Nivesh Aggarwal
Computer Science & Engineering
Indian Institute of Technology Bombay

22B0912
B.Tech.
Gender: Male
DOB: 09/04/2004

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2026	
Intermediate	CBSE	Sri Guru Harkrishan public school	2022	97.00%
Matriculation	CBSE	St. Anne's Convent School	2020	97.20%

Scholastic Achievements

- Awarded **AP (Advance Performer)** grade for excellent performance in **Computer Programming and Utilization** and **Calculus I** both awarded to **top 1% out of** 1400+ **students** at IIT Bombay *(2023)*
- Achieved **All India Rank of 60** in Joint Entrance Examination Advanced among 150,000+ students *(2022)*
- Achieved **All India Rank of 121** in Joint Entrance Examination Main among 1,000,000+ students *(2022)*
- Awarded the prestigious **Kishore Vaigyanik Protsahan Yojana (KVPY)** scholarship given by Govt of India and IISc achieving **All India rank of 9 in SX stream** and **32 in SA stream** *(2020, 2021)*
- Receiving **National Talent Search (NTSE)** scholarship by NCERT, Government of India *(2020)*

Olympiads

- Won **Silver medal** at the 54^{th} *IChO* ranking **43^{rd} globally** and **1^{st} in the Indian contingent** *(2022)*
- Ranked in **top 6** in **Indian National Maths Olympiad (INMO)** and **shortlisted for IMO** team *(2022)*
- Cleared **Indian National Physics Olympiad (INPHO)**, ranking among the **top 39** students in India *(2022)*
- Among the **top 102** students to clear **Indian National Astronomy Olympiad (INAO).** *(2021)*
- Cleared National Standard Examination in Junior Science **(NSEJS)** ranking in the **top 1% nationally** *(2019)*

Key Projects

Combinatorial Computing *(July 2023)*

Seasons of Code 2023 — *Web and Coding Club, IIT Bombay*

- Explored various concepts in Combinatorial Computing like **Posets**, **Extremal Comb**, **generating functions**, etc
- Applied the proof of **Hall's theorem** to find solution of **bipartite matching problem** and converted the given problem to **Network Flow Graph** solving it using **Ford-Fulkerson algorithm** with proof
- Developed a **Sudoku solver** using the **Z3 library** in python, applying **SAT formulation** for efficient solutions

Quantum Computing and Devices *(Autumn 2023)*

Guide: Prof. Bhaskaran Muralidharan | SURP, EnPOWER, IIT Bombay

- Explored quantum algorithms like the **Deutsch-Jozsa algorithm**, **Grover's Algorithm** and **Shor's Algorithm**.
- Investigated the topic of **Classical and quantum information theory**, studying **Shannon Entropy** and **Von Neumann's Entropy** deriving Bell's Inequality and analyzing it in context of **Super Dense Coding**.
- Applied the knowledge of Linear Algebra to study the postulates of quantum Mechanics studying **time evolution of quantum states, Composite systems** and **measurements on Quantum states** focusing on **POVMs**.

Cryptography in Practice *(Spring 2024)*

Guide: Prof. Manoj Prabhakaran |Course Project: Cryptography and Network Security

- Implemented various cryptographic encoding, Hashing, Signature, Certification and commitment schemes.
- Used various attacks like **timing based side channel attack**, **Length extension attacks** and various faults in implementation like **key repurposing, Nonce Reuse**, etc. to break various modern cryptographic schemes.

Algorithmic Trader *(Autumn 2023)*

Guide: Prof. Ashutosh Gupta | Course Project: Data Structures and Algorithms

- Implemented **Lempel-Ziv'77 (LZ77), Huffman Encoding**, and **Run-Length Encoding (RLE)** techniques, to efficiently reduce file sizes while maintaining data integrity and optimizing storage efficiency.
- Implemented market and maintained order book in **C++** to **match buy and sell** orders. Used **median filtering** and **detecting arbitrage** opportunities in the market in asymptotically polynomial time make a profit.
- Used **OOPS** and implemented **customised data structures** in **C++** to make our algorithms more efficient.

Hands on AI/ML *(Spring 2024)*

Guide: Prof. Swaprava Nath | Course Project: AIML Lab

- Developed various regression and classification models from scratch like **Linear regression, decision tree, CNN, SVM, k-means clustering** using **Numpy, Pandas, Matplotlib Sklearn,** and **Pytorch** libraries
- Used **alpha-beta pruning** to play Tic-tac-toe and Notakto and explored **equilibrium** in simultaneous move games.
- Implemented **voting rules,** checked **manipulatability** and applied **Gale Shapley algorithm** for stable matching

Other Projects

Lights Out *(October 2023)*

Guide: Prof. Avinash Bhardwaj |Course Project: Optimization Models

- Formulated a **linear program** to find the optimal solution of a **lights out** game and extending this problem to a general graph providing a **certificate of infeasibilty** and use in **real life social interaction problems**
- Found a **proof** for the the Lights out problem being **solvable** for any arbitrary graph starting in the **all-on state**

Basics of Operating systems *(Spring 2024)*

Guide: Prof. Mythili Vutukuru | Course Project: Operating Systems

- Improved xv6 OS by incorporating **advanced system calls**, **copy-on-write fork** , implementing a **weighted round robin scheduler** and page fault handler and built a simple shell to execute user commands like bash shell
- Implemented a **file system** with all basic functions like reading, opening and deleting files on an emulated disk.
- Implemented **multi-threaded programming** in C using locks, semaphores and conditional variables using **pthreads**

Cricksweeper *(Spring 2023)*

Guide: Prof. Kameswari Chebrolu | Course Project: Software Systems Lab

- Combined Minesweeper and Cricket together to make a fun to play game using **HTML, CSS and JavaScript**
- Made the design using CSS and HTML incorporating **animations** and **responsive elements** while accounting for **different implementations of tags** in web-browsers especially **safari** to create **universal code**

Technical Skills

Languages:	C/C++, Python, LaTeX, bash, AWK, VHDL, MIPS, x86 Assembly, HTML, CSS, OCaml
Development:	MATLAB, Doxygen, Git, Excel, Fusion360, Arduino-IDE, Blender
Libraries:	NumPy, Pandas, Matplotlib, Z3, scipy, Pytorch, Scikit, Hashlib

Position of Responsibility

Events Co-ordinator | Techfest, IIT Bombay *(Jun 2022 - Dec 2023)*

Asia's largest Science and Technology Festival | Footfall: 1,75,000+ | Events: 280+

- Tasked with ideating and executing of **Ambience across 550 acres campus** for enhancing audience experience
- Coordinated with **over 200 College Ambassadors** for the conduction of **Techfest Zonals in Jaipur**
- Organised and coordinated an event for **stem cell donation** as a social initiative in collaboration with an NGO

Organising Committee | 16th IIT Bombay Debate Tournament *(Sept 2023 - Oct 2023)*

Largest Parliamentary Debate Competition in India | participants: 300+ | Budget: INR 4 Lakhs

- Part of a **two-tier team** of **30 members** to run a debate tournament with **100+ teams** from **20+ countries**
- Efficiently managed all aspects of **tournament logistics**, including participant registrations, draws, and score keeping.

Mentor-Brain tumor detection using CNN | Winter in Data Science 2023 *(Winter 2023)*

Winter in Data Science 2023

- Guiding students in mastering **Convolutional Neural Networks (CNNs)** and hands-on implementation using **PyTorch** for robust **Brain Tumor Detection** models that can detect tumor upto the accuracy of 89%
- Taught fundamentals of **Neural Networks**, emphasizing the **Linear algebra** and **Calculus** involved and practical application through **NumPy** implementations, while also acquainting them with their counterparts in **PyTorch**

Relevant Courses

Computer Science	System Software Lab, †Data Structures and Algorithms, Discrete Structures, Data Analysis and Interpretation, †Computer Architecture, Design and Analysis of Algorithms, †Operating Systems, †AI/ML, Logic and Theory of Computation, Geometric Algorithms, Cryptography, †Computer Networks*, †Programming Paradigms*
Mathematics	Optimization Models, Calculus, Linear Algebra, Differential Equations
Others	Economics, Management, Design, Makerspace, Chemistry, Classical and Quantum Physics,Physics Lab, Chemistry Lab, Biology, philosophy

† The course has a corresponding lab *Ongoing

Extracurriculars

- Have been active in debating and participated in *Monash open, Uhuru Worlds and Odesa open (2022-present)*
- **Represented India** as an adjudicator in **United Asian Debating Championship, Malaysia** *(2022)*
- Awarded **Best Design Award** in **XLR8** for the development of a **Wi-Fi controlled bot** using **ESP32** *(2022)*
- Created a **Business Model Report** on **Infosys** using **SWOT analysis** and understanding their strategies *(2022)*
- Successfully Completed the **Limestone Data Challenge** placing in the **top 58 teams in IIT Bombay** *(2022)*
- Completed an year long **National Sports Organisation (NSO) programme** in **Guitar** at IIT Bombay *(2023)*
- **Ranked first** in **Chemenigma** conducted by India's largest SciTech Cultural festival **Pravega, IISc** *(2023)*