

MOHD SAFWAN

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EDUCATION

Indian Institute of Technology Bombay, Mumbai, India — Graduating in June 2022
B.Tech + M.Tech , Electrical Engineering (Communication and Signal Processing) GPA: **8.1/10**

WORK EXPERIENCE

Applied Scientist Intern — *Matching Quality Team, Amazon* Summer '21

- . Built multilingual, multimodal deep learning based models to match products with search queries.
- . Used SOTA image and text feature extractors to generate product embeddings and calculate similarity.
- . Worked on datasets with 10 million+ rows and optimized the training time by **75%** for fast experimentation.
- . Incorporated a novel multi-head classifier and achieved upto **10%+** gains in F1 scores over multiple locales.

Co-founder, Technical Lead — *Augle AI (augle.ai)* Jan '19 - Dec '20

- . Developed and deployed robust **SOTA Face Recognition** based attendance and temperature logging system to tackle problems due to COVID 19. Optimized model to run on mid range Android devices smoothly.
- . Built and deployed multiple Imaging, Vision and AI solutions as APIs to various clients using **AWS services**.
- . Managed a team of 8+ researchers and developers to iteratively improve solutions.
- . **Won** Startup Jalsa 2019 and secured funding at **5.3 Cr** valuation. **Winner** of E Cell's Eureka IITB track.

Finding Images/Videos using a Selfie — *Freelance Project, Reels & Frames (picsniff.com)* Summer '20

- . Developed a solution to find all photos and videos of a person from a collection by looking at a single selfie using metric learning based face recognition model. Tested and achieved **95%+ accuracy** on client's data.
- . Optimized the video memory (GPU) usage when handling images with arbitrary aspect ratios.
- . Optimized the search time to a **few milliseconds** for searching in 1000 images with multiple faces in each.
- . Added robust blur detection technique to filter out unwanted results. Added a *tkinter* based GUI interface.

KEY PROJECTS

Parallelized Verification of Conjecture for Metric Dimension — *C++, CUDA (Course Project)* Spring '21

- . Wrote C++ code to verify the conjecture for metric dimension of a grid graph augmented with one edge.
- . Used OpenMP, MPI, and CUDA to parallelize the algorithm ($\mathcal{O}(n^{13})$) and compared their performance.
- . Implemented own Hash Set on GPU due to lack of STL library and got **200x** improvement with CUDA.
- . Successfully verified the conjecture $\forall n \leq 20$ on an Nvidia Tesla V100 GPU in less than a minute.

Creating Street View from Satellite View — *Dual Degree Project* Ongoing

- . Working on semi-supervised few-shot translation of satellite image of a given location to it's street view image. This has potential for reliable geo-localization using a user's input street view image.
- . Experimenting with different published and novel image space and feature space translation techniques.

Analysis of Preferential Voting Systems — *Statistics, PAC Learning (Course Project)* Spring '21

- . Analyzed and experimentally verified the sample complexity bounds obtained from confidence intervals using PPR Martingales for determining the Probably Approximate Correct winner of Borda Elections.
- . Designed a novel algorithm to determine PAC winner of Copeland Election with limited number queries per vote, and outperformed the baseline DCB algorithm on various synthetic and real world datasets.

Single Image Dehazing using GAN — *Deep Learning, Computer Vision (Research Project)* Autumn '20

- . Developed a deep learning model to successfully remove haze from hazy images in a single-shot fashion.
- . Created dataset of unhazed - hazed image pairs from NYU dataset by using depth information and applying various degrees of haze with randomly picked airlight using a mathematical model of hazing.
- . Successfully trained a generative U-Net network with a patch discriminator to remove haze using the Conditional GAN framework with a reconstruction loss. Achieved impressive **24dB+ SNR** (close to SOTA).

Measurement of Fetal Head in Ultrasound Images — *Computer Vision (Research Project)* Spring '19

- . Used **U-Net** like architecture with a modified ResNet-52 encoder network to segment the fetal head.
- . Calculated the circumference using parameters of the best fit ellipse for the predicted region.
- . Implemented *elliptical weight map for loss* to get smoother boundary along with BCE and DICE loss.
- . Used **Dense Conditional Random Fields** post-processing for removing noise from segmentation mask.

SCHOLASTIC ACHIEVEMENTS

- . Secured **All India Rank 457 / Top 0.23%** in JEE Advanced 2017 out of *200,000* students.
- . Ranked in **Top 0.12%** students in JEE Main 2017 out of *1.2 million* students.
- . Was placed in Statewise **Top 1%** in NSEA (Astronomy Olympiad) and selected for INAO.

OTHER PROJECTS

Tic Tac Toe Learning Environment — *Reinforcement Learning (Course Project)* Autumn '20

- . Wrote an open source framework for running and evaluating different game playing agents on the simple tic tac toe game using websockets communication and created a web GUI with **D3.js**.
- . Added implementation of **Deep Q Network** agent and classic algorithms like MiniMax, AlphaBeta search.
- . The **DQN** agent successfully learnt to play optimally after few hundred thousand games.

Realtime Coherent Style Transfer for Videos — *Computer Vision (Course Project)* Spring '19

- . Implemented *ReCoNet* architecture in PyTorch to transfer artistic style to videos while preserving content.
- . Implemented a *Temporal Loss* by warping outputs using *Optical Flow* forcing smoothness in time domain.
- . Trained the network by synergic method on combination of *MPI-Sintel* and *FlyingChairs* datasets.

Petryr : An Open Source Python Library — *Self Project* Spring '20

- . Fast **NumPy** based library for working with 2D geometric transforms with **300+** monthly downloads.
- . Wrote unit tests with full coverage with automated tests and build checking at every push using Travis CI.

Image Inpainting with Deep Image Priors — *Image Processing (Course Project)* Autumn '19

- . Formulated image inpainting as a Maximum Likelihood Estimation problem and exploited the property of CNNs as universal function approximators to use it as a prior for **zero-shot** image reconstruction.
- . Developed an hour-glass (Encoder-Decoder) architecture with skip connections to maximize the likelihood term, subsequently producing the near original image even when 80% of random pixels are removed.

POSITIONS OF RESPONSIBILITY

Teaching Assistant | Checking reports and conducting vivas in Control Systems Lab. Autumn '21

Convener, Web & Coding Club | Conducted various boot-camps, competitions while managing the club's resources with a long term goal of creating a thriving programming community in the institute. 2018-'19

TSS Instructor | Taught 100+ students Python and concepts of Object Oriented Programming. Autumn '19

School of Science | Mentored 4 freshmen in implementing basic DL algorithms from scratch. Summer '19

TECHNICAL SKILLS

Languages - Python, C++, C, CUDA C, Assembly, Embedded C, Julia, MATLAB, Octave, Bash

Frameworks - AWS, Boost, Docker, PyTorch, TensorFlow, Numba, OpenCV, NumPy, sklearn, Pandas, Git

Reverse Engineering - gdb, Wireshark, tcpdump, Nmap, IDA, pwntools

KEY COURSES UNDERTAKEN

High Performance Scientific Computing, Advanced Machine Learning, Foundations of Intelligent Learning Agents, Advances in Intelligent Learning Agents, Computer Vision, Digital Image Processing, Probability & Random Processes, Introduction to Number Theory & Cryptography, Data Interpretation and Analysis

EXTRACURRICULAR ACTIVITIES

- . Volunteered in NSS to teach Mathematics to underprivileged children.
- . **Winner** of Cybersecurity Club's jeopardy style Capture The Flag competition 2020.
- . **2 Time National Winner**, IPL Auction Competition 2018 & 2019 by Entrepreneurship Cell.
- . **Won** TechFest's Coding Challenge Enigma with teams coming from colleges all over India.
- . Secured **2nd** place in the Operations General Championship conducted by Institute Technical Council.