
AREAS OF INTEREST

- Wireless Communication
 - Machine Learning
 - Deep Learning in Image & Speech Processing
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PUBLICATION

IEEE | **ONLINE PARTIAL SERVICE HOSTING AT THE EDGE** *ICCCN 2021, Greece*

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- 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**.
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RESEARCH EXPERIENCE

- **On the Latency & QoS in Haptics Simulation using Video Streaming over Wi-Fi** *[Jun'21 - Present]*

Guide: Prof. Nikhil Karamchandani, EE Dept., IIT Bombay | M.Tech Project

- **Objective:** To implement QoS for remote control & rendering of graphics in high bandwidth applications.
- **Completed Work**
 - ★ 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.
- **Future Work:** To build a reliable UDP protocol with QoS support for low latency tasks over WiFi / cellular medium and to further demonstrate these algorithms 'in action' on a live testbed.

- **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.

- **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.
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KEY ACADEMIC PROJECTS

- **Speech to Sign-Language(with emotions) for the Hearing-Impaired** *[Jan - Apr'21]*

Guide: Prof. Preethi Jyothi, CSE Dept., IIT Bombay | Automatic Speech Recognition

- **Objective:** Convert Speech to Sign Language, by first converting to English text and predict the emotion.
- Achieved **72%** accuracy by training a **ConvNet** 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.

- **Routing Information Protocol (RIP) using C** | Self Project | Computer 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.

- **Flash No-Flash Photography** [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.
- **Facial Emotion Recognition using Deep Learning** [Aug - Dec'20]
Guide: Prof. Preethi Jyothi, CSE Dept., IIT Bombay | Foundation 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, Alex-Net and studied the evolution of their performance.
 - Deployed our best model, **VGG-16**, with 5 emotions for real-time prediction using **openCV** cascade classifier.
- **Attrition Classification** | Self Project | Machine Learning [Aug - Dec'20]
 - **Objective:** To predict whether an employee will leave the company or not based on 33 information points
 - Achieved accuracy of **88.47%** by training **SVM** (Support vector machine) classifier on **Kaggle dataset**.
 - Extracted relevant and less correlated features and applied One-Hot Encoding for features with multi-classes.
- **Spatially Varying Blurring** [Aug - Dec'20]
Guide: Prof. Suyash P. Awate, CSE Dept., IIT Bombay | Digital Image Processing
 - **Objective :** To mimic the background-blur effect in video chats
 - Performed **Mean-shift Segmentation** on the given image to mask out background and foreground pixels.
 - Used **K-means clustering** to provide blur effect by relabeling the pixel values which are close to each other.
- **Predicting Release Year of Songs** [Aug - Dec'20]
Guide: Prof. Preethi Jyothi, CSE Dept., IIT Bombay | Foundation 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.
 - Achieved an accuracy of **88.84%** in Kaggle competition by training our neural regressor on **MSD Dataset**.
- **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.

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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| • Statistical Signal Analysis | • Digital Message Transmission | • Digital Image Processing |
| • Fundamentals of Machine Learning | • Automatic Speech Recognition | • DSP & its Applications |
| • 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-term course on "State of the Art Microcontroller" organized by Dept. of CSE, IIT Kharagpur.
- Participated in the 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.