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Electrical Engineering
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Specialization: Communications Engineering

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Examination	University	Institute	Year	CPI / %
Post Graduation	IIT Bombay	IIT Bombay	2022	7.81
Graduation	MAKAUT	Heritage Institute of Technology	2018	7.85
Graduation Specialization: Electronics & Communication Engineering				
Intermediate	CBSE	D.A.V Public School	2014	86.80%
Matriculation	ICSE	Splendour High School	2012	89.28%

AREAS OF INTEREST

- Machine Learning
- Optimization
- Data Science
- Deep Learning in Image & Speech Processing

KEY ACADEMIC PROJECTS

- **Facial Emotion Recognition using Deep Learning** [Aug - Dec'20]
Guide: Prof. Preethi Jyothi, CSE Dept., IIT Bombay | Foundations of Machine Learning
 - Used **FER-13** dataset which comprises a total of **35887** pre-cropped, **48-by-48-pixel** grayscale images
 - Trained various **CNN** models like **VGG-16**, **Inception**, **AlexNet** and studied evolution of their performance
 - Deployed our best model, **VGG-16**, with 5 emotions for **real-time** prediction using **openCV** cascade classifier
- **Predicting Release Year of Songs | Kaggle Competition** [Aug - Dec'20]
Guide: Prof. Preethi Jyothi, CSE Dept., IIT Bombay | Foundations of Machine Learning
 - **Objective** : Predict the release year of a song from a set of **timbre-based audio features** extracted from it
 - Implemented a **Feed-Forward Neural Network** for regression task using **NumPy** from scratch
 - Performed different data pre-processing steps like feature scaling, selection etc. to improve overall accuracy
 - Limited RMSE to **11.15** by performing **Mini-Batch GD** & using **ADAM Optimizer** on **MSD** Dataset
- **Speech to Sign-Language(with emotions) for the Hearing-Impaired** [Jan - Apr'21]
Guide: Prof. Preethi Jyothi, CSE Dept., IIT Bombay | Automatic Speech Recognition
 - Trained **Convolutional Neural Network** on **RAVDESS** audio samples to detect emotion from speech
 - Used a **Conformer**-based pre-trained model from **ESPNET**-model zoo, for Speech2Text conversion
 - Created a **streamlit** based **UI** to record audio and display the corresponding predicted text and emotion
- **Employee Attrition Classification | Kaggle Competition** [Aug - Dec'20]
Guide: Prof. Amit Sethi, EE Dept., IIT Bombay | Machine Learning
 - **Objective**: To predict whether an employee will leave the company or not based on **33** information points
 - Extracted relevant and less correlated features and applied **One-Hot Encoding** for **multi-classes** features
 - Achieved an accuracy of **88.47%** by training **SVM** (Support vector machine) classifier on **IBM HR** dataset
- **Speech Command Recognition using End-to-End ASR** [Jan - Apr'21]
Guide: Prof. Preethi Jyothi, CSE Dept., IIT Bombay | Automatic Speech Recognition
 - Designed an **LSTM-based Recurrent Neural Network** using **MFCC** features as inputs at each timeframe
 - Used a Language Model(LM) with **beam search decoding** to avoid misspelled words in predictions
 - Used **Softmax output layer** that gives a probability distribution over characters for each timeframe

PUBLICATION

- Online Partial Service Hosting At The Edge | IEEE Xplore** **ICCCN 2021**
V S Ch Lakshmi Narayana, Mohit Agarwala, Nikhil Karamchandani, Sharayu Moharir [paper]
- Designed a solution for the **Service Hosting Problem**, which enables a fraction of the Query to be served
 - Proposed a **Dynamic Policy**, α -**Retro Renting**, and provided its performance guarantees at the Edge Server
 - Conducted extensive **Monte-Carlo** & Trace driven simulations to demonstrate the performance of α -RR
 - Found several regimes where α -RR greatly **improves cost-efficiency** and, in the worst case, it is **6-optimal**

RESEARCH EXPERIENCE

- **Geolife Trajectory Data Analysis for Content Caching** [May - Dec'20]
Guide: Prof. Nikhil Karamchandani, EE Dept., IIT Bombay | Research Project
 - Developed tools for pre-processing and map simulation from **180+ GPS Taxi Data** of Beijing City
 - Implemented **K-means** clustering of data points using **Voronoi tessellation** to the original city map
 - Used a greedy **Fractional Knapsack** approach for **caching content** on a limited available cache size

- **On the Latency & QoS in Haptics Simulation using Video Streaming over Wi-Fi** [Jun'21 - Present]
Guide: Prof. Nikhil Karamchandani, EE Dept., IIT Bombay | Master's Thesis
Objective : To implement QoS for remote control & rendering of graphics in high bandwidth applications
 - Studied Operator/Tele-Operator-Based Haptics application to perform low latency tasks in a wired medium
 - Built a **reliable UDP** Protocol for **Multi-media** applications in **C++/Python** from scratch
 - Measured **one-way** latency in a congested environment using **Marzullo's Intersection Algorithm**(NTP)
 - Studied the cause of packet drop in low reliable UDP protocols with **Wireshark** & ways to reduce it
 - Implemented **Packet marking** for priority access to a certain type of traffic for **ultra-fast** transmission
- **High Throughput, Ultra-low Latency Multimedia over Wi-Fi** [Jul - Dec'20]
Guide: Prof. Nikhil Karamchandani, EE Dept., IIT Bombay | M.Tech Seminar
 - Studied the effect of **prioritizing traffic** in **IEEE 802.11ax** Wi-Fi, while maintaining **Fairness** and **QoS**
 - Studied practical design choices to find **optimal configuration** of scanning process for **delay optimization**
 - Explored the use of Wi-Fi (IEEE 802.11n/r) network for remote control of a vehicle using **video-transmission** on the uplink and control signals for the actuator on the downlink

OTHER PROJECTS

- **Automatically Recognizing Swahili Speech using Kaldi Toolkit** [Jan - Apr'21]
Guide: Prof. Preethi Jyothi, CSE Dept., IIT Bombay | Automatic Speech Recognition
 - Built improved **monophone HMMs** and tied-state **triphone HMMs** for speaker recognition
 - Implemented different smoothed **Ngram** models with the help of **SRILM** tools trained on **Swahili** corpus
 - Explored the effect of data augmentation by speed perturbations and reestimated tied triphone models
- **Routing Information Protocol (RIP) using C** | Self project | Communication Networks [Jan - Apr'20]
 - **Objective:** To implement RIP using socket programming (in **Linux**)
 - Implemented RIP (**Distributed Bellman-Ford Algorithm**) using **C socket programming** that read a given network topology and generated the cost matrix for the **shortest paths** between the nodes
- **Digital Photography with Flash No-Flash Image Pairs** [Aug - Dec'20]
Guide: Prof. Suyash P. Awate, CSE Dept., IIT Bombay | Digital Image Processing
 - Implemented **denoising** and **detail transfer** to merge the ambient qualities of the no-flash image with the high-frequency flash detail, using **cross-bilateral** filtering
 - Performed **white-balancing** to change the color tone of ambient images, **continuous flash** to adjust flash intensity interactively, and **red-eye removal** to repair artifacts in the flash image

TECHNICAL SKILLS

- **Programming Languages :** C, C++, Python, HTML | **Operating Systems:** Windows, Linux
- **Tools and Software :** MATLAB/GNU Octave, TensorFlow, PyTorch, Pandas, Matplotlib, NumPy, Scikit-learn

RELEVANT COURSES

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|-----------------------------------|--------------------------------|----------------------------|
| • Foundations of Machine Learning | • Automatic Speech Recognition | • DSP & its Applications |
| • Statistical Signal Analysis | • Digital Message Transmission | • Digital Image Processing |
| • Wireless & Mobile Communication | • Optimization | • Communication Networks |

POSITIONS OF RESPONSIBILITY

- **Institute Interview Coordinator** | Institute Placement Team, IIT Bombay [Nov - Dec'19]
 - Coordinated with a team of **250+** members for interviews of **1600+** **students**
 - Assisted in conducting Pre-placement Talks and Tests for **15+** **firms**
- **Mess Councillor** | Hostel Council Team, IIT Bombay [Aug'19 - Apr'20]
 - **Supervised**, coordinated & managed the planning & execution of food needs for **600+** hostel students
 - Ensured **quality meals** at minimum cost, utmost hygiene with the **zero-waste** management system
 - **Organized** & participated in various **cultural, technical**, and **sports** events for Hostel-4 IIT Bombay

MISCELLANEOUS

- Secured **98.86** percentile in **GATE-19**(Electronics & Communication Engineering) among 104782 candidates
- Awarded Hostel Organization **Special Mention** for exemplary contribution to Hostel-4 throughout the year
- Won **Gem of the General Championship**(MDGC-2019) Hostel-4, IIT Bombay, as part of the Dramatics team
- Completed a short course on "**State of the Art Microcontroller**" organized by Dept. of CSE, IIT Kharagpur
- Participated in short course on "Python for **5G MU**, **Massive MIMO**, and **mmWave MIMO**" by IIT Kanpur
- Vocational Training in **All India Radio** on Installation of Studios, High Power DRM Medium Wave Transmitters
- **Interests and Hobbies:** Cricket, Badminton, Table tennis, Listening to music