Education

B.E., Electronics and Instrumentation **2019 - 2024**
BITS Pilani

M.Sc., Biological Sciences **2019 - 2024**
BITS Pilani

Work Experience

- **Research Intern** at Bosch Research (July 2023 - Present)
  - Working with a team to build a computer vision pipeline for autonomous driving.
  - Currently working on image encoders and making them better at retrieval tasks where the query is a patch of an object which can be used to retrieve images with similar objects in them.
- **Data Science Intern** at Pixis (July 2022 - October 2022)
  - Worked on 2 major projects - Targeting AI and Video Generation.
  - Used modern ML methods to find look-alikes in a 5M row dataset that helps clients target their ads to people who belong to a particular user persona (Pandas, Tableau, AWS, Sci-kit learn).
  - Designed and developed a GAN architecture to generate environment maps from text queries that can be used to synthesize videos based on text commands (PyTorch, OpenCV, Albumentations, ProGAN).
- **Computer Vision Engineer Intern** at Polybee (May 2022 - July 2022)
  - Collected data and used computer vision methods to estimate the yield of crops using images.
  - Worked on training and evaluating deep learning models and developing image processing solutions for phenotyping and fruit detection, meeting the accuracy and throughput required by industry standards (PyTorch, Detectron2, Albumentations, Git).
  - Deployed these models into production on the web platform to analyze the data collected by Polybee's drones/handheld devices.
  - Developed a data pipeline that the team can use to extract various data points from raw images.

Selected Past and Current Research

- **Development of Reliable, Low Complexity Models for Retinopathy**
  IEEE International Conference on Image Processing 2023, [paper]
  Worked with a team from UNSW and APPCAIR on this project. Developed a method for iterative knowledge distillation in deep neural network models for retinopathy, resulting in simpler models (around 100x smaller) with comparable predictive accuracy and improved reliability as a result of calibration.
- **Localising Features without labels using GradCAM**
  International Conference on Processing and Characterization of Materials 2023, [paper]
  Worked with a team from Shastra University. We had access to a dataset with defected

and non-defected parts images and I trained a model that could classify the images accordingly. I identified layers that could help us esitmate the location of the defect and used the GradCAM algorithm which effectively provided weak localization.

- **Improving Patch-to-Scene Retrieval**
  My work at Bosch Research
  Models like CLIP are good at patch-to-patch retrieval but struggle when the query image is a crop of an object like a "traffic signal that is red" and we use this query to get images that have this object (along with other objects) in them. Patch-to-scene retrieval is problem that involves methods to identify and retrieve images that contain specific objects or features, as represented by a smaller query image patch. I am working on a training method that uses masked image modelling methods to make model that are good at patch-to-patch better at patch-to-scene retrieval.

Selected Projects

- **TinyPhi - Small but capable Instruction following LLM**, code
  - Coded the training pipeline that can be modified based on config file that allows to run multiple experiments easily.
  - Created the v1 of the dataset which includes 6million pairs of instruction and response gathered and de-duplicated from other open-source datasets.
  - Trained state-spaces/mamba-130m on the dataset. model
- **Monocular Depth Estimation with Self-Supervised Learning**, code
  - Implemented SAFENet paper that uses Self-Supervised Deep Learning methods to predict the depth of objects in 2-D Monocular images.
- **Hyperlocal Weather Prediction and Anomaly Detection**, paper
  - Publised in **IEEE Modelling Simulation & Intelligent Computing 2023**
  - This paper introduces a method for hyperlocal weather prediction and anomaly detection using IoT sensor networks and machine learning. The system uses data from spatially-distributed sensors to create high-resolution weather models, enhancing prediction accuracy and detecting unusual patterns in real-time.
- **Implementation of State-of-the-art Computer Vision Architectures**, code
  - Various novel model architectures used in Computer Vision were implemented along with an open-source library (lightweight PyTorch wrapper) to train Computer Vision Models on custom datasets with less than 5 lines of code.

Miscellaneous

- **ML4SCI Competition - Brown University**
  - Gravitational Lensing: Used Autoencoder for anomaly detection to study lensing in the field of cosmology. **[Ranked 2nd]**.
  - Classification of particles from energy graphs: A camera is used as a detector (calorimeter) to detect two types of particles: electrons and photons. **[Ranked 3rd]**