# Meheraj Hossain

418, Makki Mashjid Goli, West Rampura, Dhaka-1219

📞 +88 01853594333 ✉ meherajj@gmail.com 💼 meheraj-hossain ⭕ github.com/meheraj2325 Ⓚ kaggle.com/meheraj2325

## Research Interest

Natural Language Processing, Computer Vision, Large Language Models, Vision Language Models

## Education

| | |
|---|---|
| **University of Dhaka** | **Dhaka, Bangladesh** |
| *Bachelor of Science (B.Sc.) in Computer Science and Engineering* | *January 2017 – August 2021* |

CGPA: **3.74 / 4.00** (**7**th out of **65** students)

## Professional Experience

| | |
|---|---|
| **Therap (BD) Ltd.** | **Dhaka, Bangladesh** |
| *Therap Services LLC, Connecticut, USA* | |

| | |
|---|---|
| *Machine Learning Engineer* | *October 2022 – Present* |

- Working on a project to develop a **computer vision**-based product for remote patient monitoring within medical care facilities.
- Led the development of a **video-redaction** system that enables precise redaction of target individuals in a video using **Person Detection**, **Instance Segmentation** models, and **Multi-object Trackers**.
- Designed efficient stream-processing pipelines with optimized computer vision models using **NVIDIA Deepstream SDK**, enabling real-time video analytics on NVIDIA Jetson devices.
- Contributed to a **U.S. patent** for a non-invasive, real-time identification and redaction system in a monitored environment.

| | |
|---|---|
| *Associate Machine Learning Engineer* | *September 2021 – September 2022* |

- Explored recent research regarding various deep learning-based Computer Vision tasks such as Object Detection, Face Recognition, Pose Estimation, Segmentation, Activity Recognition, etc. for different scenarios.
- Experimented with cutting-edge vision-based Activity Recognition models on established benchmark datasets and assessed the real-time performance of these models on live camera feeds.
- Worked with a variety of depth sensors to utilize depth data in evaluating the effectiveness of depth-map based Human Activity Recognition models.

## Research Experience

| | |
|---|---|
| **Center for Computational & Data Sciences (CCDS)** | **Dhaka, Bangladesh** |
| *Research Assistant (Part-Time)* | *September 2023 – Present* |

- Evaluated the performance of Large Language Models (LLMs) across various downstream tasks in low-resource languages like Bangla using techniques including prompting, fine-tuning, etc.
- Pretrained a new Bangla Language Model **Bangla-Llama-2-7B** based on meta's Llama-2 7B model with a large Bangla corpus of around 12 GB using LORA methodology. [Code] [HF HUB]
- Currently working on training **instruction-following LLaMA-based models** for the Bangla language, focusing on enhancing natural language understanding and generation in a low-resource setting.

## Publications

- Faria Sultana*, Md Tahmid Hasan Fuad*, Md Fahim, Rahat Rizvi Rahman, **Meheraj Hossain**, M Ashraful Amin, A K M Mahbubur Rahman, Amin Ahsan Ali, **"How Good are LM and LLMs in Bangla Newspaper Article Summarization"**, in Proceedings of the *27th International Conference on Pattern Recognition*, ICPR 2024, To Appear. [Paper]

- Md Fahim, **Meheraj Hossain**, Sadman Rohan, Md Ashraful Amin, AKM Mahabubur Rahman, Amin Ahsan Ali, **"L-Context: Layer-wise Context Vectors for Better Text Classification Using Pre-trained Language Models"**, In Review. [Paper]

## Patents

- David Lawrence Turock, Justin Mark Brockie, James Michael Kelly, Richard Allen Robbins, **Meheraj Hossain**, et al., **"Automated, Non-Invasive Artificial Intelligence Machine Learning Method and System for Identifying and Redacting Personally Identifiable Information in a Monitored Environment using Real-Time Sensor Data"**, US Patent Publication No. **US 2024-0212804 A1**, published June 27, 2024. (Status: Pending) [Patent]

## Projects

**Bangla Llama** | *LLM, Llama, Huggingface, LoRA, PEFT, SFT*                    **April 2024 - Present**
- Pretrained **Bangla-Llama-2-7B** based on meta's Llama-2 7B model with around 12 GB Bangla corpus using LORA methodology. [Code] [HF HUB]
- Currently conducting pre-training of **Bangla-Llama-3.1-8B** and **Bangla-Llama-3.2-3B**, based on Meta's Llama-3.1 8B and Llama-3.2 3B models.
- Preparing an instruction dataset for training instruction-following Llama-based models for the Bangla language.

**Undergrad Thesis** | *Machine Learning, Feature Selection, Bioinformatics, Data Mining*          **April 2021**

   ***Title:*** mMultiSURF- A relief based feature selection method considering class overlapping area among neighbouring instances and prior information. [Thesis Book] [Code]
- Enhanced the state-of-the-art MultiSURF algorithm to improve its robustness and accuracy in selecting relevant feature subsets within very high-dimensional datasets.
- Incorporated an individual instance weighting method within the neighborhood, reflecting the likelihood of non-overlapping regions in calculating feature importance.

**Amar Health** | *HTML, CSS, Node.js, Express.js, MongoDB*                        **January 2020**
- Developed a web-based application for electronic health record management and patient monitoring at "Telepsychiatry Research and Innovation Network Ltd" in Dhaka, facilitating psychiatric care and research. [Code]

**ML Algo Simulator** | *HTML, CSS, Python, Flask, Machine Learning*                 **April 2019**
- Developed a web application for providing a platform to simulate basic machine learning algorithms on sample datasets. [Code]

**MedAdvisor** | *Java, Android, SQLite*                                         **December 2018**
- Built an Android app that provides users with disease information, medication details, and includes a medication reminder calendar for tracking doses. [Code]

## Technical Skills

**Programming Languages**: Python, C, C++, Java, JavaScript
**Libraries**: Pytorch, PyTorch-Lightning, Tensorflow, Keras, OpenCV, Scikit-Learn, Numpy, Pandas, Matplotlib, Seaborn
**Web Development**: FrontEnd - HTML, CSS, Bootstrap, jQuery, Ajax | BackEnd - Node.js, Express.js
**Database**: MongoDB, SQL, SQLite
**Hardware Tools**: Nvidia Jetson Xavier NX, Jetson AGX Orin, Jetson Orin Nano, Raspberry Pi
**Miscellaneous**: Git, Docker, MATLAB, LaTeX, TensorRT

## Awards & Achievements

- Secured 5th Position in Apurba Presents **Bhashabhrom: Bangla Grammatical Error Detection** Challenge Datathon 2023. (**Team**: *Team Aambella*) [Link]
- Selected as Finalist in **Robi Datathon 2.0** (**Team**: *The_Anomalies*) [Link]
- **University merit scholarship** awarded by the Government of Bangladesh for outstanding academic performance at the undergraduate level.

## Extracurricular Activities

**Competitive Programming**
- Solved 1000+ problems in different Online Judges including Codeforces(Max Rating: **1527**), LightOJ, and UVA.
- Participated in several national and international programming contests during my undergraduate studies.

**Kaggle Competitions**
- Participated in several Kaggle competitions, including Google Brain Ventilator Pressure Prediction (Time Series Analysis) and Global Wheat Detection (Computer Vision Challange) etc.

## References

**Amin Ahsan Ali, Ph.D.**

Associate professor, Department of Computer Science and Engineering, Independent University, Bangladesh
Email: aminali@iub.edu.bd, Website: http://iub.ac.bd/academics/departments/cse/faculty-and-staff/aminali

**Hasnain Heickal**

Assistant Professor, Department of Computer Science and Engineering, University of Dhaka
Email: hasnain@cse.du.ac.bd, Website: https://hheickal.github.io/