Md Mushfiqur Rahman

ML researcher and developer with 5 years of experience in NLP and Computer Vision

📞 571.668.1664 | ✉ mrahma45@gmu.edu | in mushfiqur11 | 📍 Fairfax, VA

⊙ mushfiqur11 | 👤 https://mushfiqur11.github.io

CAREER HIGHLIGHTS

- **5+ years** of experience in ML research with **7 peer-reviewed** articles (5 as the first author/equally contributing co-author); **1 at a Q1 journal**. Presented at 4 conferences.
- **2 articles are under review** and another one is in progress.
- My ML model is actively being used in **denoising images at the Hinode Spacecraft.**

EDUCATION

George Mason University (Fairfax, VA)   Aug. 2021 – Present
MSc in Computer Science (with ML concentration) (Current CGPA: 3.93)

- Currently enrolled in: **PhD in Computer Science** program
- Research domain: Machine Learning and Natural Language Processing

Islamic University of Technology (Gazipur, Bangladesh)   Jan. 2017 – Feb. 2021
BSc in Computer Science and Engineering (CGPA: 3.79)

- **Research Topic** : StructGAN: Image Restoration Maintaining Structural Consistency Using A Two-Step Generative Adversarial Network
- Published **3 research papers** during the undergraduate studies

PROJECTS

Spectral Reconstruction of EIS Images with Conditional GAN

- Compared 4 image reconstruction/denoising algorithms (GAN, cGAN, WGAN, and Autoencoder) for EIS images.
- The cGAN **removes 93% noise** and improves image denoising capabilities of the EIS hosted in Hinode.

Analyzing Text-representation (tokenization vs non-tokenization) Modes in Cross-lingual Transfer

- Compared tokenization-based models (`BERT`, `mBERT`) with tokenization-free models (`PIXEL`, `CANINE`). Proposed a decision aid for text-representation based on **19 source and 133 target languages** for **3 common NLP tasks**.
- The analysis underscores the **importance of non-tokenization models** for specific tasks.

Health Information Simplification and Summarization

- Created the **first medical dataset for text simplification** based on reading level **(complex to 6th grade)**
- Benchmarked GPT4 and Llama2 (trained with RL) on this dataset. Evaluated **GPT4 in 5 different settings.**
- Created a Llama-2 variant trained with Q-LoRA (minimizing computational resource requirement by **60% for GPU usage and 90% for time**). Reduced data requirements significantly by introducing a novel SFT+PPO model (with a novel reward).

Large-scale ML Optimization for Online Continual Learning (Image Classification Tasks)

- Developed a novel algorithm to **handle catastrophic forgetting** for continual learning tasks in an online setup. When learning new a task, the model **does not lose (substantial) performance** on previously learned tasks.
- The model assumes an online setup (ie., no storage) and **achieves comparable results to a non-online setup**.

COVID Misinformation Detection

- Built a BERT-based model. Achieved **97% accuracy on Constraint2021** and **93% accuracy on CoAID** dataset.
- Extensively analyzed the effectiveness of **LLMs (GPT3) in zero-shot and few-shot settings** for this task.

Intent Detection and Slot Filling for Home Assistants (for low resource languages)

- Built the **first ever intent detection and slot filling dataset** for Bangla and Sylheti.

- GPT-3.5 model achieves **0.94 (intent detection) and 0.51 (slot filling)** F1 score for Bangla.

Analyzing the Effect of Attentions in Video Captioning

- Compared different attention mechanisms and for video captioning. Created a **video captioning model** with stacked attention that achieved **state-of-the-art performance on MSVD**.
- A **detailed ablation study of each component** of the model showed the contribution of the stacked attention in retaining semantic information.

Image In-painting and Reconstruction with GAN

- Created a **two-step GAN (refinement and reconstruction) for in-painting** that achieved SOTA performance.
- Proposed **novel loss function** (based on image-edge information) results in **5-8% gain in** performance.

EXPERIENCE

George Mason University   Fairfax, VA
Graduate Research Assistant   Aug. 2021 – Present

- Published **4 research papers** related to NLP in the last 2 years. Working on **2 more papers**.
- Actively involved in grant proposal writing.
- Taught Python in the "Introduction to Programming (Python)" lab course.

US Naval Research Laboratory   SW Washington, DC
Machine Learning Intern   May 2023 – Aug. 2023

- Built a **GAN (Generative Adversarial Network)-based image denoiser** for the EIS (Extreme-ultraviolet Image Spectrometer) machine hosted in the Hinode spacecraft.
- The ML model is **actively being used in the Hinode spacecraft** and **removes 93% noise** from the EIS-generated images. It achieves **0.48 average test error** which is significantly better than the previous best (0.72).

Military Institute of Science and Technology   Dhaka, Bangladesh
Faculty (Lecturer)   Mar 2021 – Aug. 2021

- Taught **Undergraduate Artificial Intelligence** course. Re-designed the course structure to fit current needs.
- Taught 2 sessional (recitation) courses.
- Co-supervised and helped **3 undergraduate thesis projects** related to machine learning in publishing their works.

Dhaka University of Engineering and Technology   Gazipur, Bangladesh
Undergraduate Research Assistant   Feb. 2020 - Sept. 2020

- Built a constraint-based automated scheduling system with **MiniZinc integrated in Python.**

Samsung R&D Institute Bangladesh   Dhaka, Bangladesh
ML Research Intern   Nov. 2019 Jan. 2020

- Developed a deep learning model that generates **3D objects from equirectangular (box-map) images**.
- The GAN-like model (adjusted for spherical images) achieved **0.21 RMS error** for the 3-D vertices

M-World   Dhaka, Bangladesh
Game Development Team Lead   Jul. 2019 Oct. 2019

- Developed 2 **android games using Unity and C#** for a nutrition awareness project. Both the games got launched through the play-store and received **100+ daily users** at their peak
- Led a 4-member team (2 game devs, a designer, and a voice artist) **to complete the development within 4 months**

SKILLS

- Design and build complete ML pipelines with **Pytorch/Tensorflow**. Train **GPT-like LLMs** from scratch.
- Use **cloud platforms** to run and maintain code. Write algorithms to **minimize training resource requirements.**
- Build **back-end with FastAPI/Django**. Host and maintain websites on **AWS (EC-2 and Lambda)**
- **Languages/Libraries** : Python (Pytorch, Tensorflow, Pandas, Sklearn), C, C++, Java, SQL, MongoDB, FastAPI

AWARDS AND SCHOLARSHIPS

- Obtained **full-funded PhD position** at George Mason University (2021-2026)
- Obtained **OIC scholarship (full)** for undergraduate studies (2017-2021)
- **Runner-up of Inter-University App Development Contest**, 2019 ICT Fest (2019)
- **Champion of ICT4D** at 4th AUW ICT Fest 2018 (2018)
- **National Topper** in Mathematics in IAS (International Assessment for Schools) by UNSW (x2) (2008, 2014)
- **National Mathematical Olympiads** Medals (x4) (2009, 2012, 2013, 2014)
- **Regional (Dhaka) Physics Olympiads** Medals (x2) (2013, 2014)

SCORES

- **GRE: 327** (Quant: 167 | Verbal: 160)

PUBLICATIONS

[1] **Md Mushfiqur Rahman**, Fardin Ahsan Sakib, Fahim Faisal, and Antonios Anastasopoulos. 2023. To token or not to token: A comparative study of text representations for cross-lingual transfer. In *Proceedings of the 3rd Workshop on Multi-lingual Representation Learning (MRL)*, pages 67–84, Singapore. Association for Computational Linguistics

[2] **[Equal contribution]** Fardin Ahsan Sakib, A H M Rezaul Karim, Saadat Hasan Khan, and **Md Mushfiqur Rahman**. 2023. Intent detection and slot filling for home assistants: Dataset and analysis for Bangla and Sylheti. In *Proceedings of the First Workshop on Bangla Language Processing (BLP-2023)*, pages 48–55, Singapore. Association for Computational Linguistics

[3] **[Shared Task]** Bin Han, Haotian Zhu, Sitong Zhou, Sofia Ahmed, **Md Mushfiqur Rahman**, Fei Xia, and Kevin Lybarger. 2023. Huskyscribe at mediqa-sum 2023: Summarizing clinical dialogues with transformers. Thessaloniki, Greece. CLEF

[4] Refaat Mohammad Alamgir, Ali Abir Shuvro, Mueeze Al Mushabbir, Mohammed Ashfaq Raiyan, Nusrat Jahan Rani, **Md Mushfiqur Rahman**, Md. Hasanul Kabir, and Sabbir Ahmed. 2022. Performance analysis of yolo-based architectures for vehicle detection from traffic images in bangladesh. In *2022 25th International Conference on Computer and Information Technology (ICCIT)*, pages 982–987

[5] **[Q1 Journal] Md Mushfiqur Rahman**, Thasin Abedin, Khondokar SS Prottoy, Ayana Moshruba, and Fazlul Hasan Siddiqui. 2021. Video captioning with stacked attention and semantic hard pull. *PeerJ Computer Science*, 7:e664

[6] **Md Mushfiqur Rahman**, Sabah Binte Noor, and Fazlul Hasan Siddiqui. 2020. Automated large-scale class scheduling in minizinc. In *2020 2nd International Conference on Sustainable Technologies for Industry 4.0 (STI)*, pages 1–6