

Mostofa Rafid Uddin

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📄 [mostofa-rafid-uddin](#) 📖 <https://scholar.google.com/citations?user=csnAp98AAAAJ>

Research Interests & Expertise

Research Topics of Interest: *High Expertise:* Unsupervised, Self-supervised Representation Learning, Contrastive Learning, 3D Computer Vision, Structural Bioinformatics, Object detection and Segmentation.

Moderate Expertise: Deep Generative Models, Probabilistic Graphical Models, Foundation Models, Computational Genomics, Domain adaptation, Pose Estimation.

Datasets of expertise: Scene-centric images, 3D tomographic images, Microscopy images, 3D data with various representations (mesh, point-cloud, SDF, voxels, Gaussian Splat), Biological Sequence Data (Protein, DNA, RNAseq, ATAC-seq, ChIP-seq).

Education

2020- PRESENT	Doctor of Philosophy (Ph.D), School of Computer Science, Carnegie Mellon University, Pittsburgh, PA 15213, USA Advisor: Min Xu Distinctions: CMLH Fellowship for Digital Health 2023. Relevant Coursework: Machine Learning (Ph.D.) level, Computer Vision, Probabilistic Graphical Models.
2014 -2018	Bachelor of Science in Computer Science and Engineering, Bangladesh University of Engineering and Technology (BUET), Dhaka, Bangladesh. Academic distinctions: Deans list awards, University merit scholarships. Relevant Coursework: Computer Graphics, Object-oriented Programming, Structured Programming, Pattern Recognition, Digital Image Processing.

Selected Research Publications

A few representative publications are mentioned here. For a full and up-to-date list, please visit my google scholar [link](#).

- **Mostofa Rafid Uddin**, Gregory Howe, and Min Xu. Harmony: A Generic Unsupervised Approach for Disentangling Semantic Content from Parameterized Transformations. *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2022, pp. 20646-20655. (H5-index: 356). [\[paper link\]](#) [\[news link\]](#). **Skills:** [Unsupervised Learning](#), [Representation Learning](#), [Deep Generative Models](#), [Bio-image Analyses](#).
 - In many real-life image analyses, particularly biomedical research domains, objects in the images undergo several parameterized transformations.
 - I developed an unsupervised method to disentangle the transformations from image contents and demonstrate that it significantly facilitates many downstream tasks.
- **Mostofa Rafid Uddin**, Sazan Mahbub, M Saifur Rahman, and Md Shamsuzzoha Bayzid. SAINT: Self-Attention Augmented Inception-Inside-Inception Network Improves Protein Secondary Structure Prediction. *Bioinformatics*, 2020 Nov 1; 36(17):4599-608. (H5-index: 136, Impact Factor: 6.937) [\[paper link\]](#). **Skills:** [Neural Machine Translation](#), [Structural Bioinformatics](#), [Dense Prediction](#).
 - Predicting 8-state (Q8) secondary structure from amino acid sequences of protein is an important but challenging problem.
 - Developed a self-attention augmented inception-inside-inception network that improves state-of-the-art protein secondary structure prediction and recovers insights of protein folding through interpretable attention features.
- Sayali Onkar, Jian Cui, Jian Zou, Carly Cardello, Anthony R Cillo, **Mostofa Rafid Uddin**, April Sagan, Marion Joy, Hatice U Osmanbeyoglu, Katherine L Pogue-Geile, Priscilla F McAuliffe, Peter C Lucas, George C Tseng, Adrian V Lee, Tullia C Bruno, Steffi Oesterreich, Dario AA Vignali. Immune landscape in invasive ductal and lobular breast cancer reveals a divergent macrophage-driven microenvironment. *Nature Cancer*(Impact Factor: 23.18). [\[paper link\]](#) **Skills:** [Statistical Image Analysis](#), [Applied Science Research](#).
 - Developed a pipeline for spatial cell neighborhood analysis in multispectral tumor microenvironment images.

- Demonstrated the role of different cell phenotypes in tumor microenvironment from spatial analysis.

Technical Skills

Languages: Python, Java, C, C++. **HPC Computing:** AMD Cluster, Oracle Cloud, AWS.

Frameworks: Pytorch, Detectron, Tensorflow, OpenCV, Numpy, Scipy, Scikit-learn.

Work Experience

2021 - PRESENT	Graduate Research Assistant , Computational Biology Department, School of Computer Science, Carnegie Mellon University, PA, USA
2022	Graduate Teaching Assistant , Computational Biology Department, Spring 2022 CMU 02-620: Machine Learning for Scientists Fall 2022 CMU 02-740: Bioimage Informatics
2019- 2020	Lecturer , Department of Computer Science and Engineering, East West University, Dhaka, Bangladesh.

Grants, Awards, & Services

- **Center for Machine Learning and Health (CMLH) fellowship in Digital Health, 2023** CMLH fellowships, around 100,000 USD worth, are awarded each year to several (around 10) outstanding digital health-related research proposals by CMU PhD students. I received the award in 2023 with my proposal *“Leveraging Cryo-ET Imaging Technology to Improve Patient Care for Neurodegenerative Diseases by Identifying Subcellular Biomarkers”*. [\[link\]](#) **Skills:** Grant Writing, Independent Research.
- Regularly serve as a reviewer in top AI and vision conferences such as CVPR, ICCV, ECCV, WACV, AAAI, etc.
- Worked as a mentor in CMU AI Mentoring Program, where I mentor CMU undergraduate students coming from underrepresented communities interested in AI research
- Gave research talk on IEEE Applied Imagery Pattern Recognition (AIPR) Workshop (virtual), October 2021, Washington, DC, US. [\[link\]](#)
- Won best poster award at 3rd International Conference on Networking, Systems and Security (NSysS 2017). Poster Title: *Archiving Medical Records in DNA Sequence*[\[pdf\]](#) **Skills:** Precision Health, Electronic Health Records

Mini-Research Projects

- ◇ **Design of Phase-separated Protein Sequences using Adaptive Sampling and Active Learning** Developed a probabilistic approach for designing in silico proteins with a high propensity for liquid-liquid phase separation (LLPS) and droplet formation. [\[github\]](#) **Skills:** Probabilistic Graphical Models, Protein Design, Optimization.
- ◇ **Pytorch Implemented Local Energy Minimizer** Implemented the local energy minimizer module of OpenMM software by modifying pytorch autograd mechanics. [\[github\]](#)
- ◇ **Edge prediction: Predicting Edge in Academic Citation Networks** Predicted how likely an academic article is to cite another particular article using an intelligent and novel feature engineering pipeline that could generate highly accurate predictions with relatively simpler models. [\[github\]](#)
- ◇ **Predicting age from lung single cell data** Applied multiple feature extraction models and classifiers to predict biological age from scRNA-seq data of multiple control patients. [\[github\]](#)
- ◇ **Onubadok: Bangla to English Machine Translation Using Seq2Seq Model with Attention Mechanism.** In this project on Neural Machine Translation(NMT), I observed that using Bahdanau’s attention with a vanilla encoder-decoder model improves BLEU score for Bangla to English translation. [\[github\]](#)
- ◇ **Arduino based Posture Corrector.** Developed a posture corrector android application that could detect unusual bending of user wearing a device containing flex sensor. [\[youtube\]](#)