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	9.94
Intermediate	TSBIE(State)	FIITJEE Junior College, Hyderabad	2021	97.8%
Matriculation	CBSE	Maharishi Vidya Mandir, Hyderabad	2019	97.2%

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

Scholastic Achievements

- Qualified for the Indian **International Mathematics Olympiad Training Camp** in **'20, '21**. *(2020, 2021)*
- Cleared **NSEA** in 2020 and 2021 and **Indian National Astronomy Olympiad** in 2020. *(2020, 2021)*
- Secured **All India Rank 40** in JEE Advanced 2021 and **All India Rank 122** in JEE Main 2021. *(2021)*
- Secured **Global Rank 1** in the **Southeast Asian Mathematical Olympiad 2020**. *(2020)*
- Placed **first in India** at the **Technothlon 2019 Mains** conducted by IIT Guwahati, in a team of 2. *(2019)*
- 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

Railway Management System *(2022)*

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

- Implemented a planner for a railway system allowing for both admin and client operation.
- Allows retrieval of (filtered by rating/phrases) rated **journey reviews** and can **autocomplete station names**.
- Data structures used (implemented from scratch) include **Hash Tables**, **AVL Trees**, **Tries**, **Heaps** and **Graphs**, while notable algorithms include the **Knuth-Morris-Pratt** and **Quicksort** algorithms.
- 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 many **graph-searching algorithms** like BFS, DFS, Best-First Search, **A*-Search** and **Backtracking** and applied these by writing programs to **solve Mazes** and **Crosswords** in Python.
- Designed a bot to solve **Tic-Tac-Toe** using **minimax** and another to solve **Minesweeper** via **logical inference**.
- Implemented a **Q-learning** model from scratch to solve **Nim** and a **CNN** to classify the MNIST dataset.

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

- Designing a library for **Linear Algebra** constructs in **C++** with documentation via **Doxygen**.
- Implemented elementary row operations, **reduced row echelon form**, the **QR Decomposition** and the **Gram-Schmidt orthogonalization** for matrices (and for square matrices, the **determinant** and **inverse** as well).

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** in **IBM Qiskit** including Deutsch-Jozsa, Quantum Teleportation, Quantum Fourier Transform, Phase-Estimation, Order Finding, Shor's Algorithm and Grover Search.
- Learnt basic **ML** from *The deep learning book* amd investigated algorithms using **scikit-learn** and **TensorFlow**.
- Implemented a **QML** paper on **Molecular Geometry Optimization** - finding the ground state **molecular geometry** of simple molecules - using the **Jordan-Wigner Transform** and the **Variational method**.
- Designed 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**.

FastChat *(2022)*

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

- Built a fast, light-weight **distributed** server-client **network** with **end-to-end** encryption.
- Dedicated load balancer ensures higher throughput along with lower latency of individual messages.
- Used the python **socket** library to build the network and **PostgreSQL** to maintain databases.

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 Choudhari | 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

- Took **three lectures** in **Olympiad Mathematics** on **Projective Geometry, Generating Functions** and **Barycentric Co-ordinates** as part of the teaching staff at the **Online Math Club**. *(2021)*
- 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*, Computer Networks*, Logic for Computer Science*, Computer Architecture*
Mathematics:	Calculus, Linear Algebra, Differential Equations, Mathematical Structures for SysCon, Extremal Combinatorics*
Others:	Quantum Physics, Basics of Electricity and Magnetism, Introduction to Electrical and Electronics Circuits, Engineering Graphics and Drawing, Physical Chemistry, Organic and Inorganic Chemistry, Biology

**To be completed by April 2023*

Technical Skills

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

**Learning ongoing*

Extracurriculars

- **Pianist** for more than **8 years**. Completed upto **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**.