Mohammad Arafat Hussain, PhD

Quincy, MA | **Phone:** (781) 796 4519 | **Email:** m.arafathussain@gmail.com | **GitHub:** marafathussain | **Website:** marafathussain.github.io

Scientist specializing in deep learning and data science in medical image analysis and background in neuroscience

EDUCATION

University of British Columbia (UBC), Vancouver, BC, Canada
- 04/2020 | Ph.D. in Biomedical Engineering | Research Focus: Deep learning in medical image analysis, cancer analysis
- 05/2015 | M.A.Sc. in Biomedical Engineering | Research Focus: Medical image and signal processing

Bangladesh University of Engineering & Technology (BUET), Dhaka, Bangladesh
- 04/2013 | M.Sc. in Electrical and Electronic Engineering | Research Focus: Medical image and signal processing, cancer detection
- 02/2011 | B.Sc. in Electrical and Electronic Engineering

PROFESSIONAL/RESEARCH EXPERIENCE

05/2021 – Present | Data Science Research Fellow | Harvard Medical School | Boston Children's Hospital | Boston, MA

Leveraging CNNs and Transformers for Neurocognitive Predictions and Explanations from Big Data MRI
- I boosted cognition prediction accuracy by 10% by leveraging CNNs, GNNs, Transformers, and Graph Transformers in big data brain MRI, which enhanced neurocognitive predictions and explanations.
- I increased processing speed by 15% through the implementation of time-efficient feature selection techniques in big data tasks, leading to more efficient data analysis.
- By incorporating a novel biomarker in machine learning from brain MRI, I improved human intelligence prediction accuracy by 5%, contributing to more precise predictions of human intelligence.
- I successfully led an AHA-funded project of $140,000 as a Principal Investigator while co-supervising 1 graduate and 2 undergraduate student interns, which enhanced the research capabilities and outcomes of our team.

04/2020 – 04/2021 | Data Science Research Associate | School of Computing Science, Simon Fraser University | Burnaby, BC

Advancing Deep Learning with Example Re-weighting and On-the-fly Augmentation for Big Data CT Imaging
- I boosted segmentation accuracy to over 75% by employing a novel active deep learning strategy, resulting in enhanced precision in medical imaging.
- I achieved near-perfect COVID-19 detection (~100%) from X-ray images by utilizing a learning-to-augment strategy in deep learning, contributing to timely and accurate disease diagnosis.
- I successfully led two COVID-19-related projects and supervised 2 graduate student interns, fostering independent research and practical learning.

05/2013 – 03/2020 | Graduate Research Assistant | School of Biomedical Engineering, UBC | Vancouver, BC

Advanced CNNs for Kidney Analysis: Localization, Cancer Grading, Gene Mutation Determination, and Volume Estimation
- I accomplished a significant reduction in boundary wall localization error to ~3mm by innovatively employing a Mask-RCNN approach in automatic kidney localization, resulting in more precise and accurate medical imaging.
- By integrating a learnable image histogram module into the CNN framework, I enhanced the accuracy of cancer grading/ staging by approximately 20%, leading to more accurate diagnoses and treatment plans.
- I achieved a remarkable 94% success rate in noninvasive gene mutation determination by utilizing a multiple instance decision CNN, paving the way for less invasive and more efficient genetic testing.
- I developed a unique collage image representation within the MIL framework, enabling the use of sparsely annotated data in 2D CNN, thereby increasing the efficiency and applicability of the model.
- I developed three innovative deep-learning techniques for segmentation-free organ volume estimation, which have 200 times fewer parameters than 3D UNet, resulting in a more efficient and streamlined model.

Bone Localization in Ultrasound for Minimally Invasive Orthopedic Surgery
- I accomplished a 60% improvement in 3D bone delineation accuracy by utilizing a strain-initialized surface growing method, resulting in enhanced medical imaging precision.
- By employing combined elasticity and RF signals, I achieved a 30% improvement in 2D bone delineation accuracy, leading to more accurate medical diagnostics.

Compressively Sensed Ultrasound Radio-frequency Data Reconstruction
- I achieved a significant enhancement in ultrasound RF data reconstruction by employing a unique combination of curvelets and wave-atom bases, leading to a remarkable 30% improvement in the compressive sensing process.

Towards Real-time 3D Geometric Nonlinear Diffusion Filter
- I significantly enhanced the performance of CT and MR image denoising by employing advanced diffusion filters, resulting in a substantial 70% improvement compared to the previous state-of-the-art methods.

07/2011 – 12/2012 | Research Engineer | Department of Electrical and Electronic Engineering, BUET | Dhaka, Bangladesh

Ultrasound Elastography/Attenuation Estimation for Breast Cancer Detection

- I achieved early detection of breast tumor malignancy, potentially saving the lives of 10 women, by innovating ultrasound strain imaging techniques.
- I enhanced the accuracy of ultrasound elastography by creating FEM-simulated phantoms using ANSYS and Field II.

SKILLS

- **Programming Languages and Frameworks:** Python, MATLAB, C, SQL, HTML, JavaScript, TensorFlow, PyTorch, CUDA
- **Machine Learning:** Deep Learning, Convolutional Neural Networks (CNNs), Large Language Models (LLMs), Transformers, Graph Transformers, Graph Neural Networks (GNNs), Supervised Learning, Transfer Learning, Active Learning
- **Data Analysis:** Statistical Analysis, Data Visualization, Feature Engineering, Feature Selection
- **Tools and Libraries:** NumPy, Pandas, SciPy, Scikit-learn, Jupyter Notebook, Git, Nilearn
- **Databases:** SQL, PostgreSQL
- High-Performance Computing on Clusters

NOTABLE CERTIFICATIONS

- **Generative AI with Large Language Models** | DeepLearning.AI
- **DAT208x: Python for Data Science**, edX | Microsoft

LEADERSHIP

- **Secretary,** ECE Graduate Student Association, UBC, Vancouver | *05/2017 – 04/2018*
- **Lab Admin,** Biomedical Signal, and Image Computing Lab, UBC, Vancouver | *06/2018 – 04/2020*

PUBLICATIONS

Google Scholar: https://scholar.google.ca/citations?user=hFwvdQcAAAAJ&hl=en
ORCID: https://orcid.org/0000-0003-0545-5779

REFERENCES

Available Upon Request