Anmol Saraf | **200070007**
Electrical Engineering | **B.Tech.**
Indian Institute of Technology Bombay | **Gender: Male**
DOB: 11/05/2002

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2024	
Intermediate	CBSE	Sanskartirth Gyanpeeth	2020	94.00%
Matriculation	CBSE	S.D. Jain Modern School	2018	97.00%

Pursuing Minor in **Computer Science and Engineering** & Honors in **Electrical Engineering**

Scholastic Achievements

- Secured **All India Rank 92** in **JEE Advanced** among 0.15 million candidates *(2020)*
- Achieved **All India Rank 86** in **JEE Main** out of 1 million+ aspirants *(2020)*
- Awarded the **Chanakya Fellowship** of ₹120,000 by the **Department of Science and Technology, GoI** *(2023)*
- Felicitated with the **Best Project Award** among **60+** teams in the Electronics Design Lab *(2023)*
- Recipient of the **KVPY Fellowship** granted by the **Department of Science and Technology, GoI** *(2018)*

Research and Professional Experience

Harvard University | *Research Internship* *(Jun'23 - Aug'23)*
Guide: Prof Vijay Janapa Reddi | Edge Computing Lab

- Collaborated with a **13-member** team to generate domain-specific hardware, employing the computer architecture simulator **AstraSim** integrated with cutting-edge **reinforcement learning** and **machine learning**-based algorithms
- Contributed on the **OpenAI Gymnasium** for computer architecture, **ArchGym** presented in **ISCA'23** conference
- Wrapped AstraSim environment in **Google's DeepMind** envlogger interface to generate **15,000+** hardware designs
- Utilized models like **NODE** and **XGBoost** on an **ML proxy** pipeline to enhance the performance of the simulator

Amazon Development Centre | *Software Development Internship* *(May'23 - Jul'23)*

- Implemented a new isolated state in **Java**, for identifying and handling error-ridden **Aurora Storage** data instances
- Improved **bugfix turnaround time**, by customizing current automated workflows to include the new isolated state
- Created automated tests in **JUnit** and **TestNG** to validate data safety and read/write operations on these instances

IoT Enabled Energy Sharing in Connected Buildings | *Chanakya Fellowship* *(Mar'23 - Present)*
Guide: Prof Anupama Kowli | Department of Electrical Engineering

- Developing a framework in a team of **3** to connect net-zero energy buildings using **IoT devices** to improve efficiency
- Achieved an accuracy of **78%** on predicting appliances present in a household, through **deep neural networks** on sparse energy consumption data of **15 minute** intervals for a duration of **2.5 years** of less than **100** households
- Developed a **web scraping** tool in Python which increased the accuracy by **15%**, to extract daily temperatures
- Exploring cybersecurity methods such as **data scrambling** to hide information and enable sharing in **IoT** devices

Transforming Ultrasound to CT Scans for Breast Cancer Diagnosis *(Apr'23 - Aug'23)*
Guide: Prof Amit Sethi | Medical Deep Learning and Artificial Intelligence Lab, IIT Bombay

- Utilized **CycleGANs** & **pix2pix** to generate CT scans from simulated ultrasound images, achieving an MSE of **0.008**
- Preproccessed CTs to **SoS** images to simulate ultrasound through wave interference equations using **Stride** module
- Applied **Fourier Domain Adaptation** to enhance the quality of simulated images with authentic ultrasound images

Publications

- Sahar Almahfouz Nasser, **Anmol Saraf**, et al. "Transforming Breast Cancer Diagnosis: Towards Real-Time Ultrasound to Mammogram Conversion for Cost-Effective Diagnosis", Ultrasonics, 2023 *(Submitted for Review)*

Key Projects

Team Rakshak | *Software Subsystem* *(Aug'21 - Jul'23)*
Team aim is to create Unmanned Aerial Vehicles (UAVs) to support search & rescue operations and to participate in Student Unmanned Aerial Systems (SUAS) competition which is held every year globally in the USA

- Performed object classification with an accuracy of **94%** using **transfer learning** for **ResNet** and **VGG** architecture
- Augmented images using **OpenCV** to generate **0.5 million** sample images to improve model accuracy by **20%**
- Incorporated **Principal Component Analysis** to extract the angle of tilt between the drone and the object's axis

Morphing Attacks and Defence Systems | *Course Project* *(Jan'23 - May'23)*
Guide: Prof Sunita Sarawagi | Department of Computer Science & Engineering

- Achieved a **200x better** MSE loss on unknown faces, by utilizing a **discriminator** trained on morphed face images
- Attained **80%** success rate, on attacking SOTA Face Recognition models, **OpenFace** & **FaceNet512**, by morphing two face images by interpolating their semantic and stochastic embeddings produced by **Diffusion Autoencoders**

Parallel SAT Solver | *Course Project* *(Jan'23 - May'23)*
Guide: Prof Prabhu Ramachandran | Department of Aerospace Engineering
- Achieved a **2x** speedup for up to **64-variable SAT** equations by using multi-threading in a **binary tree**-like structure
- Implemented the **DPLL** algorithm using the **mpi4py** library by setting dataflow between parent and child threads

Containment Control of Hybrid Multi-Agent Systems | *Research Project* *(May'22 - Dec'22)*
Guide: Prof Dwaipayan Mukherjee | Department of Electrical Engineering
- Simulated various heterogeneous dynamic leaders and followers on **Simulink** using passive feedback control
- Explored advanced graph theory, non-linear systems, **Barbalat's theorem** and **La Salle** invariance principle
- Performed literature survey on **Lyapunov** stability for autonomous systems including **Barbashin-Krasovski** theorem

Reflow Oven for Soldering SMD Components | *Course Project* *(Jan'23 - May'23)*
Guide: Prof Joseph John & Prof Gaurav Kasbekar | Department of Electrical Engineering
- Achieved a **six-fold** cost reduction for our product over industrial grade by optimal use of in-house components
- Designed a **printed circuit board** to host the power supply, temperature sensor, cooling fans and microcontroller
- Implemented **PID** control algorithm to follow the reflow soldering thermal profile on an **AT89C5131** microcontroller

Valet Parking Robot | *Course Project* *(Jan'23 - May'23)*
Guide: Prof Kavi Arya & Prof Paritosh Pandya | Department of Computer Science & Engineering
- Led a team of **3** to program a bot in **Heptagon**, a synchronous dataflow language, to traverse dynamic test-tracks
- Implemented obstacle-avoidance algorithm by interfacing infrared sensors on an **ATmega328P** development board

MoNuSeg Challenge | *Course Project* *(Aug'22 - Dec'22)*
Guide: Prof Amit Sethi | Department of Electrical Engineering
- Achieved a dice loss of **0.147**, by implementing a **UNet** for semantic segmentation of multi-organ tissue images
- Applied **Watershed segmentation** to the predicted probability maps from the model to distinguish individual nuclei

Comparing Various Models on Pima Indian Diabetes Dataset | *Course Project* *(Jan'22 - Apr'22)*
Guide: Prof Abir De | Department of Computer Science & Engineering
- Performed **exploratory data analysis** on the dataset to analyze it visually and find emerging patterns and anomalies
- Built **Support Vector Classifier, K-Nearest Neighbours**, and **deep neural networks** from scratch using only **NumPy**
- Performed comparative analysis for various models through **BCE error** to obtain minimum error of **0.27** for SVC

Multicycle Processor Design | *Course Project* *(Jan'22 - Apr'22)*
Guide: Prof Virendra Singh | Department of Electrical Engineering
- Designed a multicycle datapath for a **16-bit RISC** ISA microprocessor for executing 17 instructions using **VHDL**
- Modeled an **FSM** controller using **behavioral modelling** and performed **RTL** simulations on the datapath and FSM

Technical Skills

Languages	C++, C, Embedded C, Python, Java, VHDL, Verilog, Assembly (x86), MATLAB, Heptagon
Python Packages	Keras, Tensorflow, OpenCV, NumPy, Pandas, Sklearn, OS, Pytorch, Matplotlib, OpenAI Gym

Positions of Responsibility

Software Vice Head | *Team Rakshak, IIT Bombay* *(Jul'22 - Jul'23)*
- Participated in a team of **8** in the **SUAS competition** in the **USA**, resulting in 30^{th} place ranked among **80 teams**
- Spearheaded a **2-tier**, **8-member** software subsystem while facilitating streamlined information transfer between subdivisions. Interviewed, **recruited** and **mentored** 5 junior design engineers out of a pool of 50+ UG applicants

D-AMP Mentor | *Student Mentorship Program, IIT Bombay* *(Jun'23 - Present)*
- Selected into a team of **54** members out of **140+** candidates on the basis of SOPs, **interviews and peer reviews** to mentor **10** sophomores and help them manage academic and co-curricular pursuits and also develop self-sufficiency
- Received **2 days** of training on essential **mentorship skills** from a certified CBT-REBT therapist and trainer

Teaching Assistant
- *CS101: Introduction to Programming | Prof Ajit Rajwade* *(Nov'22 - Feb'23)*
  Mentored **14 students** through software labs to introduce freshmen to **C++** as their **first** programming language
- *MA108: Differential Equations | Prof Santanu Dey* *(May'22 - Jul'22)*
  Responsible for mentoring **42 students**, discussing weekly tutorial assignments and answering their doubts

Key Courses Undertaken

Electrical Engg	Speech Processing*, Communication Networks, Spin-Based Computing*, Image Processing, Probability and Random Processes, Markov Chains and Queuing Systems
Computer Science	Data Structures & Algorithms, Design & Analysis of Algorithms*, Embedded Systems, Principles of Data and System Security, Parallel Scientific Computing and Visualization
Machine Learning	Programming in Data Science, Introduction to Machine Learning, Advanced Machine Learning, Foundations of Intelligent and Learning Agents*

(To be completed by Nov'23)

Extra Curricular Activities

- Awarded ₹4,000 for placing 2^{nd} in the **Trust Lab CTF** competition organized for 50+ participants *(2023)*
- Participated in various intra-department, inter-department and inter-college **chess** competitions *(2023)*
- 1^{st} position in **National Cadet Corps** (NCC) debate competition *(2020)*
- Represented **Botswana** as a lead pianist in a concert in **Zambia Music High School Camp** *(2014)*