Sabbir Hossain Ujjal

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Education

Bachelor of Science in Electrical and Electronic Engineering (EEE) *March 2018-May 2023*
Major in Communication & Signal Processing (CSP)
Bangladesh University of Engineering and Technology (BUET) [Link]

- **CGPA - 3.75/4.00**

Relevant Coursework: Random Signals and Processes | Digital Signal Processing I | Continuous Signals and Linear Systems | Control System | Microprocessors and Embedded System

Research Interest

Natural Language Processing (NLP) | Multi-modal Large Language Model (LLM) | Conversational Agents (CA) | Human Robot Interaction | Computer Vision | Applied Machine Learning & Deep Learning

Publications

- **mTOVA: A Multilingual Task Oriented Virtual Assistant for Human Computer Communication**
  - **Conference:** 5th IEEE International Conference on Telecommunications and Photonics (ICTP) 2023
  - **Authors: Sabbir Hossain Ujjal**, A F M Mahfuzul Kabir, Mohammad Ariful Haque
  - DOI: 10.1109/ICTP60248.2023.10490454

Research Experience

Development of a multilingual conversational agent using deep learning and natural language processing

Supervisor: Dr. Mohammad Ariful Haque

- In our thesis work, we had developed a multilingual conversational agent (CA) which can understand voice command and generate response to help perform day-to-day tasks both in Bangla and English. We used **RASA** platform for deploying our CA and **ASR** and **NLU** models for understanding user voice command.

Development of Bangla Large Language Model (Ongoing)

- Development of efficient Bangla tokenizer using **custom BPE** tokenizers.
- Collection, cleaning and preparation of huge amount of open source **Bangla** text data.
- Pretraining and fine-tuning LLM and benchmarking for downstream tasks.

Work Experience

Machine Learning Engineer (Team Lead), ACI Limited *Aug 2024 - Present*

- **L**eading and mentoring a cross-functional team in developing business-specific automation solutions leveraging machine learning model and systems. Also design and implement strategic initiatives to optimize AI/ML project scalability and deployment, while overseeing the entire machine learning lifecycle from conceptualization to production, ensuring seamless integration and maximum business impact.
- Projects implemented under my supervision:
  - Prescription OCR [Link]
  - Insight Generation from tabular data leveraging LLMs. [Link]
  - Theft detection via action tracking in Retail shops.

Machine Learning Engineer, ACI Limited *Oct 2023 - Aug 2024*

- **Virtual Assistant (Link):** Developed a 24/7 virtual assistant using ASR, LLM, and RAG technologies to provide product information and problem-solving support for the company's employee and customers.
  - Trained Whisper based **ASR** model for Bangla and English audio transcription.
  - Implemented Retrieval-Augmented Generation (**RAG**) with **LLMs** and **Vector Databases** to efficiently answer product-related queries in a business context.
  - **Impact:** Helps our department employee (around 100) (In testing phase which will release for customers) to find relevant information.

- **ACI SpeechHub (Link):** Developed an audio-centric utility platform streamlining business operations leveraging **ASR** and **NLU** technology for the company.
  - Implemented Whisper based **ASR** model for Bangla and English audio transcription.
  - Summarization and keyword extraction from transcribed audio using **BERT** based models.
  - **Impact:** More than 100 employees are using this utility tools in the company for meeting transcription and business feedback analysis.
- **Voice Based Ordering System:** Developed an end-to-end Automatic Speech Recognition (**ASR**) system to streamline the ordering process for sales representatives. This voice-command solution significantly reduced order-taking time, effectively **halving the workload** for interactions with retailers.
  - **Impact:** Around 3000 field force (sales representative) are using to take orders from retail shops.

Machine Learning Engineer, AIEdgeInside - [AI Startup] *Aug 2023 - Oct 2023*

- **Computer Vision:** Experimented and developed system utilizing **computer vision** models for various applications.
- **Generative AI:** Researched and experimented with **vision generative models** for various applications.

Competitions

- **Robi Datathon 3.0 [Champion]** [Link]
  - The biggest data analysis competition in Bangladesh where we have to solve business oriented problem leveraging ML algorithms. My team 'ACI_ServerDown' has become the **champion**, outshining 1,000 teams formed by 3,500 talented individuals.
- **ভাষা-বিচিত্রা: ASR for Regional Dialects [First Runner-up]** [Link]
  - The objective of this challenge is to create a robust model which **transcribe Bengali speech** with various regional **dialects** following the orthography set by linguists. My team 'কাকাতুয়া' became the **first runner up** and our model was the fastest model for competing the task among the solutions.
- **Bengali.AI Speech Recognition [Bronze Medalist]**[Leaderboard: **59** internationally, **4th** in Bengladesh] [Link]
  - The objective of this challenge is to create a robust model which could recognize Bengali speech from out-of-distribution (**ODD**) audio recordings.
- **2nd AVA Challenge@IEEE MIPR 2024 [Second Runner-up]** [Link]
  - The objective of this challenge is to build a robust model for **video analysis** which can predict the risk of an impending car accident to the recording vehicle

Open Source Contribution

- **Awesome Bangla Datasets** [Code]
  - A centralized repository of Bengali datasets to advance deep learning applications in Bengali language to bridge the gap between AI technology and Bengali language applications.
- **banglanlptoolkit** [PyPi Package] [Code]
  - Developed a comprehensive Bangla Natural Language Processing toolkit featuring text normalization, tokenization, punctuation generation, and text augmentation capabilities. **[35k downloads till now]**
- **faster-translate** [PyPi Package] [Code]
  - Built a fast and efficient Bengali translation tool using ctranslate2, enabling rapid text translation with pre-trained translation models. [**7k downloads till now**]

Achievements

- **RISE Student Research Grant Award**
  - Research grant for undergraduate thesis by Research and Innovation Centre for Science and Engineering (RISE).
- **Dean's List Award in multiple semesters**
  - Academic honor by BUET for attaining CGPA of 3.75 for two consecutive terms.
- **President's Scout Award**
  - The highest rank of Bangladesh Scouts
- **Scholarship from Secondary Education Board**
  - Scholarship awarded by Ministry of Education, Bangladesh

Highlighted Projects

- **AI Generated Text Detection** [Project Page]
  - Developed a robust deep learning model to accurately distinguish between AI-generated and human-written text, enhancing various evaluation processes.
  - Language/Framework/Model: Python, Pytorch, DeBERTa, Feature engineering
- **Resume Classification and Sorting** [Project Page] [Code]
  - Engineered a deep learning-based end-to-end system for automated resume classification and sorting, streamlining and enhancing recruitment processes.
  - Language/Framework/Model: Python, Pytorch, BERT, DeBERTa
- **Bengali Name Extractor** [Project Page] [Code]
  - Developed a robust NLP-based system for accurate person name extraction from text which can be used in any call center and online voice based transaction systems.
  - Language/Framework/Model: Python, Pytorch, BanglaBERT
- **Drowsiness Detection by PPG signal Analysis.** [Project Page]
  - Designed and implemented a wearable device using PPG signals to detect drowsiness, alerting users to prevent potential road accidents.
  - Language/platform: Matlab, C++, Arduino
- **Real Time Covid Patient Monitoring** [Project Page] [Code]
  - Developed an IoT-based COVID-19 patient monitoring system with deep learning analytics, providing real-time emergency notifications to relevant parties.
  - Language/platform/Model: Python, C++, Arduino, YAMNet
- **Bangla Calendar Clock** [Project Page] [Code]
  - Developed a multilingual, multi-calendar microprocessor-based clock displaying Gregorian, Bengali, and Arabic dates, Our developed clock was later selected and hung on the microprocessor lab of BUET EEE department.
  - Language/platform: C++, Arduino
- **Real Time Object Detection for Blind People** [Project Page] [Code]
  - A computer vision based project to developed and end-to-end system for detecting object from an image and audibly sending these detected object messages to the user.
  - Language/platform/Model: Python, Colab, YOLO, Faster-RCNN

Technical Skills

- **Programming Languages:** Python, C, C++, MATLAB
- **Frameworks & Libraries:** PyTorch, TensorFlow, Keras, RASA, FastAPI, Langchian, LlamaIndex, Pandas, Scikit-learn
- **DevOps Services:** RESTApi, FastAPI, Flask, Uvicorn, Qdrant, Weaviate
- **Circuit Simulation and Design:** Proteus, PSpice
- **Others Tools/Software:** Git, Bash, LaTex, PowerPoint, Excel

Leadership and Volunteering Activities

- Team Lead, Machine Learning Engineer Team — *Aug 2024 - Present*
- Senior Patrol Leader (SPL), Shamsul Hoque Khan School & College Scout Group — *Feb 2014 - Nov 2014*
- Advisor, Shopno Sarothi - স্বপ্নসারথি [Activities] — *Feb 2019 - May 2023*

MOOC Courseworks

- Deep Learning Specialization by DeepLearning.AI. [Certificate]
- Machine Learning by Stanford University [Certificate]
- Fine-tuning Large Language Models by DeepLearning.AI [Certificate]
- Python for Everyone by University of Michigan [Certificate]
- Mathematics for Machine Learning Specialization by Imperial College London [Certificate]

Reference

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