

Fatwir Sheikh Mohammed

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

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Education

- University of Washington** Seattle, USA
 - Master of Science in Electrical Engineering* Sept 2022 - June 2024
 - GPA: 3.89/4.00, Specialization: Machine Learning, Deep 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 - Present
 - Worked on the **neural style transfer problem** for stains using supervised and adversarial approaches, saving the firm approximately **700 hours** in manual annotations. Also, this resulted in a staggering cost reduction of staining from **\$5 million to only \$1000**
 - Experimented with **normalization** and **chunking** for large 3D datasets (~250 GB) leading to **10% improvement** in training loss
 - Employed supervised learning with **UNets**, incorporating losses such as **KLD**, **weighted MSE** and trained on 7500 images
 - Implemented **Pix2Pix** and **CycleGAN**, outperforming the supervised method by almost **15%** on a validation set of 750 images
 - Optimized **data processing pipeline**, refining algorithm accuracy, and implementing parallelization for large datasets. This included a content-based autocropping feature, that led to **40%** reduction in processing time and saving **30 - 50%** in storage
- RadiusAI** Seattle, USA
 - Computer Vision Researcher (Capstone)* Jan 2023 - June 2023
 - Worked on **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** to train a custom object dataset of around 140 images
 - Achieved a validation PSNR of 25.96 dB in training a Neural Radiance Field (**NeRF**), with a mere **0.6 dB** deviation from the original implementation. Notably, training time was substantially reduced by 42% by efficiently utilizing **93% of the GPU**

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 Presentation**)
- 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**)

Research Experience

- GRAIL: UW Graphics and Imaging Laboratory** Seattle, USA
 - Graduate Research Assistant (Computer Vision and NLP)* Nov 2022 - June 2023
 - Developed the **largest** public vision-language histopathology dataset, comprising approximately **1, 000, 000** image and text pairs
 - Designed a neural network (**QuiltNet**) for this dataset and achieved superior performance compared to State-of-the-Art models
 - Made significant improvement in **zero-shot** and **linear probing** using our **LMM**, **QuiltNet** in classifying images and cross-modal retrieval
 - This **LLM and ASR-based** multimodal data generation approach was bestowed with an **oral** publication at **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. *SOTA*) on 2D Gaussian targets with active contours using WGANs
 - Improved computational efficiency for the *SnakeGAN* to learn the latent space distribution of **SVHN** and **CelebA** datasets
 - 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 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
 - Improved R value by 0.15 by exploiting frequency information of PPG and its derivatives using **GRUs** and **spectrograms**
 - 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 BP
 - Estimated phase by **oscillation enhancement** and computing single orthant analytic signal, followed by motion magnification

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