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Atishay Jain

Computer Science & Engineering
Indian Institute of Technology Bombay

Education

- **B.Tech., Computer Science and Engineering**, Indian Institute of Technology Bombay *('21 - '25)*
  GPA: 11.00/10.00
  Pursuing a **Minor** in **Artificial Intelligence and Data Science**
- **Matriculation, CBSE**, Pushpa English Medium School *('08 - '19)*
  Grade: 95.8% (District Rank 2)

Scholastic Achievements

- Secured **All India Rank 104** in Joint Entrance Examination **Advanced** amongst the **150,000+** candidates *(2021)*
- Achieved **All India Rank 123** and was awarded the prestigious **KVPY** fellowship by **IISc** Bangalore, India *(2020)*
- Awarded the **Advanced Performer (AP)** grade in **Artificial Intelligence and Machine Learning** Lab for exceptional performance, ranking among the **top 1%** of students *(2023)*
- Achieved **All India Rank 270** in Joint Entrance Examination **Main** among over **1 million** candidates *(2021)*
- Received **MMVY** scholarship from state government of Madhya Pradesh for outstanding academic **merit** *(2021-22)*
- Secured **Merit** Prize in 13^{th} National UCMAS Abacus & Mental Arithmetic Competition among **5k+** students *(2014)*

Internship Experience

Strats and Quant Intern | Morgan Stanley *(May'24 - Jul'24)*

eFX Trading Team, Fixed Income Division

- Researched and developed a **signal** based on **price skew** across various **ECNs** as part of Electronic-FX Trading team
- Ideated and **back-tested** a profitable **trading strategy** leveraging **skew-based** signals, resulting in favorable **returns**
- Enhanced **trade signal detection** and **price action** pattern identification through in-depth strategy performance analysis
- Developed a framework to **evaluate** impact of parameters on strategies based on **technical indicators** like **MACD** and **RSI**
- Awarded a **Pre-Placement Offer (PPO)** for outstanding performance and key contributions during the internship

Web Development and Technical Intern | IFP Petro *(Dec'22 - Jan'23)*

Software Development

- Developed a web application using **MERN** stack to streamline and **automate** acceptance of order pickup requests of used oil from multiple suppliers, enhancing the **operational efficiency** and optimizing overall oil transportation logistics
- Integrated user login and **registration** functionalities using ExpressJS framework and **MongoDB** backend to the web app

Soft Hand Simulation | Technical University of Munich *(May'23 - Jul'23)*

Remote Research Intern, Guide: Dr. Daniele Bernardini

- Implemented an **under-actuated** soft hand model of a **gripper** using the **MuJoCo** physics simulator, calibrating it to mimic actual robotic hand movements and designed the model's basic structure along with simulation controls in **C++**
- Encoded **constraints** on the sum of angles and torque acting on joints, which accounted for movements of the gripper

Research

Instruction Fine-tuning in Bilingual Setting | R&D Project, BharatGPT *(Jan'24 - May'24)*

Guide: Prof. Ganesh Ramakrishnan, CSE, IIT Bombay

- Studied the **EMMA-X** pre-training algorithm and **PolyLM** model, synthesizing useful insights from both approaches
- Evaluated various LLM/Question-Generation models on **bilingual QnA** scenarios, selecting **optimal** models for fine-tuning
- Automated **validation** of machine-translated text and **domain classification** of articles, using **Mixtral** and **Gemini**

Fault and Side-channel attacks on PQC | R&D Project *(Jul'24 - Present)*

Guide: Prof. Sayandeep Saha, CSE, IIT Bombay

- Analyzed and implemented a **Differential Fault Analysis** (DFA) attack on the **AES** encryption scheme
- Researched on SPHINCS and related hash-based signature schemes, and explored potential fault attacks on SPHINCS
- Implementing a **fault attack** on the SPHINCS, focusing on practical execution and countermeasure evaluation

Key Projects

Optimizing Speech Recognition Models | *(Spring '24)*
Course Project : Automatic Speech Recognition, Guide : Prof. Preeti Jyothi *IIT Bombay*

- Improved OpenAI's **whisper** model for Hinglish ASR by integrating **greedy** and **beam search** decoding algorithms
- Enhanced Conformer model with **PowerConv** and **inter-layer** CTC, reducing WER on librispeech from **0.74 to 0.66**
- Applied **PARP** method to **fine-tune** smaller self-supervised speech models (**wave2vec-base**), achieving significant performance gains and reduced the computational costs by efficiently discovering and adjusting **sparse subnetworks**

Image Caption Generation | *(Winter '22)*
Winter In Data Science, Deep Learning *Analytics Club, IIT Bombay*

- Developed a **univariate** LSTM model forecasting **Stock Prices** of oil over a 30-day horizon, optimizing **RMSE** metric
- Explored **NLP** techniques to conduct **sentimental analysis** on **Stock Market headlines** using NLTK and spaCy
- Utilized pre-trained **VGG19** model to extract features from **Flickr8k** image dataset, integrated these features into **LSTM** network for generating descriptive image captions, and rigorously evaluated the model through **BLEU** scores

Tones2Notes: High Resolution Music Transcription | *(Autumn '23)*
Course Project: Artificial Intelligence and Machine Learning, Guide : Prof. Preeti Jyothi *IIT Bombay*

- Implemented a **CRNN** model to automatically **transcribe** monophonic audio into MIDI, by capturing musical notes
- Improved model performance using **bidirectional GRU** units, optimizing F1-score and MAE on the **MAPS** dataset
- Engineered a comprehensive **pipeline** from input **audio processing** to MIDI output, including **piano-roll** video generation

SCLP: Compiler for C-like Language *(Spring '24)*
Course Project : Implementation of Programming Languages, Guide : Prof. Uday Khedkar *IIT Bombay*

- Developed a **compiler** in C++ for C-like languages doing scanning and parsing using **Lex/Yacc**, performing **syntax** and **semantic** analysis, generating **AST**, **TAC**, and **RTL** intermediate representations, and final **x86 Assembly** code
- Constructed the compiler with incremental **5 levels** of language features using **OOP** principles & suitable data structures

Enhancing xv6 Operating System | *(Autumn '23)*
Course Project : Operating Systems Lab, Guide : Prof. Purushottam Kulkarni *IIT Bombay*

- Integrated a **custom scheduler** in xv6 with **priority handling** to optimize process management and CPU utilization
- Implemented **lazy allocation** and **sbrk**, improving heap memory management and process address space handling
- Designed synchronization methods (**sleeplock, semaphores**) and optimized file I/O using **encrypted** read-write modes

Cache Optimization for Graph Analytics | *(Spring '23)*
Course Project : Computer Architecture, Guide : Biswabandan Panda *IIT Bombay*

- Used **ChampSim** micro-architecture simulator to analyze cache and **memory access** patterns for various Graph Algorithms
- Implemented cache hierarchies: Inclusive, Exclusive, Non-Inclusive, and replacement policies: LRU, LFU, LFRU, and FIFO
- **Improved IPC** for graph workloads by analyzing various architecture combinations on over **30 Million** instructions

Railway Journey Planner and Review System | *(Autumn '22)*
Course Project : Automatic Speech Recognition, Guide : Prof. Supratik Chakraborty *IIT Bombay*

- Designed a railway model with a **user** and **admin** interface as a **graph**, which stores and retrieves journey data with features like keyword-based review search (**KMP**), auto-completion for station names (**Trie**), and rating-based review filtering (**Heap**)
- Programmed a modified **DFS** to find direct and **indirect** journeys between specified stations, subjected to constraints

File Transfer Protocol: Socket Programming | *(Spring '23)*
Course Project : Computer Networks Lab, Guide : Prof. Bhaskaran Raman *IIT Bombay*

- Implemented a **client-server** network utilizing **TCP connections** to enable efficient and secure two-way file exchange
- Conducted comprehensive experiments with numerous clients, recording and analyzing network traffic using **Wireshark**

Other Projects

Fisherfaces for Face Recognition | *(Autumn '23)*
Course Project: Digital Image Processing, Guide: Prof. Ajit Rajwade *IIT Bombay*

- Implemented a research paper about usage and comparison of **Fisherfaces** instead of Eigenfaces for face recognition
- Reduced **error rates** on YaleB from **19.1 to 4.3** using Fisherfaces, tackling **illumination** & facial-expression challenges
- Adapted the recognition algorithm for **Glass Detection** and evaluated results using **leave-one-out** cross-validation

Algorithmic Trading | *(Spring '23)*

Limestone Data Challenge, Tower Research Capital — *IIT Bombay*

- Classified stocks into different sectors based on **price action** patterns using **Silhouette** analysis with **KMeans** clustering
- Developed a **high sharpe ratio** trading strategy to optimize daily **returns**, ranking among **top 50** teams over the institute

Autonomous Driving Vehicle | *(Summer '23)*

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

- Studied and implemented **KL-UCB** and **Thompson Sampling** algorithms for regret minimisation in Multi-Arm Bandits
- Encoded a **maze** into **MDP** and employed **Howard Policy Iteration** to determine **optimal path** from start to finish
- Developed a controller to safely **navigate** a car out of parking lot on roadway in a **gym-driving** simulator environment

Python Combat | *(Autumn '23)*

Course Project: Software Systems Lab, Guide: Prof. Kavi Arya — *IIT Bombay*

- Developed a browser-based game platform for learning **Python** featuring user-interactive **Animations** using **JQuery**
- Utilized **Brython** for in-browser code execution and CodeMirror for code editor with syntax highlighting and **auto-completion**
- Created a **Dynamic arena** with varying **object placement** on reload and **motion** speeds, ensuring immersive gameplay

Stock Market Analysis *(Summer '22)*

Summer of Science, Learning Project — *Maths and Physics Club, IIT Bombay*

- Studied key stock market terminologies and roles of **financial intermediaries**, including **IPO markets** and indices
- Analyzed **technical** trading techniques, focusing on **charting**, **futures**, **options theory**, and advanced **options strategies**

Sliding Puzzle SAT Solver | *(Spring '23)*

Course Project: Logic for Computer Science, Guide: Prof. Ashutosh K. Gupta — *IIT Bombay*

- Implemented a script in **Python** using **Z3Py** library to encode a **Tile Loop** puzzle game as a **SAT** problem and solve it efficiently with the given **constraints** along with verifying the proposed solution in case of satisfiability

Representative Imaging and Data Analysis | *(Autumn '22)*

Course Project: Data Analysis and Interpretation, Guide: Prof. Suyash P. Awate — *IIT Bombay*

- Utilized **Principal Component Analysis (PCA)** for programming an image generator in MATLAB to generate representative and new images of several identical fruits which are taken from a given large dataset of images
- Analyzed 28×28 pixel images of handwritten digits from **MNIST** database using Principal Component Analysis
- Optimally **Reconstructed** these images with modified dimensional basis, being converted to 84 by applying PCA
- Sampled points in Euclidean Plane distributed in a region with respect to a given **Multivariate Distribution**

Bubble Trouble | *(Autumn '21)*

Course Project: Computer Programming and Utilization, Guide: Prof. Parag Chaudhuri — *IIT Bombay*

- Built a Single-player Bubble Shooter Interactive game in C++ using **SimpleCPP** library graphics
- Enhanced the game by implementing several extra features such as different **Levels**, Health counter, Timer and **Splitting of Bubbles** into smaller ones on collision along with incrementing speed after each splitting of Bubbles

Gr-affable | *(Autumn '22)*

Hello FOSS , Open Source Project Development Initiative — *Web and Coding Club, IIT Bombay*

- Developed and Ideated a project on **Graph Theory and applications** and **Open Sourced** it for contributions
- Applied Graph algorithms in optimizing a Car **Journey Simulation** and remodeling it using efficient algorithms
- Utilized important and clever Graph Algorithms like BFS, DFS, Dijkstra, **Bellman-Ford** and Tarjan's algorithm
- Merged several **Competitive Programming** problems for the application of Algorithms covered in Graph Theory

Connect 4 | *(Spring '22)*

Course Project: Abstractions and Paradigms for Programming Lab, Guide: Prof. Rushikesh K. Joshi — *IIT Bombay*

- Programmed a two-player Board game of 'connect 4' in C++ using **FLTK** Library for Graphics & events
- Used **Object Oriented Paradigm** and Abstraction ideas along with powerful concepts of Inheritance, live event handling and dynamic binding to check the state of game after processing each event on the FLTK graphics window

Monte Carlo Analysis of Statistical Theorems | *(Autumn '22)*

Course Project: Data Analysis and Interpretation, Guide: Prof. Suyash P. Awate — *IIT Bombay*

- Executed Monte Carlo Simulation of various **Probability Distributions** using Data Science libraries in Python
- Utilized the simulation to empirically verify the **Law of Large Numbers**, Poisson Thinning Process and the result that large number of 1-D Random Walker's Probability distribution is a Gaussian distribution

Hackathons and Competitions

- **All India Rank 22** in the **India Terminal** 2023 programming contest organised by **Citadel** | **Citadel Securities** *(2023)*
- Ranked among **top 50** teams over institute in **Limestone Data Challenge** by **Tower Research Capital** *(2023, 2024)*
- Secured **1st position** out of **400+** teams in **CodeWars V1**, a bot programming competition hosted by WnCC *(2021)*
- Participated and developed an automatic trading bot for **Virtual Quant Trading** Challenge by **Akuna Capital** *(2024)*
- Participated in the **Amazon ML Challenge** 2023 and got ranked globally at **180**th position out of **26K+** teams *(2023)*
- Ranked **52nd** out of 1300+ participants in the **Quant Challenge** by **Dynamic Technology Lab**, implementing alpha generation strategies for financial market prediction *(2024)*

Positions of Responsibility

Institute Web and Coding Convener | Web and Coding Club, IIT Bombay *(May'22 - May'23)*

- Worked in a team of **8** to organize 40+ events catering to the programming interests of **10K+** Institute students
- Involved in curating the **Data Structure and Algorithms** booklet for helping students learn DSA concepts
- Framed **competitive programming** problems for **SciComp-Blitz** Technical Inter Hostel General Championship
- Ideated and co-created a Project in **Hello FOSS**, an event to promote **Open Source** development in the institute

Teaching Assistant (TA) | IIT Bombay *(Oct'22 - Feb'23, Aug'24 - Present)*

Courses : Digital Image Processing | Calculus 1 | Calculus 2

- Conducted weekly **tutorial sessions** for a batch of 45+ students for the **Calculus** courses (MA109 and MA111)
- Among the three UG TAs selected for **Digital Image Processing** (CS663), consisting of 240+ students (Ongoing)

Department Academic Mentor | Student Mentorship Program, IIT Bombay *(May'23 - Present)*

- Among the **32 candidates** selected after extensive **peer reviews**, SoP, and interviews out of **70+ applicants**
- Appointed as **mentor** and contact point of **5 sophomore** students to resolve their academic and personal queries
- Continuing as mentor in the **ARP** program

Junior Editor | BitStream, CSE Department, IIT Bombay *(Dec'21 - Apr'22)*

- Worked on theme ideation and composition of **Marvel Superheroes Enter CSE IIT-B** article, published in the 2021-22 edition of the Annual Newsletter of CSE BitStream, the journalist body of department of Computer Science & Engineering

Summer of Science Mentor | Maths and Physics Club, IIT Bombay *(May'23 - July'23, May'24 - July'24)*

- Mentored **6** students in learning project on **Data Structures** and **Algorithms**, providing resources & guidance in SoS'23
- Mentored **6** students in learning project on **Large Language Models**, providing resources and clearing doubts in SoS'24

Technical Skills

Languages:	Proficient in: Python, C/C++ | Familiar with: Java, Bash, MATLAB, Q, Sed, Prolog
Data Science:	PyTorch, TensorFlow, Keras, Scikit-Learn, NumPy, Matplotlib, Pandas, NLTK
Miscelleneous:	Git, LaTeX, HTML, JavaScript, CSS, Doxygen, Z3, VHDL, SQL, Wireshark, Sphinx

Relevant Coursework

Computer Science :	Computer Programming and Utilization†, Abstractions and Paradigms for Programming†, Software Systems Lab, Data Structures and Algorithms†, Discrete Structures, Computer Networks†, Digital Logic Design and Computer Architecture†, Logic for Computer Science, Design and Analysis of Algorithms, Operating Systems†, Automata Theory, Database and Information Systems†, Implementation of Programming Languages†
Machine Learning :	Automatic Speech Recognition, Foundations of Intelligent and Learning Agents, Information Retrieval & Mining for Hypertext & the Web*, Speech and Natural Language Processing and the Web*, Fundamentals of Digital Image Processing, Artificial Intelligence and Machine Learning†, Data Analysis and Interpretation, Introduction to AI-Data-and-Policy*
Mathematics :	Calculus I, Calculus II, Linear Algebra, Optimization Models, Differential Equations, Introduction to Numerical Analysis, Decision Analysis and Game Theory, Probability and Stochastic Processes*
Physics :	Basics of Electricity and Magnetism, Quantum Physics and Application, Introduction to Electrical and Electronics Circuits
Others :	Physical Chemistry, Organic and Inorganic Chemistry, Economics, Psychology, Engineering Graphics and Drawing, Perspectives on World Cinema*, Planetary Sciences: Earth and Beyond, Environmental Studies*, Biology

† Theory + Lab

*to be completed by Nov 2024

Extracurricular Activities

- Built a **Wifi controlled** Bot in **XLR8** competition held by Electronics and Robotics Club, IIT Bombay *(2022)*
- Pitched a startup idea about **Electric Vehicles** in **EnB Buzz** event organized by E-Cell, IIT Bombay *(2021)*
- Performed in a Band as lead **Keyboardist** in front of 1000+ attendees on CSE department's Traditional Day *(2024)*
- Junior **Diploma** in **Music** (Subject - Synthesizer), received from **Prayag Sangeet Samiti**, Prayagraj *(2019)*
- Learnt IoT and Arduino in **Tinkering Bootcamp** during Learners' Space, Technical Summer School *(2022)*
- Performed in front of 1500+ audience at the Convocation Hall during the **Annual Insync Dance Showcase** *(2024)*
- Stood **First** in Inter-School General Knowledge Quiz Competition organized by Lioness Club, Tikamgarh *(2015)*
- Won **Best Student of the Camp** award for overall performance in Shourya Summer Camp, Gyanodaya *(2016)*