

Fatwir Sheikh Mohammed

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Interests: Machine Learning, Deep Learning, Computer Vision, Image Processing

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Education

- University of Washington** Seattle, USA
Master of Science in Electrical Engineering Sept 2022 - June 2024
 - GPA: 3.86/4.00, Specialization: Machine Learning and Computer Vision, Advised by Dr. Linda Shapiro
- National Institute of Technology Karnataka** Surathkal, India
Bachelor of Technology in Electrical and Electronics with Minor in Computer Science July 2018 - May 2022
 - CGPA: 9.71/10, Ranked **2nd out of 109** students in the department, *Thesis: A Game of Snakes and GANs [2]*
 - Awarded the DAAD-WISE Fellowship by the German Consulate and the IAS Fellowship by the Indian Academy of Sciences

Professional Experience

- Alpenglow Biosciences** Seattle, USA
Deep Learning Research Intern June 2023 - Dec 2023
 - Made progress on the **neural stain style transfer problem**. Achieved a **90%** reduction in staining time and a **1000-fold** decrease in staining costs using **supervised** and **adversarial learning**, enabling **virtual staining** on the fly
 - Boosted training by **10%** through normalization and chunking for UNets on 7500 patched 2D slices (512×512) for a 3D dataset (~ 250) GB
 - Implemented **Pix2Pix** and **CycleGAN** from scratch, outperforming the baseline supervised model by **15%** on a validation set of **750** images
 - Investigated various guided **diffusion**-based models, including pre-trained and custom-built, for **zero-shot** stain transfer
 - Prototyped a content-based autocropping feature that optimized the **data processing pipeline** for large 3D image datasets
 - Implemented feature reduced processing time by **40%** and saved almost **30 – 50%** in storage space
 - Contributed to development of a **GUI** for microscope software and enhanced the saving module for laser calibration and scan settings
- RadiusAI** Seattle, USA
Computer Vision Researcher (Capstone) Jan 2023 - June 2023
 - Worked on the **self-checkout problem** using synthetic Image Generation (2D/3D) to improve training of object detection models
 - Accelerated training by almost **20%** using **Fully-Fused MLPs** for a custom retail product dataset of around 140 images
 - Obtained a validation PSNR of 25.96 dB in training a Neural Radiance Field (NeRF), deviating by a mere **0.6 dB** from original implementation
 - Effectively harnessed **93%** of the **GPU's** capacity and slashed the training time by almost **42%**, marking notable improvement in efficiency

Publication(s)

- W. O. Ikezogwo, M. S. Seyfioglu, F. Ghezloo, D. S. C. Geva, **F. S. Mohammed**, P. K. Anand, R. Krishna, L. Shapiro, "Quilt-1M: One Million Image-Text Pairs for Histopathology", Proc. NeurIPS 2023 Datasets and Benchmarks Track (**Oral - Acceptance $\sim 0.5\%$**)
- S. Asokan, **F. S. Mohammed**, and C. S. Seelamantula, "A game of snakes and GANs," Adversarial Learning Track, Proc. IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 2023 (**Oral Presentation - Acceptance $\sim 13\%$**)

Research Experience

- GRAIL: UW Graphics and Imaging Laboratory** Seattle, USA
Graduate Research Assistant (Computer Vision) Jan 2024 - Present
 - Using **VQ-GANs** to develop codebooks for **OCT** and **IR** images, enhancing synthesis and downstream capabilities (systemic disease prediction)
- Graduate Research Assistant (Computer Vision and NLP)* Dec 2022 - June 2023
 - Developed the **largest** public vision-language histopathology dataset, comprising approximately **1, 000, 000** image-text pairs
 - Fine-tuned a pre-trained CLIP model (**QuiltNet**) on zero-shot classification across **12** datasets, achieving an improvement of **10%** in accuracy
 - With our **LMM, QuiltNet**, we obtained around a **5%** improvement on 4 datasets in **linear probing** using $\{1, 10, 100\}\%$ of data and boosted cross-modal retrieval by an average of **36%** in image-text and text-image retrieval on the **Quilt-1M** holdout dataset
 - This **LLM and ASR-based** multimodal data generation approach was bestowed with an oral publication in the datasets track of **NeurIPS 2023**
- Indian Institute of Science, Bangalore** Bangalore, India
Bachelor Thesis (GenAI and Optimization) Dec 2021 - July 2022
 - Worked on optimizing the performance of **GANs** as a precursor to which Wasserstein Generative Adversarial Networks (**WGAN**) were implemented for 1D and 2D Gaussian Target Distributions whilst analyzing snakes using gradient vector flow (GVF) fields
 - Solved the optimal discriminator PDE by bridging the gap between GVFs and GANs - **finite differences** and **grid inversion** in 2D
 - Accelerated convergence within **100 iterations** (vs. *State-Of-The-Art*) on 2D Gaussian targets with active contours using WGANs
 - This snake based GAN optimization was bestowed with an **oral** publication at the **Adversarial Learning Track of ICASSP 2023**
- Peter L. Reichertz Institute for Medical Informatics - TU Braunschweig** Braunschweig, Germany
Research Intern - DAAD-WISE Scholar (Deep Learning for Medical data) July 2021 - Nov 2021
 - Performed **Blood Pressure estimation** from photoplethysmogram (PPG) signals taken from the **MIMIC - III** waveform dataset
 - Devised a **spectro-temporal** Deep Neural Network and attained near perfect correlation ($R \approx 0.95$) between BP with PPG signals
 - Enhanced the performance of the DeepNet by **10%** leveraging **Python, MATLAB and Bash** scripts for extensive data preprocessing using classical signal processing techniques (Elgendi Algorithm, Hampel and Frequency Filters)
 - Trained the network on 251 patient records (approximately 2 hours of time-data) using leave-one subject out cross-validation (**LOSO-CV**)
- Centre for Computational Imaging - IIT Palakkad** Palakkad, India
Summer Research Intern - IAS-SRFP Scholar (Image Processing) May 2021 - Nov 2021
 - Analysed Subtle Motion on ultrasound images of the Common Carotid Artery to perform **video magnification** to estimate Blood Pressure
 - Estimated phase by **oscillation enhancement**, using the single orthant analytic signal, followed by motion magnification and grid interpolation

Relevant Courses and Skills

Relevant Courses: Advanced Introduction to ML, Computer Vision, Control Theory, Data Structures and Algorithms, Digital Imaging Systems, Digital Signal Processing, Fourier and Wavelet Analysis, Graph Theory, Machine Learning, Neural Networks, Linear Algebra, Probability and Random Processes, Optimization Techniques, Soft Computing, Signals and Systems

Skills: Python, PyTorch, OpenCV, NumPy, SciPy, Scikit-Learn, AIVIA, Napari, Jira, Git, AWS, Dask, COLMAP, SpaCy, Seaborn, TensorFlow, Keras, Pandas, MATLAB, Quaternion FT, Advanced Image Processing, Ultrasound Imaging, Deep Learning, Machine Learning