Shivam Kumar | **22B0917**
Computer Science & Engineering | **B.Tech.**
Indian Institute of Technology Bombay | **Gender: Male**
DOB: 13/07/2004

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2026	
Intermediate	CBSE	St. Paul's Senior Secondary School	2022	96.80%
Matriculation	CBSE	St. Paul's Senior Secondary School	2020	99.00%

Pursuing **Minor** in **Statistics and Informatics**

Scholastic Achievements

- Achieved an **All India Rank 326** in **Joint Entrance Examination Advanced** among 150k+ candidates *(2022)*
- Secured an **All India Rank 275** in **Joint Entrance Examination Main** among 1 million+ candidates *(2022)*
- Awarded the **AP (Advanced Performer) grade** in Sociology given to less than **1%** of students *(2023)*

Professional Experience

Yun Solutions | *Data Analyst Intern* *(May'24-June'24)*

- Implemented a **moving average technique** to identify sudden **spikes** in the straddle price fluctuations. Used it to analyze **inter-index** relationships, identifying instances where movements of **correlated indices diverged**
- Developed a **NN model** to predict **hourly closing prices** for major **indices** upto dte4, leveraged **Keras Tuner** for hyperparameter optimization and **SHAP** for feature relevance, achieving a mean error of **1.5-4.5%**
- Engineered a robust **API** using **Flask**, ensuring reliability through **Postman** testing, designed efficient **MongoDB** queries to fetch input features and populated the predictions on the frontend using **Next.js**

Key Projects

End-to-End ML/DL Models *(Spring 2023)*

Guide: Prof. Swaprava Nath | AI/ML *IIT Bombay*

- Implemented **linear & logistic regression, Decision Tree, SVM classifier, KNN, CNN,** and **RNN** models
- Learnt and implemented feature reduction techniques: **PCA** for unsupervised and **LDA** for supervised dataset
- Found **subgame perfect equilibrium** in TicTacToe and Notakto using **backward induction** and α-β **pruning**
- Implemented different equilibria in **Normal-form games** and the **Gale-Shapley** algorithm for perfect matching

OS Features Implementation: xv6 and Beyond *(Spring 2023)*

Guide: Prof. Mythili Vutukuru | Operating Systems *IIT Bombay*

- Developed a **shell** supporting background execution, signal handling, series & parallel execution of user commands
- Implemented **IPC** mechanisms: Unix domain **sockets**, POSIX **shared memeory**, and **pipes** for data exchange
- Implemented new **system calls**, modified the default scheduler to the **weighted round-robin scheduler**, **mmap** system call for **on-demand memory allocation**, and a **copy-on-write fork** mechanism in **xv6** OS
- Engineered reader-writer synchronization using **pthread mutexes** and **conditional variables** for both modes, ensuring optimal **multi-threading** performance alongwith custom **semaphores** for prevention of race-conditions

NIFTY Straddle price predictive model *(Mar'24)*

Self Project

- Developed an **LSTM** architecture to capture **temporal dependencies** and **nonlinear patterns** inherent in the NIFTY price data to **forecast** its **straddle prices** after **preprocessing** and **normalizing** the historical data.
- **Fine-tuned hyperparameters** to optimize model performance and mitigate **overfitting** through **grid search**

Algorithmic Trading Simulator *(Autumn 2023)*

Guide: Prof. Ashutosh Gupta | Data Structures & Algorithms *IIT Bombay*

- Executed an **algorithmic trading simulator** encompassing **order book analysis**, **virtual market simulation**, and systematic identification of **arbitrage** opportunities, with a focus on **optimizing profit margins**
- Implemented sophisticated strategies using **optimal data structures** for order selection that creates arbitrage
- Enhanced the simulator to perform execution of **linear combinations** of order taking care of order cancellation
- Extended the project across **multiple simulated markets**, capitalizing on cross-market arbitrage opportunities

Cache Replacement & Prefetching *(Autumn 2023)*

Guide: Prof. Biswabandan Panda | Course Project: Digital Logic Design & Computer Architecture *IIT Bombay*

- Gained insight into the inner workings of cache useful for **cache-conscious programming optimizations**
- Implemented and performed a comparative evaluation of various **cache replacement policies**, including LRU, LFU, FIFO, and BIP, within the ChampSim simulator across a wide array of workloads using various trace files
- Designed a **Stream prefetcher** to analyze memory access patterns and test effective prefetching strategies. Attained significant performance enhancement across a range of diverse workloads compared to **IP-Stride** prefetcher

Other Projects

Sorting & Searching in Assembly *(Autumn 2023)*
Guide: Prof. Biswabandan Panda | Course Project: Digital Logic Design & Computer Architecture *IIT Bombay*
- Wrote an **assembly program in MIPS** to find the number of elements smaller than a given query in an integer array by implementing **Heap Sort** and **Binary Search** to execute the program in **O(nlogn)** time complexity
- Wrote functions for implementation of **Vector** (data structure) and **Heap Sort** in **x86 assembly language**

Hand Written Digit Recognition *(Dec'22)*
Self Project
- Created a **logistic regression** and **Neural network** model to classify the handwritten digits using **sklearn, tensorflow, keras** and **OpenCV** trained on **MNIST** dataset and further tested it on self-handwritten dataset
- Tested it on **14,000** samples, achieving an accuracy of **92%** in **logistic** and **97.47%** in **Neural network** model

DevCom Website *(Jul'23-Aug'23)*
Developer's Community *IIT Bombay*
- Used **HTML** for structuring, **CSS** for styling, **Bootstrap** for responsive design, and **React** for dynamic user interfaces and routing to create an attractive and fully functional **official website of DevCom**
- Implemented intuitive **navigation and user interfaces**, ensuring the website's smooth accessibility by the users
- Meticulously **tested and optimized** the website's layout and functionality for smartphones, tablets, and laptops

Signal and Image processing *(Autumn 2023)*
Guide: Prof. Ajit V. Rajwade | Data Analysis & Interpretation *IIT Bombay*
- Implemented signal noise reduction techniques such as **Moving Statistical Filtering** with the help of MATLAB
- Graphically compared the variation in **correlation coefficient** and **quadratic mutual information(QMI)** of the pixel values of two MRI scans of the brain with the lateral shift in the images using **MATLAB**

Mountain Cargo Bot *(Spring 2022)*
Guide: Prof. Ankit Jain, Prof. John Joseph | Makerspace *IIT Bombay*
- Designed and built a specialized **four-wheeled bot** capable of **autonomously** following a white line path, ascending a challenging 30-degree incline carrying a 300-gram load, unloading the payload at the top, and retracing
- Implemented a precise **line-following algorithm** using IR sensors and **Arduino** microcontroller, designed a **payload carry-release mechanism**, and optimized the bot's motor control and power management systems.

Minesweeper Cricket *(Spring 2022)*
Guide: Prof. Kameshwari Chebrolu | Course Project: System Software lab *IIT Bombay*
- Conceptualized and executed a web game that blended two seemingly unrelated concepts, Cricket and Minesweeper
- Created an engaging and responsive user interface using **HTML and CSS**, allowing the user to choose the grid size, added sound effects and message popups, and implemented interactive gameplay logic using **JavaScript**

Positions of Responsibility

Core Member | *Developer's Community* *(Mar'23 - Dec'23)*
- Official member of IIT Bombay's **largest Developer's Community, DevCom** responsible for ideating, developing and deploying numerous applications such as **Instiapp, Resobin** which are used by over 5000+ students
- Worked on fixing front-end bugs in the **Resobin website**, implemented a **search bar feature** on the timetable page and developed the official website of **Devcom** using **HTML, CSS, Bootstrap and React**

Codewars Mentor | *WnCC* *(Mar'24 - Apr'24)*
- Mentored **two teams** of **4 members** each for the Codewars event, responsible for resolving their **technical queries** regarding problem statement and game engine setup also helped them with resolving programming bugs

Key Courses Undertaken

- **Computer Science:** Computer Programming and Utilization, Software Systems Lab, Data Structures and Algorithms (& lab), Discrete Structures, Data Analysis and Interpretation, Digital Logic Design and Computer Architecture (& lab), Design and Analysis of Algorithms, Operating Systems (& lab), AI/ML (& lab), Automata theory and Logic, Computer Networks (& lab)*, Abstractions and Paradigms for Programming (& lab)*
- **Mathematics & others:** Calculus, Linear Algebra, Differential Equations, Introduction to Probability, Introduction to Derivative Pricing, Economics, Makerspace, Sociology, Classical Mechanics, Quantum Physics, Biology

**To be completed by Autumn 2025*

Technical Skills

- **Languages:** C/C++, Python, Bash, MongoDB, MATLAB, LaTeX, VHDL, x86 and MIPS Assembly
- **Development:** HTML, CSS, JavaScript, TypeScript, Next.js, React, Git, GDB, Make, Docker, AutoCAD
- **Libraries:** NumPy, Pandas, Matplotlib, Seaborn, Sklearn, Tensorflow, Keras, openCV, Flask, BeautifulSoup

Extracurriculars

- Actively engaged in **competitive programming** hosted on various programming sites including **Codechef: 1898**, **Codeforces: 1619(Expert)** and **LeetCode: 1908(Knight)**, also have combinedly solved **900+** problems
- Part of team BamBhole which achieved **170th rank** among 3500+ teams at **ICPC India Preliminary Contest**
- Achieved a **global rank 532** and **568** in **CF round 957** and **920** respectively among $\sim 40,000k$ participants
- Participated in **XLR8 bot-making competition** conducted by **ERC** in a team of 4, in which built a **manually controlled bot** capable of negotiating different obstacles while completing the designated track efficiently
- Actively participated and completed an year-long **NSO** programme in **Squash** at IIT Bombay *(2023)*