Mitali Meratwal

Curriculum Vitae

Education

- **Indian Institute of Technology Bombay** *(2019-(Expected) 2023)*
  Bachelor of Technology with Honours, Electrical Engineering
  Department Rank 10 amongst 76 students; Major CPI: 9.56/10
  Pursuing a minor in Computer Science; Minor CPI: 9.67/10

Publications

- **Multi-camera and multi-person indoor activity recognition for continuous health monitoring using long short term memory** [Papr]
  Mitali Meratwal, Nicolai Spicher, Thomas Deserno *(Published in SPIE Medical Imaging 2022)*

Scholastic Achievements

- Secured **All India Rank 116** in *JEE Mains* emerging as **City Topper** and **State Girls' Topper** *(2019)*
- Secured **All India Rank 789** in *JEE Advanced* competing against 225 thousand candidates *(2019)*
- Recipient of **KVPY** fellowship awarded to top **1%** by IISc and Government of India *(2019)*

Internships

Intelligent Attribution *(May'22 - June'22)*

Company: Microsoft India | Software Engineering Intern *Hyderabad, India*

- Worked with the **Digital Security and Resilience** team on intelligent insights from millions of data records
- Designed and implemented a **scoring heuristic** to identify the best resource owner based on dynamic features
- Improved attribution significantly, enforcing **effective remediation** and judicious distribution among owners
- Deployed on **Azure Functions** and created a **PowerBI** dashboard for graphical analysis and comparison
- Received an offer to join full-time after graduation from the company for performance during internship

Special Discounts *(Dec'22)*

Company: Fraazo | Tech Intern
A D2C delivery startup for fresh farm produce serving 200k households daily *Mumbai, India*

- Worked as **backend** engineer to develop internal **APIs** using Ruby on Rails and Active Record Query Interface
- Redesigned APIs for management of special discounts by admin users and reduced query time by tenfold
- Improved **efficiency** and **reduced data leakage** in payload of many APIs

Action Recognition in Smart Homes *(May'21 - Aug'21)*

Prof. Thomas M. Deserno | Research Internship *TU Braunschweig, Germany*

- Developed video analysis framework for **multi-camera**, **multi-person activity recognition** in smart homes
- Tested performance of existing work on enhanced **pose estimators** like OpenPose, AlphaPose, LightTrack
- Designed multi-layer **LSTMs** with **attention** block for **temporal modelling** and CNN for spatial dynamics
- Upgraded person tracking with **YOLOv4+Deepsort** to support re-identification and handle occlusions
- Expanded dataset to **300GB** and improved recall on realistic and simulated fall datasets from **79%** to **99%**

Research and Technical Projects

Multi-Process Service and FaaS GPU *(Aug'22-Present)*

Prof. Purushottam Kulkarni and Prof. Umesh Bellur | R&D Project *CS Dept., IIT Bombay*

- Benchmarked **interference effects** of NVIDIAs MPS on colocation of multiple processes on modern GPUs
- Analysed impact on **GPU performance** with different mixes of workloads and GPU **core restrictions**
- Autogenerated **function variants** across multiple axes and built use case for schedulers in FaaS platforms

Speech-text alignment *(Aug'22-Present)*

Prof. Preeti Rao | Bachelor Thesis Project *EE Dept., IIT Bombay*

- Critically evaluated performance of different stages of Vakyansh **audio processing** toolkit for news broadcasts
- Identified systematic errors and tested on improved **voice activity detection** in presence of background music
- Implemented speech segment to **text alignment** using **string similarity score** in moving ngram windows

Automatic Speech Recognition *(Jan'22 - April'22)*

Prof. Preethi Jyothi | CS753 Course Project *CS Dept., IIT Bombay*

- Performed **main speaker identification** and **localization** using an audio-visual transformer approach
- Fine-tuned Coqui speech to text models pretrained on English to build **Marathi** and **Kannada** ASR systems using extremely low resource **multilingual data** while minimizing word error rates
- Designed **word prediction** and **sentence creation** models using trigram **language model** and **FSTs**

Low-Light Image Enhancement *(Aug'21 - Nov'21)*

Prof. Amit Sethi | EE610 Course Project *EE Dept., IIT Bombay*

- Implemented different methods based on **retinex theory** and **dual-tree complex wavelet transform**, and **illumination map estimation** to enhance visibility of images captured under low light conditions
- Compared the performance against patch-wise, central pixel value predicting CNN model

Self Driving Car *(Sept'20 - July'21)*

Autonomous Vehicles, Computer Vision Subsystem | Team SeDriCa, UMIC *IIT Bombay*

SeDriCa is a 22 membered student team working to build India's first self-driving car with level 5 autonomy

- Developed a **Multi-Task Learning** model using uncertainty to weigh losses for **object detection** and **road segmentation** on BDD100K dataset by fusing **Scaled-YOLOv4** and **PSPNet** to reduce computation cost
- Designed and tested **cross connected network** from Faster R-CNN and PSPNet with ResNet50 backbone
- Scrutinized **Hierarchical Multi-scale attention**, **EfficientDet**, **D-LinkNet** to replace existing models

Multi-Modal Image Registration using Unsupervised Deep Learning *(Jan'21 - April'21)*

Prof. Suyash Awate | CS736 Course Project *CS Dept., IIT Bombay*

- Customised **Voxelmorph** to register **cross subject brain scans** of different modalities (MRI and CT)
- Trained **CycleGAN** network to register CT scan images with their MRI counterparts on the same dataset

Bosch's Traffic Sign Recognition Challenge *(March'21)*

Inter IIT Tech Meet *IIT Guwahati*

*Part of 10-member team that won **Bronze** out of **23 teams** which participated*

- Generated **layer wise visualisations** of the model trained by user and embeddings of dataset using **t-SNE**
- Implemented **GradCAM++** and **Lime** to enable the user to investigate incorrect predictions and devised automated scripts for explaining **failures of system** based on confusion matrix, loss and accuracy plots

Image Super Resolution *(Dec'20)*

Prof. Amit Sethi | Course Project *CMInDs Dept., IIT Bombay*

- Implemented **SRGAN** to estimate high resolution images from low resolution with an aim to recover content
- Formulated a VGG based **content loss** using output features of VGG19 model pretrained on ImageNet

The Tracking and Navigation Challenge *(Aug'20)*

Autumn of Automation | UMIC *IIT Bombay*

- Programmed a bot with **ROS** to solve perfect maze while avoiding obstacles using **wall follower** algorithm
- Exploited **OpenCV** and **Canny edge detection** for procuring letters present on the walls of the room
- Performed letter recognition utilizing **transfer learning** and **fine tuning** achieving best accuracy of **93%**

Fruit Quality Predictor *(May'20-Jul'20)*

Institute Technical Summer Project *IIT Bombay*

- Built a **real time** application for non-invasive **quality assessment** of fruits by leveraging smartphone cameras
- Constructed a custom dataset and employed various **data augmentation** techniques to make the model robust
- Trained custom and SOTA models achieving best accuracy of 99%, 95% and 90% for banana, mango and pear

Other Projects

Low Cost POF Link Communication | *Electronic Design Lab* *(April'22)*

- Built and tested **Polymer Optical Fibre** communication link for digital transmission up to 10 MHz by designing a **PRBS transmitter** with P-I-N photodiode and **trans-impedance amplifier** based receiver

IITB-RISC | *EE739 Course Project* *(April'22)*

- Designed and coded a 16-bit, 8-register, 6 stage pipelined processor computer system, IITB-RISC, using VHDL
- Optimized for performance and maximized CPI by including hazard mitigation and branch prediction techniques
- Proposed a design for a 2-way fetch superscalar processor with mitigation and branch prediction techniques

Temperature Monitor | *Microprocessors Lab* *(March'21)*

- Interfaced **LM35** temperature sensor using **ADC MCP3008** and displayed it on LCD using **embedded C**
- Played alarm while blinking LEDs at certain frequency if the average temperature falls or rises outside the range

Front-End Web Development | *Learner's Space IIT Bombay* *(July'20)*

- Designed and built a responsive personal homepage using **HTML5, CSS** and **JavaScript** in the boot camp

Positions of Responsibility

Department Academic Mentor *(July'21 - Present)*

Department Academic Mentorship Program | *Dept. of Electrical Engineering* *IIT Bombay*

- **Heading** the web subgroup of EE-DAMP, in charge of migrating the WordPress website to **GitHub pages**
- Mentoring Academic Rehabilitation Program student, assisting in planning out exit degree options and completion of the course credits while matching their pace of study
- Guided **4 sophomores** in their academic and co-curricular pursuits by leveraging the resources of the institute

Technical Skills

Languages	C/C++, Python, KQL, PowerShell, Ruby, VHDL, MATLAB, Julia
Libraries	PyTorch, Keras, Tensorflow, OpenCV, Numpy/SciPy, Matplotlib, Seaborn, Pandas
Softwares	Git, Quartus, Keil, LaTeX, AutoCAD, SolidWorks, Audacity
Development	HTML, CSS, JavaScript

Key Courses

Computer Science	Data Structures And Algorithms, Computer Networks, Operating Systems, Medical Image Computing, Foundations of Intelligent and Learning Agents, Automatic Speech Recognition, Computer Graphics*, Foundations of Network Security and Cryptography*, Convolutional Neural Networks for Visual Recognition by Stanford University†
Electrical Engineering	Signal Processing, Digital Systems, Microprocessors, Control Systems, Probability and Random Processes, Speech Processing*
Mathematics	Calculus, Linear Algebra, Differential Equations, Complex Analysis

* *courses will be completed by Dec'22*

† *online course*

Extracurricular Activities

- Volunteered for community service under National Service Scheme by recording audio books for visually impaired
- Coordinated the execution of **FInCoF** Freelancers, Interns and Co-founders Platform getting 120+ startups on board and assisted in securing 90+ internships for the students during Covid-19 *(June'20)*
- One among ten students selected for **Science Film Making Workshop** organised by the Vigyan Prasar *Department of Science of Technology*, Govt. of India and *Film society of Surat, Gujarat* *(Oct'2016)*
- Completed a DSLR workshop and served as a member of Delhi Public School Surat Photography Club *(2016)*
- Successfully completed **8 Level Graduate Course** of **IMA** (Intelligent Mental–Arithmetic ABACUS) *(2010)*