Sahasra Ranjan | **190050102**
Computer Science & Engineering | **B.Tech.**
Indian Institute of Technology, Bombay | **Gender: Male**
DOB: 01-01-2001

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2023	
Intermediate	CBSE	Bhuvnesh Bal Vidyalaya	2019	94.40%
Matriculation	CBSE	Christ Church Diocesan School	2017	10

Pursuing **Honors** in Computer Science and Engineering.

Scholastic Achievements

- Achieved All India Rank **127** in Joint Entrance Examination, Advanced out of **2,40,000** candidates *(2019)*
- Secured All India Rank **281** in Joint Entrance Examination, Mains out of **1.2 million** candidates *(2019)*
- Among top students in India to get selected for Indian National **Physics** Olympiad (INPhO), Indian National **Chemistry** Olympiad (INChO) and Indian National **Mathematics** Olympiad (INMO) *(2019)*
- Recipient of the prestigious **Kishore Vaigyanik Protsahan Yojana** (KVPY) Fellowship *(2018)*
- Awarded National Talent Search Examination **NTSE** scholarship by NCERT, Govt. of India *(2017)*

Work Experience

Protein Language Modeling with ESM1b-e2e *Summer 2021*
Prof. Martin J. Lercher, Alexander Kroll | Research Internship *HHU, Dusseldorf, Germany*

- Worked on a **BERT** based model on **PyTorch** to create high dimensional representations for enzyme sequences for the prediction of **enzyme-substrate binding** (binary classification task)
- Explored various state-of-the-art NLP models, including **Transformer**, **BERT**, **ESM-1b**, and **MSA Transformer**
- Adapted **ESM-1b** model to build an end-to-end model which **outperformed** the existing SOTA models for the task
- Extracted sequence alignments from **Uniclust** dataset using **hhblits** and implemented the MSA transformer training
- Improved accuracy for the task was achieved from **79.8**% to **87.5**% with the new representations that were created with parallel training on 8 GPUs for 10 epochs

AtDoc: Online Doctor Consultation Service *Summer 2020*
Database and Backend Internship *AtDoc*

- Lead the **backend development** in a telemedicine startup to schedule non-contact consultations for patients
- Implemented a database for storing **encrypted** information of doctors and patients on AWS using **PostgreSQL**
- Worked on a **Django** based backend enabling end-to-end features including in-app **audio and video calling**

Key Projects

Video Denoising using Low-Rank Matrix Completion *Spring 2021*
Guide: Prof. Ajit Rajwade | Course Project: Advanced Image Processing *IIT Bombay*

- Applied **Adaptive Median Filtering** algorithm for removing impulsive noise from the spatial domain of the video
- Implemented Three Step Cross Search using **MATLAB** for organising similar patches across the temporal domain
- Adapted **Fixed Point Iterative Algorithm** for reducing Poisson and Gaussian noise from the image sequence

Online Coding and Development Environment *Autumn 2020*
Guide: Prof. Amitabha Sanyal | Course Project: Software and System Labs *IIT Bombay*

- Created a **web platform** providing an in-browser **IDE** and support for user organised **coding competitions**
- Used **Django**, **Angular** and **PostgreSQL** to create an interactive user interface with secure user-authentication
- Implemented user directory separation, **multiple language support** and isolation using **Docker** for data protection

SnapMath - Image to LaTeX convertor *Summer 2020*
Institute Technical Summer Project | Institute Technical Council *IIT Bombay*

- Implemented a **CNN** and **LSTM** based model on **PyTorch** for generating LaTeX expression of the input equation
- Adapted the **OpenAI** problem statement and used im2latex-100k dataset to achieve a **BLUE-4** score of **38.82**
- Deployed the model on a **Django** based interactive web application and integrated the **Django-TeX** parser

Testing Transport Layer Protocols *Spring 2021*
Guide: Prof. Vinay Ribeiro | Course Project: Computer Networks *IIT Bombay*

- Implemented client and server using **Socket Programming in C**, to send files using different variants of **TCP**
- Used **Bash** to **automate** experiments and generate plots for comparing **throughput**, **delay**, and **packet loss**
- Recorded network traffic using **Wireshark** and analysed **window scaling graphs** for **TCP Cubic** and **TCP Reno**

Other Projects

Image Compression using Quad-Tree *Autumn 2020*
Guide: Prof. Ajit A. Diwan | Course Project: Data Structures and Algorithm *IIT Bombay*

- Created a **Region quad-tree** class in C++ to store grey-scale images with highly optimised space complexity
- Implemented **optimised algorithms** to allow for intersection, overlap, resize, complement, and extraction of images

Video from Single Exposure Coded Snapshot *Spring 2021*
Guide: Prof. Ajit Rajwade | Course Project: Advanced Image Processing *IIT Bombay*

- Adapted publication from **ICCV'11** to reconstruct spatial and temporal domain of the video from coded snapshot
- Implemented **Orthogonal Matching Pursuit** algorithm for sparse reconstruction to achieve RMSE of **0.03301**

Bodhitree - Online learning platform *Spring 2021*
Guide: Prof. Kameshwari Chebrolu | RnD Project *Bodhitree Development Group, IIT Bombay*

- Worked on **Django** and **React-JS** based codebase of Bodhitree currently being used by **500+ instructors**
- **Migrated** various sections of the codebase to the latest technologies and deep checked and fixed the **vulnerabilities**

Tomographic Reconstruction of Brain Magnetic Resonance Image *Spring 2021*
Guide: Prof. Ajit Rajwade | Course Project: Advanced Image Processing *IIT Bombay*

- Used simulated measurements of brain MR volume slices at 18 random angles and reconstructed complete slices
- Generated inverse radon transform using **Ram-Lak filter** and performed **Compressed Sensing** based reconstruction

Robust Mastermind Player *Spring 2021*
Guide: Prof. Ashutosh Gupta | Course Project: Logic for Computer Science *IIT Bombay*

- Encoded moves of the mastermind game into an **SAT** problem and solved using **conflict driven clause learning**
- Implemented a solver in Python using **z3py library** which was robust to the other player lying up to **30%** of the time

RISC 16 bit Processor *Spring 2021*
Proj. Virendra Singh | Course Project: Digital Logic Design *IIT Bombay*

- Devised an efficient, scalable 10 state FSM for a 16-bit **multicycle processor**, eight registers, and 4MB of RAM
- Synthesized and assembled ALU, Memory unit, **FSM controller** and **Datapath** in Quartus Prime using **VHDL**

Technical Skills

Programming Languages	C++, Python, Bash, Awk, VHDL, SQL
Data Science	PyTorch, NumPy, MATLAB, Octave, Pandas, Matplotlib, SciPy, OpenCV
Softwares	Git, LaTeX, Docker, Quartus, Doxygen, AutoCAD, Solidworks
Development	Django, Angular, React, NodeJS, Javascript, Typescript, HTML5, CSS

Positions of Responsibility

Seasons of Code Mentor, *Web and Coding Club, IIT Bombay* *April 2021 - June 2021*

- Mentored a group of **12 students** in different projects covering Convolutional Neural Networks and their applications
- Assisted in implementing **SRCNN** model to up-sample low-resolution images, outperforming Bicubic interpolation

Teaching Assistant, *Computer Programming and Utilisation* *Dec 2020 - March 2021*

- Assisted Prof. B. Raman and Prof. K. Chebrolu in conducting the course with a batch strength of **1500+** students
- Helped students during the **programming labs**, conducted **doubts sessions** and guided for the **final project**

Core Member, *Electronics and Robotics Club, IIT Bombay* *May 2020 - April 2021*

Team Member, *DevCom - Development Community, IIT Bombay* *May 2020 - April 2021*

Major Courses Undertaken

- **Computer Science:** Computer Networks, Advanced Image Processing, Data Analysis and Interpretation, Data Structures and Algorithms, Discrete Structures, Software Systems Lab, AI and Machine Learning*, Operating Systems*, Computer Architecture*, Foundations of Intelligent and Learning Agents*, Blockchains and Cryptocurrency*, Automata Theory**, Databases and Information Systems**, Implementation of Programming Languages**
- **Miscellaneous:** Calculus, Linear Algebra, Quantum Physics, Introduction to Electronic Circuits

** To be completed by November 2021* *** To be completed by April 2022*

Extracurricular

- Built a Bluetooth controlled four-wheeled bot, used **Arduino** to add obstacle detection and alarming system *(2019)*
- Represented High School in Annual Science Exhibition, worked on **Magnetic Levitation** *(2017)*
- Completed **Guitar** learning course under Summer School of Cult conducted by Symphony, music club of IITB *(2019)*