Varsha Satish

Machine Learning / Deep Learning Researcher

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Education

University of Wisconsin-Madison, USA — *GPA - 4/4*

MS Research, Biomedical Engineering — *2024 - 2025*

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

Master of Technology, Communication & Signal Processing — *2019 - 2022*

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

Bachelor of Engineering, Electronics & Communication Engineering — *2014 - 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 — *Virtual*

Nikhil Cherian Kurian, **Varsha S**, Abhijit Patil, Amit Sethi — *Dec. 2023*

- Accepted at the 23rd annual IEEE International Conference on Bioinformatics and Bioengineering (BIBE)

Work Experience

Integrated Diagnostics and Analytics Laboratory for Precision Medicine, UW-Madison — *Madison, US*

Graduate Research Intern | Supervisor - Prof. Pallavi Tiwari — *Jan. 2024 - present*

- Performed preprocessing of DCE-MRI data, including bias correction, and normalization, and extracted various radiomic features (textural, shape, and collage) from the ISPY1 and ISPY2 datasets for predicting pathological complete response
- Conducted feature importance analysis and dimension reduction of radiomic features derived from longitudinal DCE-MRI to predict pathological complete response (pCR) in breast cancer patients undergoing neoadjuvant chemotherapy (NAC)
- Trained machine learning classifiers (SVM, RF, XGB) with feature selection techniques (MRMR, RFECV) to predict pCR

nference — *Bangalore, India*

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

- Designed a segmentation network to localize varied-stained tissue images (IHC, H&E) at 1x resolution with AUC value of 0.95
- Engineered a deep learning solution to segment whole slide images (WSIs) of kidney into constituent entities, namely glomeruli, tubules and vessels, with mean average precision value of 0.7, as a part of the kidney diagnosis pipeline

Amazon — *Bangalore, India*

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

- Worked on adapting a 92.6% smaller multi-lingual encoder model to lower latency and training time while maintaining original performance of 2.3+B parameter BERT-based AlexaTM model
- Tailored task classification pipeline to direct queries to relevant domains across 4+ Alexa platforms to enable multimodal features
- Performed A/B testing on the new architecture by exposing it to small percentage of multilingual traffic to analyze performance

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

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

- Improved correlation between the objective quality assessment algorithm and human subjective scores by 12% by incorporating subject viewing directions to analyze user visual discomfort with virtual reality videos
- Trained neural networks to predict of head motion trajectory using the video frames and previous viewing direction as the input to enable selective video frame optimization of future frames

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.

Honors & Awards

2022	**Best MTech Thesis Award**, Department of Electrical Engineering (Specialisation cohort size - 49)	*IIT Bombay*
2022	**Finalist**, KNIGHT Challenge at the IEEE 19th International Symposium on Biomedical Imaging conference	*ISBI, Kolkata*
2017	**Finalist**, Nokia White Paper Contest, Phase Shift - BMSCE'S Tech Symposium	*BMSCE*

Research Interests

Medical Image Processing, Deep Learning, Machine Learning, Computer Vision

Research Projects

Addressing Open-set Semi-supervised Learning in Histopathology Images

Masters Thesis - Part 1

Thesis: "Deep Learning Towards Robustness in Medical Images" - 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 with **AUC of 0.94** on Kather dataset.

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

Masters Thesis - Part 2

Thesis: "Deep Learning Towards Robustness in Medical Images" - 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.

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.
- **One of the 4 finalists** in the KNIGHT Challenge at the IEEE 19th International Symposium on Biomedical Imaging conference (ISBI) 2022.

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.

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.