AKSHATHA MOHAN

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EDUCATION

Washington University St. Louis *August 2025 - Present*
PhD in Imaging Science

Texas A&M University (TAMU) *December 2024*
M.S. in Electrical and Computer Engineering
GPA: 3.9/4.0
Related courses: Pattern Recognition, Machine Learning, Digital Image Processing, Linear Algebra, Computational Photography, Parallel Computing, Analysis of Algorithms

Bangalore Institute of Technology *May 2021*
B.E. in Electronics and Communication
GPA: 9.15/10
Related courses: Digital Image Processing, Signal Processing, Probability, Statistics, Operating System

RESEARCH INTERESTS

My research focuses on developing multimodal imaging science and machine learning methods that make patient heterogeneity in neurological disease visible and clinically meaningful. By integrating structural neuroimaging, CSF proteomics, and genetic risk information, I aim to identify biologically grounded disease subtypes and patient-specific patterns of brain vulnerability. My long-term goal is to translate complex biomedical data into interpretable biomarkers that support more precise patient stratification and treatment decisions guided by underlying disease biology rather than symptoms alone.

RESEARCH EXPERIENCE

Quantitative measurement of clinical and simulated CT scan images Feb 2025 - May 2025
Supervisors: Prof. Joseph Y Lo Duke University

· Analyzing clinical and simulated CT images to study false positives in AI-based lung cancer detection as part of research with Duke University's Virtual Imaging Trials team.

Texture Analysis of Lung Cell Morphology after Nanoparticle Exposure (Accepted for oral presentation at SPIE: Medical Imaging) [1] May 2024 - Dec 2024
Supervisors: Dr. Joshua Peeples, Prof. Christie Sayes TAMU

· Analysis of finding a significant relationship between morphological imaging metrics like lacunarity and fractal dimension and sensitization of dendritic cells over nanoparticle exposure.
· Quantifying and analyzing differences in cellular texture using Earth's Movers Distance.
· Implemented a novel Quantization and Counting Operator (QCO) for statistical texture analysis, enabling sophisticated feature extraction and co-occurrence statistics to capture spatial relationships in SEM images.

Master's Thesis: Lacunarity Pooling Layers for Plant Image Classification using Texture Analysis [2] August 2023 - April 2024
Supervisors: Dr. Joshua Peeples (Advanced Vision and Learning Lab (AVLL)) TAMU

· Introduced a novel pooling technique to improve image classification by leveraging texture information.
· Achieved state-of-the-art accuracy improvements of up to 98.07% on the PlantVillage dataset and 95.00% on LeavesTex1200, while maintaining computational efficiency with minimal additional parameters compared to existing methods.

- Coded and evaluated three distinct approaches to lacunarity computation (base, differential box counting, and multi-scale), enabling flexible integration with various CNN architectures like ConvNeXt, ResNet18, and DenseNet161.
- Refined scientific writing and communication skills through the iterative process of thesis writing and publication preparation.

Quantitative Analysis of Explainable Artificial Intelligence (XAI) Methods for remote sensing image classification [3] January 2023 - June 2023
Supervisors: Dr. Joshua Peeples (Advanced Vision and Learning Lab (AVLL)) TAMU

- Conducted a comprehensive analysis of XAI methods for improving interpretability in high-dimensional image (multispectral and Synthetic Aperture Radar (SAR)) applications.
- Fine-tuned state-of-the-art models (ConvNeXt, Vision Transformers, Focal Networks) for remote sensing applications, then analyzed their decision-making through five XAI methods (LIME, HiResCAM, GradSHAP, Saliency, Occlusion), achieving classification accuracies of 82% on SAR and 97% on RGB data.
- Developed a comprehensive evaluation framework in PyTorch and Captum to assess XAI methods across six distinct metrics categories, including faithfulness, robustness, and localization, identifying optimal explanation techniques for different imaging modalities and model architectures.
- Designed a novel evaluation pipeline integrating Otsu thresholding and superpixel segmentation for automated region-of-interest detection, enabling systematic comparison of model explainability.

Spatial Transformer Network YOLO Model for Agriculture Object Detection [4] May 2023 - August 2023
Supervisors: Dr. Joshua Peeples (Advanced Vision and Learning Lab (AVLL)) TAMU

- Collaborated with Texas A&M AgriLife's Department, specifically working with Dr. Seth Murray's and Dr. Robert Hardin's agriculture lab to build an automated plant phenotyping system.
- Developed an innovative image preprocessing technique for multi-spectral images, involving band superimposition and min-max normalization.
- This novel approach significantly enhanced spatial resolution and implemented effective denoising, resulting in improved signal-to-noise ratio (SNR).

Generation of Netlist from a Hand-Drawn Circuit through Image Processing and Machine Learning [5] January 2021 - May 2021
Supervisors: Dr. Narendra C P BIT

- Developed an innovative approach to convert hand-drawn circuits into digital simulation using image processing and machine learning techniques.
- Architected a machine learning pipeline combining Histogram of Gradients and Support Vector Machine classification by implementing adaptive binarization and skeletonization for circuit component detection, achieving accuracy of up to 95% across 5 different electronic components and reducing manual schematic creation time by 70%.
- Engineered an automated simulation generation system by developing a novel end-point analysis algorithm and OCR integration through OpenCV, enabling direct conversion of 100+ hand-drawn circuits to LTSpice compatible format and eliminating manual component placement needs.

PUBLICATIONS

[1] A. Mohan, T. Jefferis, C. M. Sayes, and J. Peeples, "Texture analysis of lung cell surface morphology after nanoparticle exposure," in *Medical Imaging 2025: Digital and Computational Pathology*, SPIE, vol. 13413, 2025, pp. 221–230.

[2] A. Mohan and J. Peeples, "Lacunarity pooling layers for plant image classification using texture analysis," in *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshops*, Jun. 2024, pp. 5384–5392.

[3] A. Mohan and J. Peeples, "Quantitative analysis of primary attribution explainable artificial intelligence methods for remote sensing image classification," in *IGARSS 2023 - 2023 IEEE International Geoscience and Remote Sensing Symposium*, 2023, pp. 950–953. DOI: 10.1109/IGARSS52108.2023.10281981.

[4] Y. Zambre, E. Rajkitkul, A. Mohan, and J. Peeples, *Spatial transformer network yolo model for agricultural object detection*, 2024. arXiv: 2407.21652 [cs.CV]. [Online]. Available: https://arxiv.org/abs/2407.21652.

[5] A. Mohan, A. Mohan, B. Indushree, M. Malavikaa, and C. P. Narendra, "Generation of netlist from a hand drawn circuit through image processing and machine learning," in *2022 IEEE 2nd International Conference on Artificial Intelligence and Signal Processing (AISP)*, 2022, pp. 1–4. DOI: 10.1109/AISP53593.2022.9760577.

TEACHING EXPERIENCE

Texas A&M Electrical and Computer Engineering Department August 2023 - May 2024
Course: ECEN 214: Electrical Circuit Theory TAMU

- Led ECEN 214 Electrical Circuit Theory lab sessions, supervising three sections per semester with 70+ undergrad students.
- Administered exams, assessed student reports, and taught fundamental topics including electronic components and measurement tools.

INDUSTRY EXPERIENCE

Android Security Software Engineer August 2021 - July 2022
Ittiam Systems Pvt. Ltd. Bangalore, India

- Developed software fuzzers for Android's Open-Source Project, focusing on Linux kernel and UI test automation, resulting in more than 80% code coverage and enhancing overall platform security.
- Engineered C++ code for LLVM and Syzkaller backend, successfully debugging and improving AOSP platform security.

Video Processing Research Intern May 2021 - August 2021
Indian Institute of Science (IISc) Bangalore, India

- Pivoted research direction following a key discovery in the H.264 buffer model.
- Engineered a real-time video streaming system by implementing H.264/AVC codec with FFMPEG over WiFi, achieving end-to-end latency under 3ms for 90% of packets across 10Mbps, 20Mbps and 30Mbps video bitrates.
- Optimized dynamic rate control mechanism by analyzing buffer sizes from 3Mb to 100Mb, demonstrating that smaller buffers (3Mb) provide more constant bitrate suitable for real-time transmission while larger buffers (100Mb) allow more quality-focused bitrate variation.

Computer Vision Research Intern June 2020 - September 2020
EngineCAL Pvt. Ltd. Bangalore, India

- Developed a real-time Machine Vision driver assistance leveraging AI for monitoring lanes and vehicles on the road, including automotive object detection in autonomous vehicles. Implemented real-time alerts via a Telegram bot in a robotic system.
- Configured and optimized Raspberry Pi and NVIDIA Jetson Nano GPU camera modules for efficient object recognition tasks and data processing.
- Executed the training and deployment of the MobileNet-SSD v2 algorithm on edge devices, achieving a 72.7% mean average precision (MAP).

COURSE PROJECTS

Medical Chatbot: LLM and Vector Embedding-Based Medical QA System
Large Language Models

Engineered a FastAPI application leveraging transformer-based foundation models, i.e., LLMs and Retrieval-Augmented Generation (RAG) in LangChain enabling precise medical question-answering and optimized user experience.

Convolutional Neural Networks for Reversing Artistic Image Filters
Computational Photography

Improved image restoration for photographs modified with 22 photographic filters enhancing visual quality, achieving a minimum loss value leading to a peak signal-to-noise ratio (PSNR) increase of 0.0035.

Facial Recognition using the Viola-Jones Algorithm
Pattern Recognition

Engineered training of a face classifier using the AdaBoost algorithm on a diverse dataset of 2000 face and 1470 non-face images, employing effective preprocessing techniques to enhance model performance.

POSITIONS OF RESPONSIBILITY

Editor at Indian Student Association January 2023 - December 2023

- Designed and marketed events and increased the online outreach on the IGSA Facebook page by 34%.

President at Electronics and Communication Student Association August 2020 - May 2021

- Managed a 16-member team responsible for execution of workshops and events in the ECE department.

SKILLS/HOBBIES

Programming Languages	C, C++, Python, R, SQL, CUDA, Linux, Unix
Machine Learning Tools	PyTorch, TensorFlow, scikit-learn, pandas, NumPy, PowerBI, Tableau, LangChain
Cloud Technologies	AWS Sagemaker, AWS Bedrock, AWS S3, AWS EC2, AWS Athena, Azure Data Factory, Azure AI Fundamentals (Certified)
Hobbies	Sketching and Writing