Kunal Chhabra
Electrical Engineering
Indian Institute of Technology, Bombay

19D070031
Dual Degree (B.Tech. + M.Tech.)
Gender: Male
DOB: 29-12-2001

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2024	
Intermediate	CBSE	DAV Centenary Public School, Barara	2019	94.20%
Matriculation	CBSE	Swami Vivekananda Public School, Jagadhri	2017	10

Pursuing Minors in **AI and Data Science & Computer Science and Engineering, IIT Bombay** with a perfect **CPI of 10**

Scholastic Achievements

- Secured an **All India Rank 110** (among **1.2 Million** candidates) in **IIT-JEE Main** conducted by **NTA** *(2019)*
- Achieved an **All India Rank 514** (among **0.2 Million** candidates) in **IIT-JEE Advanced.** *(2019)*
- Shortlisted among **top 30** students to be a part of **3**-day **Jane Street** Quantitative Trading Camp(QTC) across **top Asia Pacific**-based universities to explore the real-world ways of using math & probability *(2021)*
- Selected among **top 1000** out of **1.5 Lakh** students in **KVPY** Aptitude test organised by **IISc, GoI** *(2017)*
- Awarded the National Talent Search Examination(**NTSE**) Scholarship by the Govenment of India *(2017)*

Internships

Unsupervised Anomaly Detection in Audio Events | *LG Soft India* *(May'21-July'21)*

Solo *project to segregate anomalous sounds from normal working sounds in machines*

- Modified the existing Masked Autoencoders based Density Estimation(**MADE**) **State-of-the-art** technology to **Grouped-MADE** architecture capable of detecting anomalies when training set doesn't contain any anomalous sound
- Curated the **DCASE 2020** Audio Dataset consisting of operating sounds of **6** different types of toy/real machines
- Explored and evaluated **3** different orderings of input-output layers of the GMADE architecture for **maximizing** scores
- Achieved **74%+ AUC Score** on **Pump MIMII** Dataset using **LR ordering** on unseen normal and anomalous sounds

Dimensionality Reduction Using Sparse Autoencoders | *Michigan State University* *(Jun'21- Present)*

Ongoing research in classical **Curse of Dimensionality** *under Prof Kalyanmoy Deb,* **Endowed Chair Professor** *at MSU*

- Studied the existing **linear** & **non-linear** State-of-the-art techniques dealing with the curse of Dimensionality in **Keras**
- Generated datasets of **100000+ dimensions** and tested **Sparse Auto-Encoder** for the classical **Hypersphere** problem
- Scrutinized **10+** hidden layers architecture in detail with **MSE** loss & hypertuned model for various **code sizes**
- Configuring the generation of dataset using **Gram-Schmidt Orthogonalization** for better optimization in **PyTorch**

Key Technical Projects

Senior Design Engineer,Team Rakshak *(Aug'20-Present)*

Student Initiative to develop a fleet of cost effective UAVs, Controls Subsystem *IIT Bombay*

- Part of a team consisting of **30+** students for developing fleet of **UAVs** for participation in **AUVSI-SUAS** Competition
- Developed **python scripts** for server **login**, UAV mission **extraction** and **upload** of collected image **data**
- Working on **interoperability** for ensuring continuous communication between a remote server and autonomous UAV

Movie Script Generator using NLP Language models *(Mar'21-May'21)*

Course Project | Guide: Prof. Biplab Banerjee *IIT Bombay*

- Generated short scenes of romance genre from previous script using **transformer** and **attention-based model**
- Developed a lexically dense dataset from **60** romance scripts containing **20,000+** unique words after **pre-processing**
- Implemented **pre-trained GPT2-small** and **fine-tuned** GPT2 on dataset using **open-source transformer** package
- Evaluated the models using **KL Divergence** where pre-trained GP2 beautifully **resembled** the original distribution

Video inbetweening using direct 3d convolutions *(Sep'20-Nov'20)*

Course Project | Guide: Prof. Biplab Banerjee *IIT Bombay*

- Implemented the video generation tasks from images using **CVAE** and **CGAN** unsupervised generative techniques
- Used **Moments in Time** dataset- **1M** videos split into **339** categories using **Google Cloud**
- Reproduced interesting dynamics in output videos using **CVAE**, pixels were downscaled to reduce computational time

RISC Micro-Processor | *Course Project* | *Prof. Maryam S.Baghini* *(May'21 - July'21)*

- Implemented a **5-stage** Pipelined **RISC** Microprocessor to **prevent Interlocking** using **Quartus Prime** Lite on **VHDL**
- Emulated the **RiSC-16 ISa** by Prof. Bruce Jacob, based on the **LC-896** developed by Prof. Peter Chen
- Designed the **MIPS**-like Processor with **8** registers, **512** byte data memory and **16**-bit instructions

Fraudulent Transaction Detector |*Technical Summer Project* *(May'21 - July'21)*

Institute Technical Summer Project *IIT Bombay*

- Applied **PCA** model on **European Credit-Card Transaction Data,2013** to generate **28** variables to train upon
- Employed anomaly detecting algorithms such as **Isolation Forests, One Class SVMs** and **Local Outlier Factor** algorithms
- Enterprised advanced **Multi-layer Perceptron** and **Genetic algorithm** to obtain **99.993%** accuracy on testing data
- Used **ROC-POC** Curves on **Plotly** to analyse the models, and deployed them onto a **Streamlit** dashboard

Self Irrigation System |*Tinkering Bootcamp* | *Learners Space* | *IIT Bombay* *(July'20)*

- Designed the code of an automated Self irrigation system in **Arduino** IDE for various environmental conditions
- Used **DHT11 Sensor** that integrated well with the code and displayed temperature and humidity on **BLYNK App**

Academic and Other Projects

ATM Simulator | *Course Project* | *Guide: Prof. V. Rajbabu* *(Apr'21)*

- Programmed the **Pt-51 micro-controller** using **embedded C** to simulate an **ATM** with an interfaced **LCD** display
- Established serial communication using a **USB-UART** module and successfully executed **ATM query** algorithm

Musical Notes | *Course Assignments* | *Guide: Prof. Maryam S.Baghini* *(Mar'21)*

- Played the upper octave of **7** Indian **classical** major **notes** using **8** slide switches and **8** LEDs on **Krypton** Board
- Generated **4Hz** frequency from a **50MHz** master clock using clock divider and used **FSM** to play notes in a loop

Multi-Functional ALU | *Course Project* | *Guide: Prof Virendra Singh* *(Dec'21)*

- Designed a signed **16-bit** Arithmetic & Logical Unit (**ALU**) using **Structural VHDL** in **Quartus Prime**
- Swotted the working of **Fast Adders** in detail and executed **Kogge Stone** & **Brent Kung adders**

DC Power Supply | *Course Project* | *Guide: Prof. BG Fernandes* *(Sep'19-Nov'19)*

- Operated with transformer and **full wave bridge rectifier** with **capacitive filter** to get rectified wave
- Utilized **Zener diode**,**IC 7805** and **IC 7905** to get regulated DC supply from **rectified** wave output

Positions of Responsibility

Internship Coordinator | *Placement Cell* | *IIT Bombay* *(Jun'21 - Present)*

- Part of a **24-member** team responsible for streamlining the **Internship** Process for **1500+** students.
- Soliciting relations with **200+ MNCs** in sectors including **Software**, **Consulting, FMCG** and **Finance**
- Contacting **100+** established **Foreign Universities** to improve International Research Exposure for students

Activity Associate | *National Service Scheme (NSS) Web* | *IIT Bombay* *(Jun'20 - May'21)*

- Updated **Team Lists** for the year **2020-21**,minor front-end work on the **Official NSS Webpage** using **CSS** and **JS**
- Contributed in front end work of **5** NSS Websites and managed database for the same using **MongoDB**

Coordinator, Horizons | *50th Edition* | *Mood Indigo* | *IIT Bombay* *(May'20 - Apr'21)*

Asia's Largest College Cultural Festival | *2,000+ colleges* | *100+ events*

- Invited **20+ artists** from **4 countries** to increase the international grandeur of the 50th MI edition
- Spearheaded a team of **10+ organizers** to execute events in the **flagship event Vogue**- MI's Official **Fashion Competition**

Technical Skills

Programming	Embedded C, C++, Python, Julia, MATLAB, VHDL,Assembly, HTML, CSS, PHP, JavaScript, NodeJS, Bootstrap
Software & Tools	ROS, Gazebo,librosa,AutoCAD, SolidWorks, ArduinoIDE, Numpy, Keras, Tensorflow, PyTorch, Quartus, Excel, Git, LaTeX, AutoCAD, SolidWorks

Key Courses Undertaken

Computer Science	**Computer Networks***, **Foundations of Intelligent and Learning Agents***, Introduction to Machine Learning, Machine Learning for Remote Sensing-II
Mathematics	Linear Algebra, Complex Analysis, **Calculus**, Differential Equations II,**Mathematical Structures for Control**
Electrical	**Image Processing**,**Probability & Random Processes**, Analog Devices, Digital Systems, **Signal Processing**, Control Systems, Microprocessors,**Foundation of VLSI CAD***

*(*Courses to be completed by Nov'21)*

Extra-Curriculars

- **4*** star coder at Online Coding Platform **CodeChef**, with a current maximum rating of **1827**
- **Semi-Finalist** in the **Classmate Spell-Bee Competition** powered byToI Newspaper with **2,00,000+** participants*(2014-15)*
- **Led** a **5 membered team** in **ERATOSTHENES** by **IAU** worldwide to measure circumference of Earth *(2016-17)*
- Developed market strategies & created **Revenue Model** using case studies in **EnB Buzz**,by **EnB Cell,IITB** *(2019)*

Scholastic achievements and extracurricular activities are not verified by the Placement Cell