **parallel/serial** command handling, **signal** management, **process** group control and efficient **background process** management
- Simulated **shared memory** and performed **IPC** using **pipes** along with local **socket communication**
- Explored synchronization techniques, **locking** mechanisms and utilized **semaphores** to manage concurrent processes
- Implemented core functionalities for a simple file system emulator, including operations for file **creation**, deletion, **opening**, closing, **reading**, **writing** and offset management utilizing **block-based storage** and **inode** handling
- Implemented custom system calls, memory management features like **mmap** and **copy-on-write** fork by implementing functions spanning process management, virtual memory management, system calls, and **trap handling** in **xv6**

Algorithmic Trader *(Oct '23 - Nov '23)*
Guide: Prof. Ashutosh Gupta | CSE Dept. | DSA Course Project *IIT Bombay*

- Developed an algorithmic trading system in **C++**, integrating data structures like **hash tables** and linked lists
- Designed & implemented a **custom unordered map** for handling trade orders, optimizing time and space complexity
- Applied **OOP** principles to create modular and scalable code thereby enhancing maintainability and readability
- Effectively implemented trading strategies like buying low/selling high & detecting **arbitrage** opportunities
- Implemented a scalable C++ market model, prioritizing price and time factors, with **socket integration** for efficient market communication, and developed an algorithmic trader strategy for real-time trading decisions

Blockchain Simulation & DEX *(Jan '25 - Apr '25)*
Guide: Prof. Vinay Ribeiro | CSE Dept. | Blockchains Course Project *IIT Bombay*

- Implemented a blockchain simulation to model decentralized nodes, block creation, transaction & block propagation along with **eclipse** & selfish mining attacks, incorporating network latency, **PoW** latency & event-driven scheduling
- Developed a decentralized exchange (DEX) in **Solidity**, with features like token swaps, liquidity addition & removal
- Implemented mechanisms for **LP token minting**, earning fees in proportion to LP token holdings, integrated swap functions by utilizing the **ERC20** technical standard and also showcased arbitrage exploitation

Handcrafted JPEG: Image Compression *(Sep '24 - Nov '24)*
Guide: Prof. Ajit Rajwade | CSE Dept. | Digital Image Processing Course Project *IIT Bombay*

- Implemented a custom JPEG encoder & decoder from scratch using **Python**, showcasing image compression expertise
- Applied discrete cosine transform **(DCT)**, quantization, **Huffman coding**, zig-zag scanning and **RLE** on zeros
- Introduced an **optimization** by omitting Huffman code lengths, exploiting the **prefix-free** property, which improved compression ratio up to **0.7×** over standard JPEG for select images at the same quality factor
- Reconstructed encoded images using **IDCT**, de-quantization & Huffman decoding to achieve accurate image recovery

Linux Bash File Organizer *(Mar '23 - June '23)*
Guide: Prof. Kameswari Chebrolu | CSE Dept. | Software Systems Lab Course Project *IIT Bombay*

- Created a versatile **Bash** script for automated file organization based on file **extension** and creation **date**
- Improved efficiency through features like optional file deletion, exclusion of extensions, and automated logging
- Enhanced user convenience with automated file extraction from ZIP archives within the source directory
- Implemented robust error handling, including directory existence checks, unique filename generation to prevent conflicts, and detailed summary reporting with folder and file count statistics, enhancing the user experience

Algorithmic Machine Learning *(Jan '24 - Apr '24)*
Guide: Prof. Swaprava Nath | CSE Dept. | AI/ML Course Project *IIT Bombay*

- Developed machine learning algorithms from scratch in Python (**Linear Regression**, Logistic Regression, **Naive Bayes**, Decision Trees, Perceptrons), demonstrating strong understanding of ML fundamentals and techniques
- Implemented NNs without libraries (Feedforward NNs, **CNNs**, **RNNs**) showcasing proficiency in Deep Learning
- Applied mathematical concepts through manual implementation of Softmax, **gradient descent** and **backpropagation**

Internship Experience

Computer Vision Intern *(Jan '24 - Mar '24)*
SangamOne Connected Services *IIT Bombay*

- Developed an Automatic Number Plate Recognition system for extracting license plate numbers from car photos
- Utilized SSD MobileNet V2 transfer learning to accurately mark license plate boundaries for improved recognition

Technical Skills

Programming	Bash | Solidity | C/C++ | Python | MIPS Assembly | React
Development	HTML | CSS | JavaScript | React | Make | NodeJS | MATLAB
Softwares and Packages	GitHub | LaTeX | NumPy | Pandas | Matplotlib | PySpark | SQL

Courses Undertaken

Computer Science	Data Structures and Algorithms | Discrete Structures | Data Analysis and Interpretation | Software Systems Lab | Digital Logic Design and Computer Architecture (DLDCA) | OS | AI & ML | Design & Analysis of Algorithms | Logic & Automata
Mathematics	Multivariable Calculus | Linear Algebra | Differential Equations | Real Analysis

Extracurricular Achievements

Cultural	• Clinched the top spot at the school level and secured the second position in the city-wide Gita chanting competition in Group B featuring over 1,000 students organized by the Chinmaya Mission • Achieved the **third position** in a speech competition, addressing an audience of **1,000** students • Mastered pastels, watercolors, and outlining to replicate intricate figure details in childhood
Technical	• Secured third place in the district-level Hindustan Olympiad for Aptitude and Current Affairs • Enhanced the GeeksForGeeks platform's codebase and functionality by contributing a testcase • Engaged in a school Science Exhibition showcasing LiFi technology by transmitting music through LEDs and receiving it via a solar panel demonstrating a strong grasp of innovative tech concepts
Misc.	• I play **guitar** as a hobby and can perform lead and basic **chord progressions** for several songs • Enrolled in **NCC** actively engaging in activities such as **map reading, and tent construction**