Varsha S

Machine Learning / Deep Learning Researcher

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Work Experience

nference — *Bangalore, India*

Data Scientist | Pramana — *Jan. 2023 - present*

- Worked primarily on developing deep learning based solutions to solve challenges in the field of medical imaging, specifically histopathology.
- Designed a segmentation network to localise varied-stained tissue images (IHC, H&E) at 1x resolution with **AUC value of 0.95**.
- Engineered a deep learning based solution to **segment kidney whole slide images** into constituent entities, namely glomeruli, tubules and vessel, with mean average precision value of 0.7, as a part of kidney diagnosis pipeline.

Amazon — *Bangalore, India*

Applied Scientist | Alexa NLU — *Jul. 2022 - Jan. 2023*

- Worked on adopting a **multi-lingual encoder** architecture for meeting latency constraints and minimising cost of NLU models.
- Performed A/B testing on the new architecture to expose it to small percentage of traffic to analyse the performance before launch.
- Captured metrics like latency, friction to come up with patches to fix the failures iteratively, also calibrated model confidence to reduce false accepts and false rejects.

Visual Information Processing Lab, Indian Institute of Science (IISc) — *Bangalore, India*

Research Assistant | Supervisor - Prof. Rajiv Soundararajan, IISc — *Jul. 2018 - May. 2019*

- Studied the effect of head movement trajectory information of subjects to **objective quality assessment** problem in the VR videos.
- Trained **neural networks** to use the video frames as well as viewing direction as the input and predict the viewing direction of the next frame i.e., **prediction of head motion trajectory**.

Honeywell Aerospace — *Bangalore, India*

Intern | Department - SATCOM — *Jan. 2018 - Jul. 2018*

- Developed proof of concept of Trustzone creation and API development for ARM Cortex-A processors.

Signal Processing, Interpretation and REpresentation (SPIRE) Lab, IISc — *Bangalore, India*

Research Intern | Supervisor : Prof. Prasanta Kumar Ghosh, IISc — *Jun. 2016 - Aug. 2016*

- Implemented **EM Algorithm** in C to optimize an analytically intractable likelihood function - with an aim of reducing latency.
- Implemented Distributed EM algorithm on MATLAB, employed when data is generated at several nodes.

Education

Indian Institute of Technology, Bombay — *GPA - 9.47/10*

Master of Technology, Communication and Signal Processing — *2022*

BMS College of Engineering — *GPA - 9.24/10*

Bachelor of Technology, Electronics & Communication Engineering — *2018*

Publications

Improved Histology Image Classification under Label Noise Via Feature Aggregating Memory Banks — *Kolkata, India*

Nikhil Cherian Kurian, **Varsha S**, Akshay Bajpai, Sunil Patel, Amit Sethi — *Mar. 2022*

- IEEE 19th International Symposium on Biomedical Imaging (ISBI)

Multi-Modal Information Fusion for Classification of Kidney Abnormalities — *Kolkata, India*

Varsha S, Sahar. A. Nasser, G. Bala, Nikhil Cherian Kurian, Amit Sethi — *Mar. 2022*

- IEEE International Symposium on Biomedical Imaging Challenges (ISBIC)

Robust Semi-Supervised Learning for Histopathology Images through Self-Supervision Guided Out-of-Distribution Scoring

Nikhil Cherian Kurian, **Varsha S**, Abhijit Patil, Amit Sethi

- IEEE/ACM Transactions on Computational Biology and Bioinformatics - under review

Research Projects

Addressing Open-set Semi-supervised Learning in Histopathology Images — *Masters Thesis*

Guide: Prof. Amit Sethi, IIT Bombay — *Jan'22 - Jul'22*

- Proposed an contrastive framework which addresses the challenging open-set semi supervised learning problems in histology images.
- Proposed an efficient outlier detector using self supervised learning.

Multi-modal Information Fusion for Classification of Kidney Abnormalities

ISBI Challenge '22

Guide: Prof. Amit Sethi, IIT Bombay

Jan'22 - Mar'22

- Proposed an **attention-based** deep learning framework for automatic preoperative prediction of risk class for patients with renal masses identified in clinical Computed Tomography (CT) imaging of the kidneys.
- Trained an attention-based classifier on clinical features and imaging features extracted from the latent space of a segmentation network named **nn-UNet**.
- Won the 4th place in the 2022 International Symposium on Biomedical Imaging (ISBI) KNIGHT Challenge.

Robust Deep Learning Framework to address General Label Noise in Medical Imaging

Research Project

Guide: Prof. Amit Sethi, IIT Bombay

Jun'21 - Oct'21

- Proposed a simple and effective method that addresses the **general label noise problem** in an integrated framework based on a sample weighting scheme for medical imaging data.
- Obtained **slide level accuracy of 86.67%** on TCGA dataset, with our memory bank with k-medoids prototype method, the accuracy value better than the existing approaches in literature.

Self-supervision Techniques in Convolutional Neural Networks

M.Tech Seminar

Guide: Prof. Amit Sethi, IIT Bombay

Aug'20 - Dec'20

- Conducted literature survey of **self-supervision** techniques for **image representation learning**.
- Implemented pretext tasks including Inpainting, Jigsaw Puzzles using **PyTorch** with AlexNet as the backbone network, analysed on Paris StreetView and **Caltech 101** datasets, respectively.

Few-shot Learning with Contrastive Self-supervision

Research Project

Guide: Prof. Amit Sethi, IIT Bombay

Jan'21 - May'21

- Trained a Prototypical Network using prototypical loss and **contrastive SimCLR loss with episodal training**.
- Obtained a test accuracy of 52% with 5-shot learning on mini-Imagenet and a test accuracy of 98.1% with 5-way learning on Omniglot dataset.

Honors & Awards

2022	**Best MTech Thesis Award**, Department of Electrical Engineering	*IIT Bombay*
2017	**Finalist**, Nokia White Paper Contest, Phase Shift	*BMSCE*
2012	**Academic Excellence Award for ranking first in school**, 10th ICSE Board exam	*RNSV*

Research Interests

Machine Learning, Deep Learning, Image Processing, Computer Vision

Selected Course Projects

Image Segmentation of Right Heart Ventricle

Advanced Topics in ML

Guide: Prof. Amit Sethi, IIT Bombay

Oct '20

- Engineered Pixel-wise Segmentation of Right Ventricle of Heart in MRI Images from RVSC-MICCAI 2012 dataset with UNet Architecture as baseline model to get a **Dice-score of 0.2761**.
- Performed ablation studies with hyperparameter tuning to achieve **0.24 Dice-score** with Switching loss.

Droplet Detection on Camera Lens

Introduction to ML

Guides: Prof. Amit Sethi, IIT Bombay; Saqib Shamsi (Whirlpool)

Apr '20

- Designed a deep learning model to detect whether the droplets in an image are distortion on the lens or are a part of the scene captured, with ResNet-18, VGG and DenseNet as various backbone architectures.
- Experimented with **Label Smoothing** and **Adversarial Learning** obtained a test accuracy of 69.46% using Weighted Cross Entropy Loss on ResNet-18 backbone.

Emotion and Gender Recognition from Faces

Advanced Topics in ML

Guide: Prof. Amit Sethi, IIT Bombay

Nov '20

- Trained a **D-CNN** based automatic Facial Emotion and Gender detection system on FER2013 dataset.
- Extracted faces from self-generated images using Harr Cascade Classifiers, trained a D-CNN from scratch and exploited transfer learning by using VGG-16 to achieve a decisive accuracy of 75%.

Generative Adversarial Networks for Image Synthesis

Computer Vision

Guide: Prof. Sharat Chandran, IIT Bombay

Apr '21

- Trained **Deep Convolutional GAN** with Binary Cross Entropy loss to generate images of **MNIST** digits.
- Trained a Conditional Wasserstein GAN to create synthetic images of Fashion MNIST dataset.

Extracurricular Activity

Student Companion

IIT Bombay

Institute Student Companion Program

May. 2020 - Jun. 2021

- **Mentoring new entrants**, helping them on academic and non-academic fronts during Covid-19 pandemic.