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Mohit Agarwala

Research Engineer (Deep Learning & Algorithms), IIT Bombay (M.Tech)

Areas of Interest

Machine Learning, Optimization, Data Science, Deep Learning in Image & Speech Processing, 3D Computer Vision, Software Integration

Work Experience

July 2022–Present **Research Engineer (Deep Learning) - *Computer Vision & Algorithms***, OLA ELECTRIC.
*Core member of **Algorithms, Software & Systems Team** at OLA Electric Autonomous Vehicle R&D*

- Currently involved in development and maturity of L0 - L2+ ADAS production ready features
- Object Detection & Tracking, Lane Segmentation for Perception Task of Self Driving Vehicles
- Worked on Carla Simulator for Synthetic Data Generation and training/testing features for bench setup
- Involved in end-to-end approach for BEV Generation and Waypoint prediction on NuScenes Dataset
- Optimized deep learning models for deployment on edge (Jetson Nano) using Tensor RT
- Experience in sensor calibration (Camera and Lidar) and synchronization for data collection vehicle
- Helped setting up auto-pipeline for faster annotation of millions of in-house collected sensor data

Jan 2022–Jun 2022 **Dailizing & clustering of Non-daily Trains using Machine Learning**, Indian Railways.
Developed algorithm for optimized weekly scheduling of trains in GQD network using unsupervised methods

- Resolved train reversals and misdirection classifications from the SATSANG data
- Clustering & visualization of trains in GQD using representation learning methods e.g, t-SNE, PCA
- Identified under-utilized paths for further processing to increase throughput of the Indian Railway Network

Jul 2020–Aug 2021 **Geolife Trajectory & Google Cluster Data Analysis for Content Caching Algorithm**, Stochastic Systems Lab, Graduate Research Assistant, IIT Bombay.

- Proposed a Dynamic Policy, α-Retro Renting, and provided its performance guarantees at the Edge Server
- Developed tools for pre-processing and map simulation from 180+ GPS Taxi Data of Beijing City
- Implemented K-means clustering using Voronoi tessellation to the original city map
- Found several regimes where α-RR greatly improves cost-efficiency and, in the worst case, it is 6-optimal

Jun 2021–Jun 2022 **On Latency & QoS in AR/VR Simulation using Video Streaming over Wi-Fi**, Stochastic Systems Lab, Graduate Research Assistant, IIT Bombay (Master's Thesis).

- 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 & implemented packet marking in a congested environment for priority access

Education

Year	*Degree*	*Institute*	*GPA(10)/Marks(%)*
2022	**M.Tech in Communication & Signal Processing**	**IIT Bombay**	**9.11**
2018	B.Tech in Electronics & Communication	Heritage Institute of Technology, Kolkata	7.85
2014	Senior School	DAV Public School, Midnapur	86.80%
2012	High School	Splendour High School, Kharagpur	89.28%

Publications

WCTR '23 **M. Agarwala**, et al., "Clustering techniques to optimize railway daily path utilization for non-daily trains," 2023 World Conference on Transport Research, Under Review.

TOMPECS '22 V. S. C. L. Narayana, **M. Agarwala**, N. Karamchandani and S. Moharir, "On Renting Edge Resources for Partial Service Hosting," 2022 Transactions on Modeling and Performance Evaluation of Computing Systems, JOURNAL PREPRINT.

ICCCN '21 V. S. C. L. Narayana, **M. Agarwala**, N. Karamchandani and S. Moharir, "Online Partial Service Hosting at the Edge," 2021 International Conference on Computer Communications and Networks (ICCCN), 2021, pp. 1-9, doi: 10.1109/ICCCN52240.2021.9522218.

Key ML Projects

Aug 2020– Dec 2020 **Facial Emotion Recognition using Deep Learning**, *Prof. Preethi Jyothi, CSE Dept., IIT Bombay.*
- 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

Jan 2021– Apr 2021 **Speech to Sign-Language for the Hearing-Impaired**, *Prof. Preethi Jyothi, CSE Dept., IIT Bombay.*
- 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

Jan 2021– Apr 2021 **Speech Recognition using End-to-End ASR**, *Prof. Preethi Jyothi, CSE Dept., IIT Bombay.*
- 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

Aug 2020– Dec 2020 **Predicting Release Year of Songs**, *Prof. Preethi Jyothi, CSE Dept., IIT Bombay.*
- 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

Aug 2020– Dec 2020 **Digital Photography Flash No-Flash Image Pairs**, *Prof. Suyash Awate, CSE Dept., IIT Bombay.*
- 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

Relevant Courses

Completed Foundations of Machine Learning, Automatic Speech Recognition, DSP & its Applications, Statistical Signal Analysis, Digital Image Processing, Optimization, Communication Networks, Real Analysis, Deep Learning in Natural Language Processing, AI Data & Policy

Ongoing Specialization on Self Driving Cars

Technical Skills

Languages Python, C/C++, Matlab/GNU Octave

Frameworks Keras, PyTorch, Tensorflow, Pandas, MatplotLib, NumPy, Scikit-learn

Utilities Docker, Anaconda, Git, Vim, LaTeX, Jupyter Notebook, Carla | *Operating system* : Linux, Windows, ROS

Miscellaneous

- Secured 98.86 percentile in GATE-19(Electronics & Communication Engineering) among 104782 candidates
- Presented my work on "Towards enabling ultra-low latency applications over Wi-Fi" at the WKS'22, Bangalore
- 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
- Was part of a team of academics, industry experts, and students working in data science, machine learning, and deep learning to teach a course on these topics to interested students for free during the pandemic
- Served as Mess Councillor and Institute Interview Coordinator during my time at IIT Bombay
- ***Interests and Hobbies***: Cricket, Badminton, Table tennis, Listening to music