

Eeshaan Jain

3rd year undergraduate, Electrical Engineering, IIT Bombay

☎ (+91) 8668473114 | ✉ jaineeshaan17@gmail.com | 🏠 eeshaanjain.github.io | 📱 EeshaanJain | 💻 eeshaanjain

Education

Indian Institute of Technology Bombay

CPI: 9.57/10

DUAL DEGREE (B.TECH + M.TECH) IN ELECTRICAL ENGINEERING WITH MINOR IN AI AND DATA SCIENCE

Jul 2019 - Ongoing

Aditya Horizon Junior College

Percentage: 93.2%

INTERMEDIATE (HSC - HIGHER SECONDARY CERTIFICATE)

Jul 2017 - Apr 2019

Wisdom World School

Percentage: 98.2%

MATRICULATION (ICSE - INDIAN CERTIFICATE OF SECONDARY EDUCATION)

Jun 2012 - May 2017

Interests

Machine Learning Graph Neural Networks, Generative and Adversarial Networks, Privacy on Social Networks
Quantum Quantum Computing, Quantum Machine Learning

Experience

AGRIVATOR

A Startup at IIT Bombay

MACHINE LEARNING SUBSYSTEM

Jun 2021 - Oct 2021

- Surveyed recent literature on **SOTA** approaches to image segmentation on **crop-weed detection** and **soil-nutrient monitoring**
- Benchmarked real-time performance of **Fast-RCNN**, **Faster-RCNN** and **YOLO-v4** on soyabean crop weed detection
- Integrated the model with an **autonomous bot** to continuously monitor crop state and synchronously provide improvements

Key Projects

ESTIMATION OF EPIDEMIC STATE USING GRAPH NEURAL NETWORKS

GUIDE: PROF. ABIR DE

Sep 2021 - Nov 2021

- The goal of the project was to approximately determine the **state of epidemic spread** in a small-world network using **GCNs**
- Generated **random networks** using the Erdős-Rényi-Gilbert, Watts-Strogatz and Barabási-Albert models for our dataset
- Implemented the **SIR** contagion model, treating the epidemic as a CTMC, on our graphs to get a **spatio-temporal** dataset.
- Performed **node classification** (S/I/R) using **Graph Neural Networks** by monitoring only a **small subset** of nodes (15% - 25%)

BENCHMARKING IMAGE NETWORKS ON CANINE VISION SPECTRUM

GUIDE: PROF. AMIT SETHI

Oct 2021 - Nov 2021

- The goal of the project was to **benchmark** popular CNN models on an image dataset transformed into the **canine** vision spectrum
- Applied **non-linear transformations** and **clipping** to the cats v/s dog dataset by Microsoft Research to get images in the CVS
- Surveyed literature based around effect of color space and vision spectrums on the performance of CNNs in the classification setting
- Benchmarked the performance of our dataset on DenseNet-121, ResNet-50 and EfficientNet-B1 in two parameter settings

IMPROME - IMAGE PROCESSING MADE EASY

GUIDE: PROF. AMIT SETHI

Aug 2021

- Developed a **graphical user interface** using the **PyQt** framework in Python to perform image processing operations
- Reviewed literature on **color spaces**, **histogram specifications**, **intensity transformations** and **frequency transformations**
- Implemented image processing algorithms such as vectorized **convolutions**, **transformations** and **equalizations** from scratch

NEURAL MACHINE TRANSLITERATION

GUIDE: PROF. BIPLAB BANERJEE

Mar 2021 - May 2021

- The goal of the project was to create an interface to facilitate **transliteration of text** in images from one language to another
- Explored and implemented various **sequence to sequence** machine transliteration models to convert a piece of Hindi text into English
- Pipelined the transliteration model with **optical character recognition** techniques using EasyOCR to extract Hindi text from an image
- Surveyed literature on **attention-based transliteration models** such as **DeepTrans**, which is implemented in the TensorFlow library

STOCK MARKET ANALYSIS AND PRICE PREDICTION

GUIDE: PROF. AMIT SETHI, PROF. SUNITA SARAWAGI

Mar 2021 - May 2021

- Studied the performance of seven sectors of the **Indian stock market** during the first wave of **COVID-19** from Feb 2020 to Jun 2020
- Performed **exploratory data analysis** on the NIFTY sectoral indices and compared them using **technical indicators** such as RSI
- Compared performance of **sequential neural network architectures** such as LSTMs and 1D CNNs to **predict stock market prices**
- Received a **special mention** and credited as the **most outstanding project** amongst 40+ projects in the field of Data Science

NON-SMALL CELL LUNG CANCER DETECTION AND MUTATION PREDICTION

GUIDE: PROF. AMIT SETHI

Jan 2021 - Apr 2021

- Trained **Inception v3** on whole-slide images obtained from TCGA to **classify** the tissue cancer into LUAD, LUSC or non-cancerous
- Obtained an **AUC score** of 0.97 on cancer classification comparable to the predictions obtained by visual inspection from **pathologists**
- Further trained the network to predict 6 of the most common **mutated genes** in **LUAD** obtaining a **maximum AUC score** of 0.84

METHODS IN NATURAL LANGUAGE PROCESSING

HSE RUSSIA, COURSERA

May 2020 - Jun 2020

- Performed **semantic analysis** using linear models (multi-label classifiers) on StackOverflow for predicting tags given questions
- Studied about **language models**, **probabilistic Markov models** and performed named-entity recognition on Twitter using LSTMs
- Worked with character, word and sentence **embeddings** and used them to identify duplicate questions on StackOverflow
- Reviewed statistical machine translation, encoder-decoder models and summarization using **pointer-generator networks**

Other Projects

PYFRAC - FRACTIONS IN PYTHON

SELF PROJECT

May 2021

- Developed the pyfrac module in Python to perform operations on **rational numbers** which can be sub-classed for complex data types
- **Extended** the usage of fractions module in python by addition of **mutability** and **optimizations** to convert decimals to fractions

DIGITAL CIRCUIT DESIGN IN QUARTUS

GUIDE: PROF. MARYAM SHOJAEI BAGHINI

Jan 2021 - Apr 2021

- Implemented a 16 bit **Kogge Stone** adder/ subtractor, arithmetic right **shift** and a **clock divider** on the Krypton CPLD-based board
- Designed a tone synthesizer circuit to **automate** the sequence of 8 musical notes to generate music using a **finite state machine**
- Emulated the **blinking taillights** of the Ford Thunderbird by modeling the blinking sequence with a **finite state machine**

WORKING WITH CISC AND RISC MICROPROCESSORS

GUIDE: PROF. DINESH SHARMA & PROF. V RAJ BABU

Jan 2021 - Apr 2021

- Implemented **software keyboard scanning** on the Intel 8051 and Mini-MIPS processor using FSM with a keystroke interval of 50ms
- Programmed the 8051 for communication via **Continental Morse Code** using UART and perceived it by synthesizing tones at 500Hz
- Analyzed the **stack structure** and operations in the 8086 and utilized **string instructions** for efficient movement of data

HYPERLOOP POD SUBSCALE PROTOTYPE DESIGN

TEAM HYPERLOOP IITB

Jan 2020 - Dec 2020

- Amongst 50 tech-enthusiasts aiming to build a **subscale prototype** of the Hyperloop Pod which could travel at hypersonic speeds
- Applied knowledge acquired on **I2C** and **CAN** communication protocols to the Hyperloop communication systems
- Studied about various control and communication systems and various **error correction** and **detection** algorithms
- Qualified in the **top 5** university teams internationally for the finals of the **European Hyperloop Week** (EHW 2021)

IMAGE TO IMAGE TRANSLATION - SKETCH TO COLOR

SEASONS OF CODE - WINTER

Apr 2020 - Aug 2020

- Surveyed literature on **generative adversarial networks** and image-to-image translation using **conditional** adversarial networks
- Implemented a **conditional-GAN** which accepts **sketched** image and predicts its **colored version** without knowing the ground truth

AUTONOMOUS GARBAGE COLLECTING BOT

INSTITUTE TECHNICAL SUMMER PROJECT

Apr 2020 - Aug 2020

- Designed an **autonomous** garbage collecting bot which can **classify**, **detect** and **collect** plastic, cardboard, metal and wrappers
- Constructed a full-scale model of the bot on **Blender**, designed the electric circuit on **Fritzing** using **Raspberry Pi 4** and **Arduino**
- Used **YOLO** for object detection, **ROS** for simulation, and designed a custom gripper for **palming action** to pick the garbage
- Declared as one of the **top 3** projects overall out of more than 60 projects that were submitted in ITSP 2020

VIRTUAL REALITY GAME DEVELOPMENT

TINKERER'S LAB, IIT BOMBAY

Apr 2020 - Aug 2020

- Headed the **animation team** and developed a first person virtual reality game in **Unity** Game Engine and **Blender** 3D software
- Applied knowledge acquired in the field of 3D animation and modelling to **create assets** and **characters** to be used in the game
- Read about construction of **virtual reality gloves** linked with **headset** to control movement and actions in the game

Skills

Languages	Python, C++, Julia, HTML, CSS, Javascript
Machine Learning	PyTorch, PyTorch-Geometric, TensorFlow, Keras, NLTK, Scikit-Learn, OpenCV, Flux.jl
Softwares	Scilab, MATLAB, Quartus, Keil, Blender, Git, AutoCAD, SolidWorks, GNU Radio, Spice
Python Libraries	NumPy, Pandas, Matplotlib, Seaborn, SciPy, Qiskit, SymPy, PyQt5, JAX, NetworkX

Scholastic Achievements

2021	Institute Academic Prize , Awarded for outstanding academic achievement	IIT Bombay
2021	Department Rank 2 , Out of 79 students in the Dual Degree Programme, Electrical Engineering	IIT Bombay
2020	AP Grade , Awarded for outstanding performance in Differential Equations-II and Physical Chemistry	IIT Bombay
2019	All India Rank 120 , JEE Main 2019 out of 1.2 million candidates	JEE
2019	All India Rank 355 , JEE Advanced 2019 out of 245,000 qualified candidates	JEE
2019	Top 300 , Indian National Chemistry and Astronomy Olympiads	INO
2018	All India Rank 100 , Kishore Vaigyanik Protsahan Yojana and received their undergraduate fellowship	KVPY
2018	Nation Top 1% , National Standard Examinations in Physics and Chemistry	IAPT
2018	State Top 1% , National Standard Examinations in Astronomy	IAPT

Key Courses Undertaken

Machine Learning	Programming for Data Science, Introduction to Machine Learning, Learning with Graphs, Foundations of Intelligent Learning Agents, Image Processing, Advanced Machine Learning*
Mathematics & Physics	Calculus, Linear Algebra, Differential Equations-II, Complex Analysis, Quantum Physics, Electricity and Magnetism
Electrical Engineering	Probability and Random Processes, Signal Processing, Microprocessors, Digital Systems, Communication Systems, Digital Signal Processing, Markov Chains and Queuing Systems*
Online Courses	Deep Learning Specialization, Natural Language Processing, Algorithmic ToolBox, Data Structures, Managing the Company of the Future, MATLAB Onramps, Machine Learning with Graphs [†] , Differential Privacy [†]

[†] non-certified

* to be completed by Apr 2022

Positions of Responsibility

CLASS REPRESENTATIVE

ELECTRICAL ENGINEERING DEPARTMENT

Sep 2019 - Ongoing

- Responsible for **establishing communication** between professors, functionaries, other academic staff, and the class
- Suggested measures that could be adopted by instructors to facilitate **better learning experience** in the mode of **online teaching**
- Facilitated discussion** among students of the class to understand general consensus on various academic issues

UNDERGRADUATE TEACHING ASSISTANT

MA108: DIFFERENTIAL EQUATIONS, MA207: PARTIAL DIFFERENTIAL EQUATIONS & CH107: PHYSICAL CHEMISTRY

Mar 2021 - Nov 2021

- Selected on the basis of **in-depth knowledge** of the subject, in addition to good **presentation** and **communication** skills
- Conducted **weekly tutorial sessions** for a batch of 50 freshmen and helped them in the course through **personal interaction**
- Assisted** the instructor in **course logistics** by proctoring exams and evaluating examinations and periodic assessments

STUDENT PROJECT MENTOR

INSTITUTE TECHNICAL SUMMER PROJECT & SUMMER OF SCIENCE

Apr 2021 - Jul 2021

- Mentored** a group of 4 students in their Institute Technical Summer Project on the topic of **Dialogue Management**
- Mentored** a student in their Summer of Science learning project on the topic **Deep Learning and Neural Networks**
- Provided mentees with **regular assistance** and **insights** on various topics to be explored in the respective fields of interest

PYTHON COURSE INSTRUCTOR

PyCK: PYTHON IS COOL, KIDS!

May 2021 - Jul 2021

- Introduced **Python** to **1000+ students** at IIT Bombay in the course PyCK hosted under Web and Coding Club, IIT Bombay
- Delivered **biweekly lectures** covering topics such as classes, libraries amongst others in Python and held frequent **doubt sessions**
- Assisted 50+ students in their project by **documenting** their **project** reports and **scrutinizing** their progress periodically

CONVENER

CHEMISTRY CLUB

May 2020 - Jun 2021

- Contributed to the **ideation** for setting up the **foundations** of the club and further for the organization of future events
- Organized and conducted **Rascionix**, a national chemistry competition with **200+ participants** from all around India
- Engaged in the creative direction of a regulated stream of **content creation** based around chemistry on various social media platforms

Extracurricular Activity

Chemenigma	Stood 2nd overall and 1st in the prelim round of Chemenigma, a chemistry tournament by IISc Bangalore	2021
Chess	Completed a year long professional course in Chess under National Sports Organization (NSO)	2019-2020
Quantum Computing	Completed the workshop held by MnP Club, IIT Bombay using Qiskit on IBM Quantum Experience	2020
LIMIT	Qualified the LIMIT examination and attended a camp in ISI Bangalore about abstract mathematics	2019
Rubik's Cube	Awarded the fastest cuber in Cubing Fever 2k16 - a district level speedcubing competition	2016
Debate	Represented the school in various inter-school debates and won the best speaker award twice	2016
Vedic Maths	Completed all 6 levels of Speed Arithmetic under IPA and stood 2nd in their state-level competition	2015

