Pursuing a **Minor** degree in **Artificial Intelligence** and **Data Science** from **C-MInDS, IIT Bombay**

SCHOLASTIC ACHIEVEMENTS

- Achieved **99.81 Percentile** in **JEE-Main** out of over 1 million candidates   *(2021)*
- Secured **All India Rank 1207** in **JEE-Advanced** out of over 0.14 million candidates   *(2021)*
- Secured **AP(Advanced Performer) grade** for excellent performance in **PH 108-Basics of Electricity & Magnetism**, awarded to 27 out of over 1300 students taking the course   *(2022)*
- One of the **17 out of 1400+** students to secure a **Change of Branch** to the department of **Computer Science and Engineering** owing to excellent academic performance in first year at IIT Bombay   *(2022)*
- Secured **All India Rank 275** in the prestigious **KVPY (Kishore Vaigyanik Protsahan Yojna)** SX and awarded fellowship by the Department of Sciences, **Indian Institute of Science(IISC) Bangalore**   *(2021)*

WORK EXPERIENCE

Applied AI Researcher at Brance Technologies   *(Summer 2023)*

- Developed and implemented performant chatbot systems using **vector embeddings** for data retrieval and **Large Language Models** for question-answering, resulting in significantly improved user experience and engagement.
- Utilized **Haystack** framework and **FAISS** to efficiently index and store proprietary data, leveraging **vectorDBs** to store the embeddings. Utilized **Hugging Face models** to form the entire **retrieval pipeline**, including **document reranking**, resulting in improved relevance and accuracy of the retrieved information for chatbot responses.
- Implemented **multiple layers**, including query expansion, intent classifier, and validator to **mitigate hallucination** and improve the responses of the chatbot. Stored conversation history using **SQLite** for maintaining session state.
- Implemented **Locality-Sensitive Hashing (LSH)** to create a highly **performant caching system** to cache user queries that utilizes **semantic search**, optimizing the speed, accuracy, and efficiency of data retrieval for chatbot.
- Leveraged **Nginx** and **FastAPI** on an **AWS EC2** instance to ensure seamless communication, and reduced latency for the chatbot system. Utilized **async calls** and FastAPI's scalability for smooth data retrieval and processing.

KEY PROJECTS

Stable Diffusion from Scratch   *(Summer 2023)*
Self Project

- Used **Pygame** and **OpenAI's Gym** to train a lunar lander game **Deep Q-Learning with Experience Replay**. Used the **Sequential API** of the Keras library to define the **Q-network** and the **target Q-network**
- Used **Tensorflow Core** to define a **custom loss function** and a **custom training loop** using **GradientTape** to train the model. Used **epsilon greedy policy** to select the action with some amount of random decisions
- Utilized a **deque** for storing the experience buffer and used **experience replay** and **soft update** of the Q targets to stabilize the learning process and improve the model's convergence towards an optimal solution
- **Tuned and optimized model hyperparameters**, including learning rate, batch size, and number of episodes, epilon, gamma, number of timesteps to achieve the best results and solved the environment within 500 episodes

Discrete Event Simulator for Bitcoin Network   *(Summer 2023)*
Self Project

- Used **Pygame** and **OpenAI's Gym** to train a lunar lander game **Deep Q-Learning with Experience Replay**. Used the **Sequential API** of the Keras library to define the **Q-network** and the **target Q-network**
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FastChat
Guide: Prof. Kavi Arya | Ongoing Course Project : Software Systems Lab

(Autumn 2022)

IIT Bombay

- Developing a messaging software with **end-to-end encryption** by using **RSA+AES** to encode the messages and both **group chat** and **individual chat** support using **python socket library** and **PostgreSQL** database
- Implementing a **load balancer** with **least connect strategy** using **bash** to distribute load among multiple servers. Focusing on obtaining **high throughput** while using only **limited resources** dedicated for the servers
- Used **bash** scripts to simulate common messaging patterns and calculate **throughput** and **latency** of the system

KYC-Website
Self Project

(Summer 2023)

- Used **Pygame** and **OpenAI's Gym** to train a lunar lander game **Deep Q-Learning with Experience Replay**. Used the **Sequential API** of the Keras library to define the **Q-network** and the **target Q-network**
- Used **Tensorflow Core** to define a **custom loss function** and a **custom training loop** using **GradientTape** to train the model. Used **epsilon greedy policy** to select the action with some amount of random decisions
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Deep Learning
Self Project

(Autumn 2022)

- Made a **convolutional neural network** to classify images of handwritten digits using **MNIST** dataset and also made a **GUI** to draw digits using **python Tkinter** and classify them using the model. Made three different models using **TensorFlow Core, Keras Functional API and PyTorch** and compared their performance
- Made many different types of **CNNs** to classify various types of data such as **Traffic signs recoginition, Crack detection, Smile detection, Hand sign recoginition** using **PyTorch** and **Keras Sequential API**
- Successfully implemented **transfer learning** to train a **pretrained MobileNetV2** to classify images of **alpacas** and used **data augmentation** like random rotation and flipping resulting in a highly accurate model
- Implemented **ResNet50's architecture** from scratch using **Keras Functional API** and trained it on a hand sign dataset to classify images of 6 different classes. Compared its performance to a **pretrained ResNet50 model**

OTHER PROJECTS

Machine Learning
Self Project

(Autumn 2022)

- Experience in machine learning frameworks such as **scikit-learn, XGBoost, PyTorch, TensorFlow, and Keras**.
- Using Python packages such as **numpy, pandas, matplotlib and seaborn** for data manipulation and analysis. Learnt about **feature engineering** and feature selection techniques to improve the performance of the models
- Learnt about the various machine learning algorithms such as **linear and logistic regressions, clustering using K-means, K-nearest neighbors and decision trees** and implemented them from scratch using numpy and pandas
- Proficiency in using **cross-validation and hyperparameter tuning** to optimize machine learning models
- Used **scikit-learn and XGBClassifer and XGBRegressor** to implement various types of classifiers and regressors to predict and classify various types of data such as **classifying flower species and predicting house prices**

Rail Planner
Guide: Prof. Supratik Chakraborty | Course Project : Data Structures and Algorithms Lab

(Autumn 2022)

IIT Bombay

- Designed a simplified vesrion of a railway planner using various data structures and analyzed the space & time complexity and the efficiency to demonstrate the **properties of different data structures in C++**
- Stored trains as a dictionary using **Hash Tables** and devised algorithms for fastest possible journies
- Used **BSTs and then AVL trees** for quick searching using the journey codes and used **Tries** to implement the autocompletion feature while searching for station names and added a feature to accept reviews for journies
- Used **Quicksort** to order trains by day and time, implemented the **KMP-string matching algorithm** for allowing review searches by using keywords and implemented **Heaps** to allow filtering the reviews by their rating

SAT Solver
Guide: Prof. Parag Chaudhuri | Course Project : Computer Programming and Utilization

Autumn 2021

IIT Bombay

- Developed a video game using the **simplecpp graphics library** and object oriented programming in **C++** with a physics simulation to model the motion of bubbles along with features such as timers, health bars, levels and scores

Bubble Trouble
Guide: Prof. Parag Chaudhuri | Course Project : Computer Programming and Utilization

Autumn 2021

IIT Bombay

- Developed a video game using the **simplecpp graphics library** and object oriented programming in **C++** with a physics simulation to model the motion of bubbles along with features such as timers, health bars, levels and scores

Technical Skills

Programming	C/C++, Python, Bash, Solidity, Java, JavaScript, VHDL, Sed, Awk
Data Science	Tensorflow, Pytorch, Keras, Trax, Scikit-learn, OpenCV, NumPy, Pandas, Matplotlib
Software & Tools	MATLAB, Git, LaTeX, Docker, Wireshark, Z3, Doxygen, Sphinx, Ngingx, FastAPI
Web Development	HTML5, CSS, JavaScript, BootStrap, jQuery NodeJS, ExpressJS, SQL, MongoDB

Key Courses Undertaken

Mathematics	Calculus, Linear Algebra, Discrete Structures, Differential Equations, Optimization Models, Logic for Computer Science, Game Theory and Decision Analysis
Computer Science	Data Structures and Algorithms[#], Data Analysis and Interpretation, Software Systems Lab, Computer Networks[#], Digital Logic Design[#], Design and Analysis of Algorithms, Introduction to Blockchains Cryptocurrencies and Smart Contracts, Computer Vision

(# Theory + Lab)

Extracurricular

- Successfully completed one year under **National Sports Organization(NSO)** in **Chess** at IIT Bombay *(2022)*
- Pitched a **Business Model Canvas** for a startup in the health sector which entailed making online ambulance bookings, for the EnB Buzz competition conducted by the **Entrepreneurship cell of IIT Bombay** *(2021)*
- Worked in a team of 4 to make an ESP32 **WiFi-controlled** bot for XLR8 conducted by **ERC, IITB** *(2022)*
- Mentored ... (SoC)