Shirsh Mall

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Education

Indian Institute of Technology Delhi — New Delhi
Master of Science (MSc.) in Physics · IIT-JAM Rank: 97 · CGPA: 7.4 — *Aug 2021 – May 2023*

- Relevant Coursework: **Deep Learning for Mechanics, Probability and Statistics**

Dyal Singh College, University of Delhi — New Delhi
Bachelor Of Science (BSc.) in Physics Honours · CGPA: 8.5 — *Aug 2018 – July 2021*

- Relevant Coursework: Linear Algebra, Calculus

Projects

GitHub Portfolio Page

Cotton Disease Prediction - Image Classification — Tools: Tensorflow, PIL, Open-CV, Streamlit

- Objective: To classify **healthy and diseased cotton plants and leaves** (**four classes**) using 2000 mobile-captured images.
- Built multiple **CNN** models, addressed overfitting, enhanced diversity with Data Augmentation; fine-tuned several pre-trained models using Transfer Learning and hyperparameter tuning.
- Achieved a **97% validation accuracy** using the **fine-tuned ResNet50** model and created an interactive **Streamlit web app**.
- This enables users to upload images for instant disease predictions, aiding in early detection and effective management.

Object Detection for Traffic Vehicle Detection — Tools: Open-CV, Numpy, Flask, HTML, CSS, Ultralytics

- Developed a precise object detection system using the IITM-HeTra dataset to **classify diverse vehicles** in road traffic.
- **Pre-processed** the labelled dataset by extracting XML labels and formatting data, trained the **YOLOv8** model and created a user-friendly **Web app** using **Flask**.
- Valuable for traffic authorities and urban planners in enhancing traffic flow, safety measures, and infrastructure decisions.

Water Bodies Image Segmentation — Tools: Open-CV, Numpy, Tensorflow, PIL

- Goal is to precisely segment water bodies in 2500 satellite images using **binary image segmentation** techniques.
- Employ **data preprocessing** (scaling, padding, and binary masking), **custom-built U-Net architecture** using TensorFlow and achieved **IOU score** of **0.95**, showcasing effective alignment.
- This project can aid in remote sensing for environmental monitoring, urban planning, and disaster management.

Image Captioning and Image Retrieval System — Tools: Selenium, TensorFlow, PyTorch, Hugging Face, FAISS, FastAPI

- Collected diverse datasets: **1000 captions** from ChatGPT and **web scraped** Google images, and 150K GCC **image-caption pairs**, after thorough **preprocessing**.
- Utilized **ViT-BERT** pre-trained model and fine-tuned to **generate image captions** and evaluated using **Rouge** score.
- **Implemented CLIP model** for **image retrieval** using PyTorch. Enhanced the retrieval capabilities by **fine-tuning** OpenAI's pre-trained CLIP model for improved performance.
- Created **web app** with user-friendly tabs for image captioning and retrieval using **FastAPI, HTML**, and **CSS**, incorporating **FAISS indexing** to boost retrieval **speed by 10x**.
- In e-commerce, this project enhances the shopping experience by enabling image and text-based product searches.

Technical Skills

Programming Language: Python | **Database**: SQL | **Data Science**: Machine Learning · Natural Language Processing · Computer Vision
Tools/Framework: NumPy · Pandas · Scikit-Learn · TensorFlow-Keras · PyTorch · Hugging Face · Plotly · Seaborn · Matplotlib
Model Deployment: Streamlit · Flask · FastAPI · Gradio | **Additional Skills:** Explainable AI (Shap) · Web Scraping

Research Experience and Academic Coursework

Masters Thesis: Particle Physics Data Analysis using Deep Learning

- **Achieved enhanced signal efficiency**, accurate signal and background **events classification**, precise transverse momentum prediction using **ANNs** and implemented **CNNs** models for **Jet-Images classification**, after jet clustering
- Employed **data analysis**, utilised **data simulation** tools for event generation using theoretical learning and **transformed data into image** representations for deeper analysis.

Assignments - Implementation from Scratch

- Multivariate non-linear regression, Binary classification, One-vs-all and Softmax multi-class classification algorithms.
- ANN and CNN multi-class classification using MNIST dataset, RNN for time series dataset and Physics Informed-Neural Network.