Aditya Singh | **22B1844**
Computer Science & Engineering | **B.Tech.**
Indian Institute of Technology Bombay | **Gender: Male**
DOB: 04/02/2004

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2026	
Intermediate	CBSE	Lotus Valley International School	2022	98.00%
Matriculation	CBSE	Lotus Valley International School	2020	97.40%

Pursuing **Minor** in **Machine Intelligence and Data Science**

Scholastic Achievments

- Awarded a **change of branch** to the department of **Computer Science** (only **17** out of **1400**+ students) *(2023)*
- Conferred with **AP**(**Advanced Performer**) grade given to (**top 1%** of 1400+ students) in Linear Algebra *(2023)*
- Bagged **All India Rank 939** in **JEE Advanced** examination among 1,50,000+ candidates *(2022)*
- Secured an **All India Rank 385** in **JEE Main** examination among 10,00,000+ candidates *(2022)*
- Secured **All India Rank 910** and was awarded the prestigious **KVPY** fellowship by IISc Bangalore, India *(2022)*
- Secured an **All India Rank 81** in **VITEEE** examination among 2,50,000+ candidates, organised by VIT *(2022)*
- Achieved **99.9 percentile** in **BITSAT** among 3,00,000+ candidates, organised by BITS Pilani *(2022)*

Olympiads & Achievments

- Recipient of **National Talent Search Examination (NTSE)** Scholarship by NCERT, Government of India *(2020)*
- Received **Certificate of Merit** in IOQM 2020 for being among **top 300 students** in the Delhi Region. *(2020)*
- Secured **1st position** in Steam 2018, a **STEM** based Problem Solving and Creativity Decision Making competition by Creative Thinkers Foundation. Selected to **represent India** in further rounds in Shanghai, China. *(2018)*
- Secured **State Rank 4** in U.P. in **Brainobrain Wonderkid Competition**, a problem solving competition. *(2015)*

Key Projects

Deep Generative Models *Summer 2024*
Summer of Code *WnCC, IIT Bombay*

- Developed and trained a **DCGAN**, analysed **loss curves** and added layers to increase the training accuracy.
- Implemented and evaluated **VAE architectures** with encoder-decoder substitutions, optimizing model performance.
- Implemented a **Diffusion model**, exploring various hyperparameters and **denoising** partially noised images.

Large Language Models Reading Project *Summer 2024*
Summer of Science *MnP Club, IIT Bombay*

- Explored concepts in **Natural Language Processing** like Recurrent Neural Networks, GRUs, LSTMs, Word Embeddings, Word2Vec, Sentiment Classification, Beam Search, Large Language Models, and tools like **Hugging Face**.
- Read articles and research papers on Self Attention, **Attention Models**, Transformers, and **Fine-Tuning of LLMs**.
- Explored recent advances like Multi-Modal Learning, Prompt Engineering, Retrieval-Augmented Generation, **Langchain Framework**, and **LLaMa Architectures** in NLP. Documented all these insights in a comprehensive report.

Deep Reinforcement Learning *Winter 2023*
Self Project

- Implemented a **Convolutional Neural Network** model using **Pytorch** and **Numpy** to classify MNIST dataset.
- Followed the book Deep Reinforcement Learning by Miguel Morales. Learnt about Markov Decision Processes and implemented **policy evaluation** and **policy iteration** to train an RL agent to find optimal policies for given MDP.
- Built an agent capable of playing TicTacToe using control algorithms like **Monte Carlo** and **Temporal Difference**.
- Implemented **Deep Q Networks** to solve the continuous space problem **Cartpole** from the **OpenAI Gymnasium**.

Algorithmic Trader *Autumn 2023*
Course Project | Guide: Prof. Ashutosh Gupta *IIT Bombay*

- Efficiently implemented **algorithmic trading strategies**, including profit maximization and **statistical arbitrage**.
- Simulated a market that executes orders, seeking to **optimize prices** for customers and to **maximize trading**.
- Utilized **multi-threaded applications** to efficiently exploit arbitrage oppurtunities across multiple markets.

Data Analytics and Visualisation Project *Summer 2024*
Self Project

- Analysed dataset on Power Generation in India using **pandas**, **matplotlib**, **seaborn** to understand the market.
- Classified consumers into various groups with a labelled dataset using **Random Forest Classifier** and without dataset using **K-Means Clustering**. Applied **principal component analysis** and created a 3D plot of the clusters.
- Classified E-Mails as spam and non-spam using Natural Language Processing tools like **BeautifulSoup** for preprocessing the email messages, **sci-kit learn** for **TF-IDF vectorizer** and the **Natural Language Toolkit(nltk)**

Bash Grader *Spring 2024*
Course Project | Guide: Prof. Kameshwari Chebrolu *IIT Bombay*
- Developed a **CSV File Manager** and Interpreter in Bash to efficiently manage student marks across multiple exams.
- Created a Git-like **version control system** to store and track different versions of the CSV files containing marks.
- Implemented functionalities like **data visualization** and **statistical analysis** for better representation of exam data.

Building a Shell *Spring 2024*
Course Project | Guide: Prof. Mythili Vutukuru *IIT Bombay*
- Developed a **custom shell** to execute Linux commands like using fork, exec, wait system calls.
- Extended the shell to support **background execution** of processes with proper child reaping.
- Implemented the exit command and **custom signal handling** for SIGINT to terminate the shell and its processes.
- Added support for **serial and parallel execution** of multiple commands in the shell.

Dynamic Memory Management *Spring 2024*
Course Project | Guide: Prof. Mythili Vutukuru *IIT Bombay*
- Developed a **custom memory manager** using mmap to allocate and deallocate 4KB memory dynamically.
- Implemented functions for **memory initialization, allocation, and deallocation** with efficient memory utilization.
- Designed mechanisms for **splitting and merging** free memory chunks to optimize allocations.

Other Projects

Computational Astronomy Project *Autumn 2023*
Self Project
- Performed **data filtering** to remove outliers from the dataset - Density of the Universe vs Time using **matplotlib**.
- Used **numpy** and **scipy** to fit the density vs time distribution and find the value of the redshift parameter.
- Applied concepts like **Hubble's Formula**, energy conservation and critical density to estimate the age of redshift.

Kernel Density Estimation using MATLAB *Autumn 23*
Course Project | Guide: Prof. Ajit Rajwade *IIT Bombay*
- Applied the **non parametric density estimation** technique called **Kernel Density Estimation**.
- Drew **training set** and **validation set** for the model from normal distribution. Trained the model using **joint likelihood estimate** and **mean squared error**. Estimated best value for the parameter using the model.
- Plotted graphs for the best parameter and compared to the real graph to analyse the correctness of the estimate.

Stable Matching using Gale Shapley Algorihtm *Spring 2024*
Course Project | Guide: Prof. Swaprava Nath *IIT Bombay*
- Implemented Gale-Shapley algorithm for **stable matching** of suitors and reviewers based on preference profiles.
- Developed functions to compute average ranking scores for both suitors and reviewers based on their matched pairs.
- Analyzed results using **histograms**, highlighting differences in average rankings between suitors and reviewers.

Tic-Tac-Toe and Notakto *Spring 2024*
Course Project | Guide: Prof. Swaprava Nath *IIT Bombay*
- Implemented **Backward Induction** to train a bot to play Tic Tac Toe, a Perfect Information Extensive Form Game.
- Trained a bot to play the Zero-Sum Game Notakto, optimizing its performance with **Alpha-Beta Pruning**.

Snake Game *Summer 2023*
Self Project
- Implemented the classic Nokia snake game, using the power of the **Pygame** module for the vibrant game interface
- Used **Python File Handling** to store scores and displaying the maximum score at the end for better user experience

Technical Skills

Programming	C/C++, Python, Bash, Sed, Awk, VHDL, MIPS, x86 Assembly, HTML, CSS, Javascript
Softwares and Packages	Pytorch, Numpy, Pandas, Matplotlib, Scipy, Astropy, MATLAB, LaTeX, Docker, MySQL

Courses Undertaken

Computer Science	Data Structures and Algorithms†, Design and Analysis of Algorithms, AI and ML†, Discrete Structures, Data Analysis and Interpretation, Software Systems Lab, Operating Systems†, Digital Logic Design and Computer Architecture†, *Computer Networks†, Automata Theory and Logic, *Abstractions and Paradigms in Programming†, Computer Programming and Utilization
Mathematics	Calculus I and Calculus II, Linear Algebra, Ordinary Differential Equations
Online Courses	Coursera Sequence Models and Coursera Convolutional Neural Networks
Learner Space Courses	Data Structures and Algorithms, *Group Theory

† *Course has a corresponding lab * to be completed by April '24*

Extracurriculars

- Solved **600+** problems in last year hosted on algorithmic programming sites like **Leetcode**, **Codeforces** and **Codchef**. Achieved a **Peak Contest Rating** of 1608 on Codchef, 1591 on Leetcode and 1373 on Codeforces. *(2024)*
- **Won 2nd prize** in Re-Decrypt by IIT Bombay, a **crypt hunt**, for decoding **encrypted** documents the fastest. *(2022)*
- Won prize in Bazinga an olympiad level maths competition organized by Maths and Physics Club, IIT Bombay *(2023)*
- Secured **2nd position** in **Chess Tournament** organised by Lotus Valley International School, Noida *(2019)*
- Awarded **Pass with Distinction** in the **Cambridge Preliminary English Test** *(2017)*