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
- 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, Docker

- Collected diverse datasets: **1000 captions** from ChatGPT and **web scraped** Google images, and 150K GCC **image-caption pairs.**
- 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**, followed by **containerization** using **Docker**.
- This project can enhance e-commerce by utilizing image captioning for product tagging, creating descriptions, and improving product text-to-image similarity searches system internally.

Technical Skills

Programming Language: Python | **Database**: SQL | **Data Science**: Machine Learning · Natural Language Processing · Computer Vision
Frameworks: Scikit-Learn · TensorFlow · PyTorch · Hugging Face | **Model Deployment:** Streamlit · Flask · FastAPI · Gradio · Docker
Additional Skills: Explainable AI (Shap) · Web Scraping

Research Experience and Academic Coursework

Masters Thesis: Particle Physics Data Analysis using Deep Learning

- Achieved accurate **signal-background events classification** and constructed **predictive ANN models** for key physical variables.
- **Transformed data into image** for deeper analysis and implemented **CNN models** for **Jet-Images classification**, after jet clustering
- Employed **data analysis**, utilised **data simulation** tools for event generation using theoretical learning.
- This project facilitates identifying signal events, **reducing repetitive initial theoretical calculations**, aiding physicists in research.

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.