Pranav M Koundinya

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Education

National Institute of Technology Karnataka, Surathkal **Dec. 2020 – April 2024**
Bachelor of Technology in Electronics and Communication Engineering *CGPA : 8.77*

Research Interests

Signal Processing, Image Processing, Deep Learning, Inverse Problems, Computer Vision

Experience

Spectrum Lab, Indian Institute of Science **Jan 2024 – June 2024**
Project Intern *Bengaluru, Karnataka*

- Working on Adversarial Regularization(AR) for solving inverse imaging problems.
- Implementing data-driven approaches such as AR for biomedical imaging applications including CT and MRI reconstructions, denoising, deblurring, inpainting.
- Deploying the Euler-Lagrange Analysis to AR to solve for the regularizer in analytical closed-form.

Spectrum Lab, Indian Institute of Science **May 2023 – July 2023**
Summer Research Intern *Bengaluru, Karnataka*

- Worked on the analysis and applications of state-of-the-art anomaly detection algorithms for industrial and biomedical applications.
- Applied unsupervised feature-embedding-based algorithms, including PaDiM and PatchCore, and fine-tuned SAM for classification and segmentation of anomalies in industrial and biomedical images.
- Worked on implementing the CLIP embedding backbone as a feature extractor for the Patch Distribution Modeling(PaDiM) algorithm.

SPIRE Lab, Indian Institute of Science **May 2022 – July 2022**
Summer Research Intern *Bengaluru, Karnataka*

- Worked on the modeling and analysis of Physics Informed Neural Networks(PINNs), based on the approach published by Maziar Raizzi in J.Comp.Phy(2019).
- Implemented a deep neural network for solving the 1D Helmholtz equation, subject to initial conditions.
- Explored multi-objective weighting and Inverse-Dirichlet iterative method for calculating optimal weights.

Relevant Coursework

- Circuits and Systems
- Linear Algebra
- Probability Theory
- Digital Signal Processing
- Digital Image Processing
- Pattern Recognition
- Machine Learning
- Neural Networks
- Deep Learning
- Sparse Signal Processing
- Compressed Sensing
- Optimization

Technical Skills

Languages: Python, C++, C, Verilog, MATLAB
Technologies/Frameworks: PyTorch, TensorFlow, SciPy, OpenCV, DeepInverse

Projects

ASIC Design Implementation of FFT Algorithm | *Verilog, OpenLane* **February 2023 - April 2023**

- Worked on the Verilog implementation of 32-bit 8-point Fast Fourier Transform of digital signals.
- Worked on implementating a custom ASIC Design of the algorithm in Openlane using the Skywater 130nm Process Design Kit(PDK).

Low Light Image Enhancement using MIRNet | *Python, Tensorflow, TensorFlow Lite* **November 2022 - April 2023**

- Implemented a deep learning model to enhance images taken in low-light conditions.
- The model is based on the MIRNet architecture by Zamir. et. al(2019).
- Attempted to implement the trained model on an embedded device, the Arduino Nano 33 BLE Sense for real-time image enhancement.

Image Restoration without Denoised Priors | *Python, Tensorflow* **August 2022 - November 2022**

- Implemented a deep learning model to denoise images as formulated in the paper 'Noise2Noise' by MIT-CSAIL, nVIDIA and Aalto University.

- Trained the model of noisy data pairs instead of clean images for the ground truth values. This approach has claimed to work when the noise follows a certain distribution.
- Implemented the algorithm for two architectures- REDNet and UNet, and trained the models to denoise Gaussian and Poisson noise.

Real-Time Lane Detection for Self-Driving Cars | *Python, OpenCV* **April 2022 - July 2022**

- Deployed edge-detection techniques such as Canny Edge Detection and Hough Line Transform on each video frame to create a real-time lane detector.
- Explored Gaussian filtering to facilitate efficient edge detection.

Brain Image Analysis | *Python, Tensorflow* **November 2021 - April 2022**

- Explored the various techniques, and classification and segmentation algorithms that can be used for early detection of Alzheimer's Disease and Brain Tumour Segmentation
- Used MRI images of the brain to classify Alzheimer's Disease into early, mid and late stages using CNN architectures such as DenseNet, ResNet, InceptionNet and MobileNet.
- Segmented tumored parts of the brain to predict its severity using the UNet architecture.

Audio Fingerprinting System | *Python, Jupyter Notebook, MySQL* **Jan 2021 - June 2021**

- Developed software to recognize a song from a piece of recording of audio file
- Incorporated audio processing techniques such as FFT and STFT to generate spectrograms of the audio files
- Implemented the algorithm developed by Shazam Inc. for song recognition by making use of audio fingerprints of the spectrogram peaks.

Leadership / Extracurricular

IEEE NITK **April 2023 – March 2024**

Chairperson *Signal Processing Society*

- Headed the organizing team for Impulse 2024 - a 24-hour signal processing hackathon.
- Organized expert talks and knowledge sharing sessions as part of SPS activities 2023-24.

IEEE NITK **April 2022 – April 2023**

Secretary *Signal Processing Society*

- Coordinated a team in organizing Impulse 2023 - a 24-hour signal processing hackathon.
- Participated in organizing Dishaspoorthi - an outreach event to teach the basics of electronics to school children at the NITK Kannada Medium School.

IEEE NITK **September 2021 – March 2022**

Executive Member

- Co-organized a summer mentorship programme on "Image Processing and Computer Vision" to the 2025 Batch of IEEE-NITK

Achievements

- Successfully presented a project proposal for the launch of Atal Tinkering Laboratory in school, and was granted a funding of INR 25 Lakh by the Govt. of India in the year 2016-17
- Ranked 6854 in JEE Advanced-2020, and 8311(99.26 percentile) in JEE Main-2020