Soham Dahane | **22B0941**
Computer Science & Engineering | **B.Tech.**
Indian Institute of Technology Bombay | **Gender: Male**
DOB: 21/01/2004

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2026	
Intermediate	HSC	Sevasadan Junior College	2022	94.17%
Matriculation	CBSE	Narayana Vidyalayam	2020	97.60%

Pursuing **Minor** in **Data Science and Artificial Intelligence** & **Entrepreneurship**

Scholastic Achievements

- Achieved **All India Rank 100** in **Joint Entrance Examination Advanced** amongst **150,000+** candidates *(2022)*
- Secured **All India Rank 293** in JEE-Main with **99.975 percentile** out of over **905,000+** candidates *(2022)*
- **State Topper** in **Indian Olympiad Qualifier in Physics (IOQP)** from the state of Maharashtra *(2022)*
- Awarded the prestigious **KVPY Scholarship & Fellowship** by Government of India **two times** *(2021,2022)*
- Among the top 300 students selected for **Indian National Mathematical Olympiad Training Camp** thrice *(2019-21)*
- Achieved a perfect score of **800/800** in the **Math** section in the **Scholastic Assessment Test** (SAT) *(2022)*
- Secured **State Rank 1** in **Wisdom Mathematics Scholarship Examination**(WMSE) **twice** *(2017,2018)*
- Awarded the certificate of **merit** by CBSE for being in the **National Top 0.1** % in **Maths** and **Sanskrit** *(2020)*

Research Experience

Decision Trees in Statistical Model Checking (SMC) *Summer 2024*
Guide: Prof. Jan Kretinsky *Technical University of Munich(TUM), Germany*

- Implemented a **C# decision tree class** to represent strategies with expressions at the nodes and actions at the leaves
- Streamlined a **decision tree learning algorithm** in **C#** that learns decision tree from a **QTable** of states and actions
- Enhanced the original **QLearning** algorithm for **MDP simulation**, utilising decision tree to increase simulation efficiency
- Worked on **adding a neural network as a node** of the decision tree, and **developed heuristics** for the placement of the NN node

Key Projects

Training AI to play games using Reinforcement Learning *Spring 2023*
Winter in Data Science *Analytics Club, IIT Bombay*

- Implemented algorithms such as **ϵ-Greedy**, **Bernoulli** and Gaussian **Thompson Sampling** and **UCB** to solve multi-armed bandit environments efficiently, and compared their asymptotic performance with theoretical predictions
- Utilized **ϵ-soft policies** to solve Tic-Tac-Toe and employed **weighted importance sampling** for solving game of Snake
- Devised a **Deep Q-Network** that learned to solve the **Mountain Car** environment in less than 60 iterations, and a Duelling **Deep Double Q-Network** agent that learns to play **Atari** Breakout increasing its score by a factor of **2.74**

Operating Systems| *Course Project : Operating Systems Lab* *Spring 2024*
Guide: Prof. Mythili Vutukuru *IIT Bombay*

- Improved upon the **xv6** OS with a **weighted round-robin scheduler**, demand paging, and **copy-on-write fork** methods in C
- Enhanced concurrency and inter-process communication using **locks**, **threads**, **semaphores**, shared memory, pipes, and sockets

Image Processing and Data Analysis| *Course Project : Data Analysis and Interpretation* *Autumn 2023*
Guide: Prof. Ajit Rajwade *IIT Bombay*

- Performed **Maximum Likelihood plane** (MLP) fitting and solved the linear equations using **MATLAB** codes
- Applied **Kernel Density Estimation** for non-parametric density estimation and computed statistical measures like **correlation coefficient** and **quadratic mutual information** (QMI) for MRI data from a segment of the human brain

Portfolio using Momentum Strategies *Autumn 2023*
Finsearch *Finance Club, IIT Bombay*

- Designed and developed a Momentum Trading strategy for **optimizing investment returns** in the stock markets, using **Requests and BeautifulSoup** to **web-scrape** daily market data from the National Stock Exchange website
- Researched pioneer momentum trading papers and applied a **Relative Strength** stock selection strategy to Nifty100 stocks in the Indian market, achieving a remarkable 17.8% **CAGR** in 5 years with **optimal parameter** selection
- Conducted extensive risk analysis incorporating factors such as **Seasonality, Diworsification and Mean Reversion** by calculating **statistical parameters alpha (α) and beta (β)**, and obtained a **Sharpe Ratio of 1.21** using this

Microarchitecture based optimization| *Course Project : Computer Architecture* *Autumn 2023*
Guide: Prof. Biswabandan Panda *IIT Bombay*

- Optimized **linear regression** code to leverage microarchitecture intricacies, achieving a speedup of **100 times**
- Studied various data **prefetchers** and implemented stream prefetching in **Champsim** for low-level (L2) Cache
- Optimized the **IPC** for graph algorithms such as BFS, DFS, Dijsktra's, etc by simulating combinations of various LLC **cache associativities, eviction policies** (LFU/FIFO/BIP) and **cache hierarchies** (inclusive/exclusive)

Deep Learning for Computer Vision| *Course Project: Machine Learning in Remote Sensing II* *Spring 2024*
Guide: Prof. Biplab Banerjee *IIT Bombay*

- Leveraged **transfer learning** with **MobileNet V2** 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 a decent **PSNR** score of **26.4**

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

- Developed a robust C++ **algorithmic trading system**, leveraging optimized data structures such as linked lists, hash tables and **priority queues** to enhance performance, streamline order management, and improve execution speed
- Effectively implemented trading strategies such as **buying low/selling high** & detecting **arbitrage** opportunities
- Implemented a highly 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**

Other Projects

Game Theory *Summer 2023*
Summer of Science *Maths and Physics Club, IIT Bombay*

- Explored **normal** and **extensive** form games, dominant strategies, equilibrium concepts, pure and mixed strategy **Nash equilibrium** & Best Response, its applications in **strategic** form games and Pareto dominance & optimality
- Explored coalition games, Shapley value, and social choice theory, including **Sen's** Theorem and **Arrow's** Theorem
- Reviewed recent research papers including one on analysis of the effect of a knowledgeable principal persuading the agent in sequential decision making and another studying the **single-agent dynamics** in a coalition forming setting

File Searching & **Compression Algorithms**| *Course Project : Data Structures & Algorithms Lab* *Autumn 2023*
Guide: Prof. Ashutosh Gupta *IIT Bombay*

- Researched the **Knuth-Morris-Pratt** search algorithm and various data structures for storing textual data efficiently including **tries** and **suffix trees**, and their uses; implemented all of them from scratch to observe their efficiencies
- Studied the structure and process of **Huffman** encoding along with proof of its **optimality**, implemented it and then combined it with the **Lempel-Ziv'77** Algorithm to implement the well-known **DEFLATE** compression algorithm

Minesweeper Cricket| *Course Project : Software Systems Laboratory* *Spring 2023*
Guide: Prof. Kameshwari Chebrolu *IIT Bombay*

- Implemented a web based game based on logic of classic minesweeper and cricket with the bombs being replaced by fielders
- Created functionality using **HTML**, **CSS** and **Javascript** to maintain various parameters such as variable grid size, scorecard for runs scored, multiple wickets, and additional features to make the game more dynamic and user friendly

Technical Skills

Languages	C++, Python, C#, Java, Bash, Awk, VHDL, x86 Assembly, MATLAB
Development	HTML, Javascript, CSS, Git, LaTeX, Doxygen, Sphinx, Sed, AutoCAD, GDB
Libraries	PyTorch, Matplotlib, NumPy, Pandas, Sklearn, IBM Qiskit

Positions of Responsibility

Joint Social Secretary,*Computer Science and Engineering Association (CSEA)* *April 2024- Present*
- Responsible for organising social events for a department of **900+** students handling a budget of more than **5 lakhs**

Teaching Assistant in MA105 and MA110,*Department of Mathematics, IIT Bombay* *August 2023-May 2024*
- Conducted regular tutorials and doubt solving sessions on Linear Algebra for a group of **35+** students

Seasons of Code Mentor,*Web and Coding Club, IIT Bombay* *May 2024-July 2024*
- Mentored **15+** students by providing curated resources and engaging assignments focused on reinforcement learning

Class Representative,*CSE Department, IIT Bombay* *December 2022-June 2023*
- Represented entire batch of **180** students to decide and disseminate important academic and non academic information

Relevant Courses

Computer Science	Data Structures and Algorithms#, Discrete Structures, Data Analysis and Interpretation, AI/ML#, Software Systems Lab, Computer Programming and Utilization, Operating Systems#, Digital Logic Design and Computer Architecture#, Design and Analysis of Algorithms, Deep Learning for Computer Vision, Automata Theory and Logic, Computer Networks*, Abstractions and Paradigms for Programming*
Mathematics	Calculus , Differential Equations, Linear Algebra, Optimization models
Others	Introduction to Entrepreneurship, Organic and Inorganic Chemistry, Physical Chemistry, Biology, Management, Sociology, Quantum Physics, Introduction to Classical Mechanics

*# : Theory + Lab * : To be completed by Autumn 2024*

Extracurriculars

- Awarded by **Tower Research Capital** for excelling in the **Limestone Data Challenge** conducted by them *(2024)*
- Built an autonomous line-follower bot capable of carrying and dumping a payload using Fusion 360 tool *(2023)*
- Appointed as **Treasurer of Interact Club** at school in collaboration with **Rotary Club**, Nagpur green city *(2019)*
- Completed an year long **National Service Scheme (NSS)** programme in Green Campus at IIT Bombay *(2022)*
- Winner of the zonal round of the **Bournvita Quiz Contest** from Nagpur zone and qualified for the nationals *(2016)*