AKSHATHA MOHAN

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EDUCATION

Texas A&M University (TAMU) *December 2024*
M.S. in Electrical and Computer Engineering
GPA: 3.8/4.0
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 interests lie in using machine learning and computer vision for modeling and understanding complex biological data, especially imaging data, on a large scale. Effectively helping in objective diagnosis, prognosis, and biomarker discovery.

RESEARCH EXPERIENCE

Texture Analysis of Lung Cell Morphology after Nanoparticle Exposure (Under review for SPIE: Medical Imaging) May 2024 - Present
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.

Master's Thesis: Lacunarity Pooling Layers for Plant Image Classification using Texture Analysis [1] August 2023 - April 2024
Supervisors: Dr. Joshua Peeples TAMU

- Introduced a novel pooling technique to improve image classification by leveraging texture information.
- The pooling layer captures the spatial heterogeneity of feature maps by examining variability within local windows at multiple scales.
- Demonstrated resilience in research by overcoming significant challenges, including a potential shift in research direction. Persevered with the original concept, leading to successful completion and publication.
- Refined scientific writing and communication skills through the iterative process of thesis writing and publication preparation.

Quantitative Analysis of Explainable Artificial Intelligence Methods for multi-spectral image classification [2] January 2023 - June 2023
Supervisors: Dr. Joshua Peeples TAMU

- Conducted a comprehensive analysis of XAI methods for improving interpretability in multi-spectral image applications.

Spatial Transformer Network YOLO Model for Object Detection [3] January 2023 - June 2024
Supervisors: Dr. Joshua Peeples TAMU

- Proposed an innovative integration of Spatial Transformer Networks (STNs) with the YOLO object detection model to address challenges in cluttered and partially occluded images.
- 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 [4] January 2021 - May 2021
Supervisors: Dr. Narendra C P BIT

- Developed an innovative approach to convert hand-drawn circuits into netlists using image processing and machine learning techniques.

PUBLICATIONS

[1] 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.

[2] 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.

[3] 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.

[4] 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.
- Enhanced H.264 rate control for adaptive video quality: Implemented and optimized H.264 rate control methods using FFMPEG on Linux.
- Network performance optimization for real-time streaming: Utilized UDP over Wi-Fi for low-latency transmission.

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 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 an 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