Krishna Narasimhan Agaram

B. Tech. • UG Second Year • Computer Science
Indian Institute of Technology Bombay

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Examination	University	Institute	Year	CPI/%
Graduation	IIT Bombay	IIT Bombay	2025	9.79
Intermediate	TSBIE(State)	FIITJEE Junior College, Hyderabad	2021	97.8%
Matriculation	CBSE	Maharishi Vidya Mandir, Hyderabad	2019	97.2%

Pursuing **Honors** in Computer Science and a **Minor** in **Machine Intelligence and Data Science**.

Scholastic Achievements

- Placed **1st** in India and **8th** in the East Division at the **Simon Marais** Mathematics Competition 2022. *(2022)*
- Qualified for the Indian **International Mathematics Olympiad Training Camp** in **'20, '21**. *(2020, 2021)*
- Secured **Global Rank 1** in the **Southeast Asian Mathematical Olympiad 2020**. *(2020)*
- Placed **1st** overall at the **Technothlon 2019 Mains** conducted by IIT Guwahati. *(2019)*
- Secured **All India Rank 40** in JEE Advanced 2021 and **All India Rank 122** in JEE Main 2021. *(2021)*
- Cleared the **NSE** in Astronomy and the **Indian National Astronomy Olympiad** in 2020. *(2020)*
- Awarded the *Kishore Vaigyanik Protsahan Yojana* **(KVPY)** scholarship for **All India Rank 23**. *(2020)*
- Awarded the *National Talent Search Examination* **(NTSE)** scholarship, ranked **2nd** in Stage 1. *(2019)*
- Conferred with the **AP** (Advanced Performer) grade for exceptional performance in **Discrete Structures**, **Data Analysis** (each awarded to 3 out of 200 students), **Quantum Physics**, Differential Equations and Physical Chemistry (each awarded to around 15 out of 1300+ students). *(2021, 2022)*
- Received **Institute Academic Prize** given to top 20 out of 1300+ students for stellar academic record. *(2022)*

Key Projects

An Introduction to QC, ML and QML *(2022)*

Seasons of Code 2022 — *Web and Coding Club, IIT Bombay*

- Studied **six chapters** of the book *Quantum Computing and Quantum Information* by Nielsen and Chuang.
- Analysed a large variety of **quantum algorithms** including Deutsch-Jozsa, Quantum Teleportation, Quantum Fourier Transform, Phase Estimation, **Shor's Algorithm** and implemented a Grover-based **k-SAT solver**.
- Learnt basic **ML** from *The deep learning book* and investigated algorithms using **scikit-learn** and **TensorFlow**.
- Examined and implemented a **QML** paper on Molecular Geometry Optimization – finding the ground-state **molecular geometry** of simple molecules – using the **Jordan-Wigner** transform and **variational methods**.
- Implemented a **Quanvolutional Neural Network** in PennyLane to classify the MNIST dataset using a hybrid **Quantum-Classical** learning model that utilizes a **random** quantum circuit as a **quantum kernel**.

Linear Algebra Library | *Self Project* *(2022, Ongoing)*

- Designing a library for **Linear Algebra** constructs in **C++** with documentation made using **Doxygen**.
- Implemented functions to perform elementary row operations, compute the reduced row **echelon** form and the **QR Decomposition** for matrices (for square matrices, the **determinant** and **inverse** as well).
- Constructed a **system of equations** solver that computes a **basis** of solutions for an arbitrary linear system.

FastChat *(2022)*

Guide: Prof. Kavi Arya | Course Project — *IIT Bombay*

- Built a **distributed** server-client network with secure **end-to-end** encryption and a dedicated **load-balancer**.
- Users can choose to chat **privately** or in a **group** and apart from text, they can also send arbitrary **files**.
- Messages are encoded using standard **message protocol** and a message buffer ensures messages are never lost.
- Used the python **socket** library to build the network, **PostgreSQL** for databasing and Sphinx for documentation.

Railway Management System *(2022)*

Guide: Prof. Supratik Chakraborty | Course Project — *IIT Bombay*

- Implemented a railway journey planning system in C++ allowing clients to find journeys between stations and curated (by keywords or rating) journey reviews, all with the ease of autocompletion of station names.
- Data structures implemented for use include lists, hash tables, **self-balancing trees**, tries, heaps and **graphs**.
- Modified the **BFS** algorithm to find all travel possibilities between two stations and return a **timetable of journeys** while also allowing for **filtering** based on waiting time between trains and layovers in between.

CS50 AI | *Self Project* *(2021)*

An Introduction to Artificial Intelligence with Python *Harvard University*

- Explored **optimization** techniques like Hill climbing, **simulated annealing** and linear programming.
- Designed an agent that can help users solve **Minesweeper** using logical **inference**, an AI that can generate **crossword** puzzles from a set of words and a **Q-learning**-based AI that achieves near-perfect accuracy at Nim.
- Implemented a **CNN** to classify the GTSRB traffic-signal dataset and an AI to **answer questions** from a corpus.

Other Projects

Complex Analysis | *Self Project* *(2021)*

- Studied Complex Analysis from *A first course in Undergraduate Complex Analysis* by Richard Spindler.
- Explored the Cauchy-Riemman equations, Cauchy Integral theorem and formula, Fundamental Theorem of Algebra, Laurent Series and Residues with **emphasis on writing rigorous proofs from visual intuition**.

Enumerative Combinatorics | *Self Project* *(2021)*

- Learnt Enumerative Combinatorics from *Counting: The art of enumerative combinatorics* by George E. Martin.
- Covered topics such as **Inclusion-Exclusion**, Balls in Bins, Generating Functions, **Recurrences**, and **Graphs**.

Indian Rangoli *(2022)*

Guide: Prof. Rushikesh K. Joshi | Course Project *IIT Bombay*

- Created a replica of a typical Indian "rangoli" - a flowery pattern - using the **FLTK C++** graphics library.
- Allowed for **extensive customisation** of the rangoli designs including petal lengths, angles, color and count.

Bubble-Shooter Game *(2021)*

Guide: Prof. Parag Chaudhuri | Course Project *IIT Bombay*

- Designed a simple user-interactive **bubble shooter game** using the **simplecpp** graphics library in **C++**.
- Features include **multiple levels** and many **different bubble and bullet types** with 700+ lines of code.

Tic-Tac-Toe *(2022)*

Guide: Prof. Kavi Arya | Course Project *IIT Bombay*

- Implemented a **two-player** Tic-Tac-Toe game in **Java** using the **Peer-to-Peer networking** model.
- Utilizes the **Socket** and **ServerSocket** classes to help use ports to send and receive messages between peers.

Teaching Experience

- Delivered **lectures** on **Projective Geometry**, Barycentric Coordinates, Generating Functions and **Symbolic Combinatorics** to high-school students as part of the teaching staff at the **Online Math Club**. *(2021, 2022)*
- Working with **Vizuara** in developing **short animated videos** using the python library **Manim** to **motivate concepts** in school-level Mathematics **through visualization** for use in schools. *(2022, Ongoing)*

Relevant Courses

Computer Science	Computer Programming and Utilization, Abstractions and Paradigms in Programming, Data Structures and Algorithms, Discrete Structures, Data Analysis and Interpretation, Software Systems Lab, Design and Analysis of Algorithms*, Digital Logic Design and Computer Architecture*, Computer Networks*, Logic for Computer Science*.
Mathematics	Calculus, Linear Algebra, Differential Equations, Mathematical Structures for Control, Cryptography and Network Security*, Quantum Information and Computation*.
Others	Engineering Drawing, Quantum Physics, Basics of Electricity and Magnetism, Introduction to Electronics, Physical Chemistry, Organic and Inorganic Chemistry, Biology.

**To be completed by April 2023*

Technical Skills

Languages	C++, Python, Bash, Java, LaTeX, MATLAB, Prolog, AWK, VHDL*, Assembly*.
Development	HTML, CSS, JavaScript, SQLite3, PostgreSQL, Git, Doxygen, Sphinx, Wireshark*.
Libraries	FLTK(C++), NumPy, Matplotlib, Sklearn, Keras, IBM Qiskit, PennyLane, Manim*.

**Learning ongoing*

Extracurriculars

- **Pianist** for more than **8 years**. Completed up to **Piano Grade 6** from **Trinity College London**.
- Actively participated in the **Monsoon Math Camp** in 2020, 2021 taught by students at top colleges like **MIT**, **Berkeley** and **IISc**; studied topics such as **Complex dynamics**, **Quantum Computation** and **Knot theory**.