Jay Chaudhary

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Education

Indian Institute of Technology Bombay (IIT Bombay) *[Nov 2021 - May 2025]*
Bachelors of Technology | Department of Electrical Engineering *CGPA:9.43* /10

Major in **Electrical Engineering** (EE), pursuing **minor** in **Centre for Machine Intelligence and Data Science**

Scholastic Achievements

- Currently ranked **13th** in the department of Electrical Engineering out of 110 students. [2023]
- Awarded with **Advanced Performer Grade** in the course
  – **EE204: Analog Circuits :** Awarded to 2 out of 210 students [2022]
- Secured **All India Rank 262** in **Joint Entrance Exam (Advanced)** out of **0.15 million** aspirants [2021]
- Attained a percentile of **99.956%** in **Joint Entrance Exam (Mains)** among **1 million** candidates [2021]
- Ranked among the state **Top 1%** in the **Indian Olympiad Qualifiers in Chemistry (IOQC)** [2021]
- Awarded **Kishore Vaigyanik Protsahan Yojana (KVPY) Fellowship** by Govt. of India [2021]

Publications

- Aye Phyu Phyu Aung, **Jay Chaudhary**, Ji Wei Yoon, Senthilnath Jayawelu, "**XMOL: Explainable Multi-property Optimization Of Molecules**", currently under review at **ICASSP 2025** Main tracks

Professional Experience

Explainable AI for Multi-property Optimization | *Research Intern* [May'24 - Aug'24]
Agency for Science, Technology, and Research, Singapore | Guide:J. Senthilnath

- Enhanced **state-of-the-art** single property geometric diffusion techniques for **multi-property** molecular optimization
- Proposed and implemented **spectral normalization** and new molecular constraints to stabilize the training process
- Developed an architecture for optimizing **multiple molecular properties**, integrating **GNNShap** for **ante-hoc** explainable AI to ensure interpretability and transparency in model training and prediction processes

Fan Detection and Classification using YOLO and ViT | *ML Intern* [Dec'23 - Jan'24]
Atomberg Technologies Private Limited, Pune

- Implemented **YOLO** for high-precision fan detection, optimizing parameters for real-time performance. Evaluated different versions, including **YOLOv5** and **YOLOv7**, to achieve excellent detection metrics through extensive testing
- Employed **ViT** for robust fan classification, fine-tuning the model on an extensive dataset for improved accuracy
- Developed an integrated **pipeline** combining YOLO and ViT, incorporating data preprocessing and augmentation

Research Projects

Semi-Supervised Object Detection with CAGE Pseudo-Labeling [Jan'24 - Apr'24]
Guide: Prof. Ganesh Ramakrishnan

- Trained multiple CNN models on the **MSCOCO** dataset, creating labeling functions adapted from the **CAGE**
- Engineered labeling functions that return a class label or **ABSTAIN** based on predictions and specific conditions
- Enhanced **Faster R-CNN** model performance by using pseudo-labeled data generated by these functions, effectively leveraging semi-supervised learning to boost detection accuracy and robustness

3D Reconstruction of Oral Cavity from Intraoral Camera Images [Jul'24 - Present]
Guide: Prof. Ganesh Ramakrishnan

- Conducted a comprehensive literature review on **3D reconstruction** methods for **intraoral** applications
- Captured and processed intraoral videos to ensure thorough coverage of oral structures for precise 3D modeling
- Currently working on refining **NVIDIA Instant-NGP** NeRF model through hyperparameter tuning and modifications tailored to intraoral 3D reconstruction needs

Threshold-Based Optimal Arm Selection in Structured Bandit Problems [Jul'24 - Present]

B.Tech Thesis Project | Guide: Prof. Prasanna Chaporkar

- Conducted an extensive literature review on algorithms for optimal arm selection under **unimodal** constraints
- Developed an algorithm to identify the optimal arm just below a given threshold, incorporating monotonic properties
- Currently working on proving **regret-bound optimality** and benchmarking the algorithm against methods like **KL-UCB** to assess its efficiency and accuracy in threshold-based selection within monotonic structures

AI/ML Projects

Image Generation Using Diffusion Models [Nov'23 - Dec'23]

Course Project: EE782 Advanced Topic in Machine Learning | Instructor: Prof. Amit Sethi

- Implemented diffusion models, trained on **MNIST, FMNIST,** and **CIFAR10** to generate good-quality images
- Enhanced performance by adjusting **U-Net** complexity, using schedulers and optimizers, and tuning hyperparameters
- Implemented stable diffusion models, enhancing image generation stability and maintaining high-quality outputs

Automatic Speech Recognition [Jan'24 - Apr'24]

Course Work: CS753 Automatic Speech Recognition | Instructor: Prof. Preethi Jyoti

- Enhanced **Grad-TTS** by replacing convolutions with **depthwise separable** ones and adding **cosine noise scheduling**
- Enhanced **Conformer** with improved conv module and **CTC**, reducing **WER** on **Librispeech** from **0.74** to **0.68**
- Optimized **Whisper** for **Hinglish speech recognition** using **Greedy** and **Beam search** decoding algorithms

Movie Genre Prediction from Poster [Mar'23 - Apr'23]

Course Project: CS419 Introduction to Machine Learning | Instructor: Prof. Abir de

- Utilized the **VGG16** model and compared its performance with a scaled-down version of the **Inception v4** model
- Applied data augmentation techniques (rescaling, rotation) to reduce bias, conducted **cross-validation** to evaluate model generalization and minimize overfitting, and assessed performance using **accuracy** and **F1-score** metrics

Conditional GAN for Person Identification and Image Diversification [Sept'23 - Oct'23]

Course Project: EE782 Advanced Topics in Machine Learning | Instructor: Prof. Amit Sethi

- Created a **Conditional GAN** framework to generate diverse images of the same individual by employing advanced data augmentation techniques, enhancing model robustness and capturing variations in pose, expression,and lighting
- Implemented a **Siamese network** for precise person re-identification, enhancing training stability and convergence

Image Captioning with Custom Encoder-Decoder Architecture | *Self Project* [Jun'23]

- Developed an **Encoder-Decoder model** for image captioning, utilizing text features from **Sequence Feature Layers (SFLs)** and image features from a **Pre-Trained VGG16** and fine-tuned the model on **Flickr8K dataset**
- Evaluated the model using **BLEU1** and **BLEU2** metrics, achieving scores of **0.54** and **0.36**, respectively

Stock Price Prediction using LSTM [Aug '23-Sep '23]

Course Project: EE782 Advanced Topics in Machine Learning | Instructor Prof. Amit Sethi

- Designed and implemented stock price prediction model based on **LSTM** architecture using time-series analysis
- Devised a trading module to buy, hold and sell stock based on the current, past stock prices and risk management

BERT-based Sentiment Analysis on Tweets | Self Project [May'23]

- Utilized **BERT** for feature extraction to perform sentiment analysis on a dataset of 1,00,000 tweets
- Cleaned the data using preprocessing techniques for compatibility with the **pretrained BERT**, and assessed the model's performance using the **Matthews Correlation Coefficient** (MCC), achieving an MCC of **0.71**

Covid 19 Trend Analysis [Mar'23 - Apr'23]

Course Project: DS203 Programming for Data Science | Instructor: Prof. Amit Sethi

- Analyzed the impact of **COVID**-19 on countries using parameters like GDP, age, and health, and also assessed its effect on students' lives, classifying mental illness with **SVC, Random Forest,** and **K Neighbors Classifiers**
- Predicted future disease trends using Support Vector Regressor, K Nearest Neighbors Regressor, and Random Forest Regressor, with extensive hyperparameter tuning and also applied **ARIMA** modeling for trend period predictions

Other Projects

Pipelined RISC Processor [Apr'23 - May'23]

Course Project: EE309 Microprocessors | Instructor: Prof. Virendra Singh

- Designed a 6-stage pipelined **RISC 16-bit** processor in **VHDL**, achieving a **CPI** close to 1 for 26 instructions
- Incorporated hazard mitigation with forwarding logic and a stalling unit, and constructed **ALU**, pipeline registers, register file, instruction decoders, forwarding unit, hazard detection unit, stalling units, branch predictor and memory
- Performed extensive debugging to detect and resolve the issues and tested the design by implementing it on **FPGA**

Wireless Vibration Sensing Nodes for SHM [Jan'24 - Apr'24]

Course Work: EE344 Electronic Design Lab | Instructor: Prof. Siddarth Tallur

- Developed a vibration sensor with data logging and wireless transmission using **ESP-32** for real-time monitoring
- Built a **GUI** to visualize key parameters and conduct frequency analysis on data obtained from various locations

Bubble Trouble - Game Development in C++ [Jan'22 - Feb'22]

Course Project: CS101 Computer Programming and Utilization | Instructor: Prof. Parag Chaudhuri

- Applied OOP principles to design classes for shooter and bubble objects, enabling accurate controls, projectile motion
- Implemented multiple features in the game including **3 progressive levels** with **dynamically increasing speed, size** and **quantity** of bubbles as well as additional graphic features to make the game interactive and user-friendly

Technical Skills

- **Programming Languages:** C++, VHDL, Python, embedded C
- **Software :** Quartus , CAD, Keil
- **Python Libraries :** Numpy ,Pandas, TensorFlow, PyTorch
- **Other tools :** LaTeX, Jupyter Notebook, Matlab

Key Courses Undertaken

Electrical	Digital Signal Processing, Communication Networks, Electronic Design Lab, Communications Systems, Control Systems, Microprocessors, Microprocessors Lab, Testing and Verification of VLSI Circuits, Electronic Devices & Circuits, Analog Lab, Analog Circuits, Digital Systems, Signal Processing, Digital Circuits Lab
Mathematics & Computing	Markov Chains and Queuing Systems, Probability and Random Processes, Game Theory, Computer Programming with C++, Calculus, Linear Algebra, Complex Analysis, Differential Equations
AI/ML	Programming in Data Science, Introduction to ML, Advanced Topic in ML, Image Processing, Optimization in ML, Automatic Speech Recognition, Learning and Inference in High Dimensions

Extra-Curricular Activities

- Participated in the national-level **Bharat Ko Jano** quiz competition organized by **Bharat Vikas Parishad** [2017]
- Formulated and pitched a **business model** for **EnB Buzz competition** organized by **E-Cell, IIT Bombay** [2021]
- Completed a year-long athletics training program under the National Sports Organization (**NSO**) [2021]
- Participated in an **RC Plane** competition organized by the **Aeromodelling Club, IIT Bombay** [2022]
- Hobbies: Cooking, Photography, Volleyball, Hiking, Video Games