



Kavya Gupta  
Computer Science & Engineering  
Indian Institute of Technology Bombay

22B1053  
B.Tech.  
Gender: Male  
DOB: 04/02/2004

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2026	
Intermediate	CBSE	Disha Delphi Public School, Kota	2022	97.00%
Matriculation	ICSE	City Montessori Inter College, Lucknow	2020	98.40%

Pursuing a Minor degree in Machine Intelligence and Data Science

## SCHOLASTIC ACHIEVEMENTS

- Awarded the **Institute Academic Award** for securing **Institute Rank 1** among 1400+ students (2023)
- Conferred with **7 AP (Advanced Performer)** grades given to the **top 1%** in Linear Algebra, Calculus I, II, Makerspace, Physical Chemistry, Quantum Physics and Computer Programming and Utilization (2022-23)
- Achieved **All India Rank 25** in **Joint Entrance Examination Advanced** out of 155,000+ candidates (2022)
- Secured **All India Rank 38** in **Joint Entrance Examination Main** amongst 1 million+ candidates (2022)
- Awarded the prestigious **KVPY Fellowship** twice and **NTSE Scholarship** by the **Govt. of India** (2020-21)
- Won **Gold Medal** and bagged **Global Rank 3** at *World International Mathematical Olympiad* (WIMO) (2021)
- Secured **Gold Medal** in *Thailand International Mathematical Olympiad* (TIMO) Final, Heat Round (2020-21)

## EXPERIENCE

### Software Development and Data Analysis Intern

(May 2024 - July 2024)

Internship

Franklin Templeton Investments

- Explored **Factor Investing** and stock market indexes like **MSCI USA Momentum**, **Quality**, **Enhanced Value**, **High Dividend**. Analyzed **metrics** like **Alpha** and **Beta** of market, and studied the **Pharma French Model**
- Developed **efficient** Python scripts using **Pandas** for **rank correlation** and **bucket returns** for each factor
- Applied **Generalised Linear Regression** in Python to calculate precise **factor returns** and **factor exposure**
- Integrated scripts with **PostgreSQL** database tables to ensure seamless **real-time handling** of data created
- Designed **interactive dashboards** using **Power BI**, featured with extensive **graphs**, **time series** charts and tables with **heatmaps** for better data visualisation and provided **custom filters** for smooth selection of data

## KEY PROJECTS

### BharatGPT: India's First Gen-AI

(Jan 2024 - April 2024)

RnD Project (CS490)

Guide: Prof. Ganesh Ramakrishnan

- Aimed to develop and train an **English Foundational Model** from scratch focusing on accuracy and scalability
- Pretrained Llama** which included creating a suitable **Docker** environment and tackling dependency issues
- Explored **Flash Attention** to enhance **transformer's efficiency**, reducing training time and inference latency
- Evaluated and compared the **MosaicML Pretrained Transformer** with **GPT-3** for performance optimizations
- Analyzed differences between **MambaByte** and Transformer architectures, focusing on **Selective State Model**

### Algorithmic AutoTrader

(Oct-Dec 2023)

Course Project: Data Structures and Algorithms

Instructor: Prof. Ashutosh Gupta

- Utilised **sockets** to implement a **miniature stock market** capable of optimally managing deals in **real-time**
- Simulated a **trader** using **threads** that generates profit utilising **median trading** and **statistical arbitrage**
- Designed custom **Graph** and **RBT** classes with advanced data handling to process large **order-books** efficiently and coded a systematic algorithm to detect and **exploit arbitrage opportunities**, thereby maximizing profit

### Micro-architecture Based Optimisation

(Sep 2023)

Course Project: Digital Logic and Computer Architecture Lab

Instructor: Prof. Biswabandhan Panda

- Developed **heap sort** and **binary search** in **MIPS ISA** to optimise **query processing** in an unsorted array
- Simulated cache **replacement policies** like **LRU**, **LFU**, **FIFO** and **BIP** using **ChampSim** on diverse trace files
- Designed and optimized a **stream prefetcher** to achieve performance gains by analyzing memory access patterns, fine-tuning **prefetch distance** and **degree**, and exceeding the performance of the IP Stride Prefetcher

### Deep Learning in Computer Vision

(Feb 2024 - April 2024)

Course Project: Machine Learning in Remote Sensing II

Instructor: Prof. Biplab Banerjee

- Leveraged **transfer learning** with **MobileNetV2** pretrained on ImageNet to build a fine-grained model on the **CUB** dataset, integrated **custom layers** for tailored feature extraction and classification of **200 bird species**
- Implemented a **U-Net** model for **image deblurring**, utilising a contracting-then-expanding architecture with skip connections to enhance resolution and **preserve feature details**, thereby achieving **PSNR** score of **26.4**

## OTHER PROJECTS

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### Deep Dive into Operating System

(Feb 2024 - April 2024)

Course Project: *Operating Systems*

Instructor: Prof. Mythili Vutukuru

- Studied the **internal working** of an operating system by exploring the various components of **xv6**, a basic OS
- Developed custom reader-writer locks using **pthread mutexes** and **conditional variables** for both reader-priority and writer-priority modes, ensuring data consistency and optimizing **multi-threading performance**
- Coded a basic **filesystem** in an OS environment, gaining experience in file management and storage systems

### Game Theory and Mechanism Design

(Feb 2024 - April 2024)

Course Project: *Artificial Intelligence and Machine Learning*

Instructor: Prof. Swaprava Nath

- Implemented **backward induction** and **alpha-beta pruning** to solve games like *Tic-Tac-Toe* and *Notakto*
- Implemented **Voting Rules** like Plurality, Borda's rule, STV and Copeland and checked their **manipulability**
- Found **stable matchings** between suitors-reviewers using **Gale-Shapley Algorithm** and analysed the rankings

### Neural Networks and Large Language Models

(July 2023)

Technical Summer School

Web and Coding Club, IIT Bombay

- Developed a **skip-gram word embedding** model to find closely related words in a custom corpus, by minimising Cross-Entropy Loss and inspecting cosine similarity, using **spaCy** and **NLTK** for text pre-processing
- Designed a **Customer Review Ratings classifier** by fine-tuning the **DistilBERT** model from the Hugging Face library on the **Yelp review** dataset, integrated with an interactive **Gradio**-based interface for abstraction

### Games with Reinforcement Learning

(Dec 2023 - ongoing)

Winter in Data Science (WiDS)

Analytics Club, IIT Bombay

- Explored the **Multi-Armed Bandits (MAB)** problem and **Finite Markov Decision Processes** while evaluating **exploration policies** such as  $\epsilon$ -greedy, **Thompson Sampling**, Gradient Bandits and **UCB**
- Implemented a solution using **Q-Learning** to train an autonomous agent in solving the **Mountain Car Game**

### Data Exploration with QMI and KDE

(Sep 2023)

Course Project: *Data Analysis and Interpretation*

Instructor: Prof. Ajit Rajwade

- Analysed the effectiveness of Quadratic Mutual Information (QMI) as an advanced **image matching metric** for T1-weighted and T2-weighted **MRI Scans** using **MATLAB**, offering an alternative to correlation metric
- Implemented Kernel Density Estimation (KDE) as a **non-parametric** probability density **estimator** in MATLAB, employing **cross-validation** to determine the optimal bandwidth parameter for improved accuracy

### TRayCer: Ray Tracing Engine

(May-June 2023)

Seasons of Code

Web and Coding Club, IIT Bombay

- Learnt and developed the fundamental principles of **Ray Optics** in C++ to create a functional **Ray Tracer**
- Designed **abstract classes** for various components of an image like shapes, materials, surfaces and the camera
- Implemented **Bounding Volume Hierarchies** and **volumetric effects** to increase image rendering efficiency
- Integrated **custom shading models** and **anti-aliasing** techniques to improve image quality and its performance

### Text Processing and Compression

(Oct 2023)

Course Project: *Data Structures and Algorithms*

Instructor: Prof. Ashutosh Gupta

- Designed a **context-based** autocomplete system using **Prefix Trie** and **KMP** techniques on user text history
- Integrated and optimised the **Lempel-Ziv'77 (LZ77)** encoding to efficiently zip text files using **backreferencing**
- Achieved **2.6:1** as the **best compression ratio** by applying the **DEFLATE** algorithm on large text corpus

## POSITIONS OF RESPONSIBILITY

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### Teaching Assistant

(Dec 2023 - April 2024)

Software Systems Laboratory

Instructor: Prof. Kameswari Chebrolu

- Created **programming assignments** in Bash, Python and Javascript and ensured smooth flow of weekly labs
- Designed the **Web Development project statement** and conducted **vivas** and evaluations of 150+ students

## TECHNICAL SKILLS

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#### Programming

C++, C, Python, Bash, Java, Sed, Awk, Qiskit, VHDL, MIPS, x86

#### Software

MATLAB, Git/Github, L<sup>A</sup>T<sub>E</sub>X, AutoCAD, Android Studio, Doxygen

#### Libraries

NumPy, Matplotlib, SciPy, TensorFlow, Pandas, Keras, PyTorch, Sklearn

## COURSES UNDERTAKEN

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- **Computer Science** : †Data Structures and Algorithms, Discrete Structures, Data Analysis and Interpretation, Design and Analysis of Algorithms, †Digital Logic Design, †Operating Systems, Automata Theory and Logic, †AI/ML, Software Systems Lab, Computing & Science, Computer Programming and Utilization.

- **Mathematics** : Calculus I, Calculus II, Linear Algebra, Differential Equations, Probability I

† Course has corresponding lab

## EXTRACURRICULARS

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- Completed the **Mathematical Olympiad** training course in Senior Secondary group at *WIMO Final* (2021)
- Completed a year-long training course in **Lawn Tennis** through National Sports Organization (NSO) (2022-23)
- Completed the **Finance 101** and **Management and Business Development** Learner's Space (Summer 2023)
- Prepared the business model of a Ed-Tech **AltacEd**, as a part of the **EnB Buzz** pitching competition (2022)