Eeshaan Jain

4th year undergraduate, Electrical Engineering, IIT Bombay

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Education

École Polytechnique Fédérale de Lausanne *Switzerland*

Semester Exchange in Computer Science *Aug. '22 - Feb. '23 (Expected)*

Indian Institute of Technology Bombay (IITB) *India*

B.Tech in Electrical Engineering (EE) with M.Tech in Machine Intelligence and Data Science (CPI: $9.62/10$) *Jul. '19 - May '24 (Expected)*

Scholastic Achievements

2022/2021	**Institute Academic Prize 2022/2021**, Awarded for excellent academic performance by IIT Bombay
2022	**Department Rank 2**, Out of 79 students in the Dual Degree Programme, Electrical Engineering
2019	**All India Rank 120**, JEE Main 2019 out of 1.2 million candidates
2019	**All India Rank 355**, JEE Advanced 2019 out of 245,000 qualified candidates
2019	**Top 300 across India**, Indian National Chemistry and Astronomy Olympiads conducted by IAPT, India
2018	**All India Rank 100**, Kishore Vaigyanik Protsahan Yojana organized by the Government of India

Professional Experience

MACHINE LEARNING RESEARCHER

Mumbai, India

In collaboration with Google AI, the University of Texas at Dallas and IIT Bombay *May 2022 - Sep. 2022*

- Designed a novel **non-adaptive subset selection framework** for generalizing **efficient learning** over several neural architectures
- Introduced a **GNN** and **attention-based** model encoder for crude **approximation** of outputs over a set of architectures
- Utilized **combinatorial optimization** for subset selection on the novel trainable and differentiable subset selectors
- Demonstrated that our approach constantly **outperformed** other non-adaptive and adaptive subset selection approaches on various datasets and subset sizes in terms of **accuracy**, **subset selection time** and **memory consumption**

ARTIFICIAL INTELLIGENCE ENGINEER

Sapporo, Japan

AWL, Inc. Japan *May 2022 - Jul. 2022*

- Surveyed optimization frameworks based around **model compression, quantization-based training** and **inference speed-up**
- Implemented **hardware-optimized operations** and routines on CPUs using **Apache TVM** to bring down single-image inference times on low-power devices by **8**× without hurting the metrics of the outputs
- Utilized the **TensorRT** and **DLA** GPU-based frameworks along with CPU fallbacks to speed up batched-inference on Jetson GPUs

Research Projects

EFFICIENT MATROID-CONSTRAINT-BASED SUBMODULAR MAXIMIZATION

Course Project: Optimization for Machine Learning

Guide: Prof. Ganesh Ramakrishnan, Dept. of Computer Science, IITB *Mar. 2022 - May 2022*

- Worked on **efficient** greedy algorithms for **maximization of submodular functions** under **matroid** constraints
- Implemented the **Continuous-Greedy** and **Accelerated Continous-Greedy** algorithms in SUBMODLIB
- Modified the **Pipage-Rounding** subroutine for **efficient translation** of fractional solutions to discrete subsets
- Implemented the **Submodular Welfare Problem** and, **Separable** and **Generalized Assignment Problem** in SUBMODLIB

POST-HOC OUT-OF-DISTRIBUTION DETECTION

Course Project: Advanced Machine Learning

Guide: Prof. Sunita Sarawagi, Dept. of Computer Science, IITB *Mar. 2022 - May 2022*

- Worked on a **new scoring function** to generalize across OOD settings and **improving the ID-OOD gap** using marginless loss functions
- Introduced a scoring function based on the assumption of a **Dirichlet distribution** on the DNN's softmax-ed logits for OOD detection and showed that it could be asymptotically interpreted as an **ensemble** of two positive scoring functions
- Showed that the score already **outperformed** other OOD methods on multiple datasets on the basis of **FPR95**, **AUROC** and **AUPR**
- **Reduced** the number of hyperparameters to tune by demonstrating the **efficacy** of marginless loss functions for the task

ESTIMATION OF EPIDEMIC STATE USING GRAPH NEURAL NETWORKS

Course Project: Learning with Graphs

Guide: Prof. Abir De, Dept. of Computer Science, IITB *Sep. 2021 - Nov. 2021*

- Worked on determination of 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%)

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

Course Projects

NEURAL MACHINE TRANSLITERATION *Course Project: Machine Learning*

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

STOCK MARKET ANALYSIS AND PRICE PREDICTION *Course Project: Programming for Data Science*

Guide: Prof. Amit Sethi, 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

Skills

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

Positions of Responsibility

CLASS REPRESENTATIVE

Electrical Engineering Department *Sep. 2019 - Ongoing*

- Responsible for **establishing communication** between professors, functionaries, other academic staff, and the class of 160 students
- Suggested measures that instructors could adopt to facilitate **better learning experience** in the mode of **online teaching**

UNDERGRADUATE TEACHING ASSISTANT

Mathematics: MA108: Differential Equations, MA207: Partial Differential Equations
Chemistry: CH107: Quantum Chemistry *Mar. 2021 - Nov. 2021*

- Conducted **weekly tutorial sessions** for a batch of 50 freshmen and helped them in the course through **personal interaction**
- **Assisted** the instructor in the course by conducting tutorials, proctoring exams and evaluating examinations and periodic assessments

STUDENT PROJECT MENTOR

Institute Technical Summer Project & Summer Of Science, IIT Bombay *Apr. 2021 - Sep. 2022*

- **Guided** students, **reviewed** their progress and suggested related literature in their summer project on Automated Sign Language Translation using Mechanical Gloves, which won the first **first-prize** overall among 70 projects
- **Mentored** students and reviewed their reports in their summer learning project on the topics **Deep Learning** and **Graph Theory**

PYTHON COURSE INSTRUCTOR

PyCK: Python is Cool, Kids!, Web and Coding Club, IIT Bombay *May 2021 - Jul. 2021*

- A part of the team of students to conduct a summer course on **Python Programming**, with **1000+** enrolments
- Delivered **biweekly lectures** covering various topics in Python, held frequent **doubt sessions** and helped in **guided projects**

CONVENER

Chemistry Club *May 2020 - Jun. 2021*

- Contributed to 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

Extracurricular Activity

AISRG	Started a student reading group at IIT Bombay on the topic of upcoming Artificial Intelligence	2022
Chemenigma	Represented IIT Bombay at Chemenigma, hosted by IISc Bangalore and stood 1st overall	2021
Chess	Completed a year-long professional course in Chess under National Sports Organization (NSO), IITB	2019-2020
LIMIT	Qualified for the LIMIT examination and attended a camp in ISI Bangalore about abstract mathematics	2019
Debate	Represented the school in various inter-school debates and won the best speaker award twice	2016
Vedic Maths	Completed all six levels of Speed Arithmetic under IPA and stood 2nd in their state-level competition	2015