Fatema Tuj Johora Faria

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Research Interests

Large Language Models, Vision Language Models, Large Vision Models, Computer Vision, Natural Language Processing, Medical Imaging Analysis, Generative Adversarial Networks, Explainable AI, Machine Learning and its applications.

Education

July 2019 to Dec 2023

Ahsanullah University of Science and Technology, Dhaka-1208, Bangladesh

B. Sc. in Computer Science and Engineering

CGPA: 3.302 on a scale of 4.00 (83^{rd} in Merit Position Among 133 Students)

Undergraduate Thesis Title: Generative Adversarial Networks for Crop Disease: A Case Study with Potato Disease Classification and Instance Segmentation

Supervisor: Dr. Mohammad Shafiul Alam, Professor, Department of CSE, AUST

Work Experience

May 2024 to Present

Application Developer (AI/ML), **Dexian Bangladesh LTD.**, *Dhaka, Bangladesh.*

- Designed **AgentDexi**, an LLM-based multi-agent system and RAG solution that analyzes job demand across various companies to provide actionable insights. This solution empowers technical recruiters to optimize their hiring strategies by aligning recruitment efforts with current industry trends and enables customization to meet specific needs for more targeted and effective outcomes.
  Technologies Used: Python, LangChain, CrewAI, Azure OpenAI, React JS, FastAPI
- Developed the **RFPMatcher**, an RAG solution to extract key information and summaries from Request for Proposal documents using domain-specific multitask prompts. The system evaluates proposal responses and incorporates a customized rubric score to compare bids, aiding in the prediction of potential win or loss outcomes. Additionally, the system generates a Table of Content for writing proposals for new bids.
  Technologies Used: Python, LlamaIndex, Azure OpenAI, AlloyDB, CouchDB, React JS, FastAPI
- Built **CaseAligner**, an LLM-powered application that generates tailored PowerPoint presentations for case studies based on specific Practice and Industry categories using internal project data. The application features a dynamic chat interface for interacting with individual slides, advanced summarization functionality for concise summaries of entire presentations or specific slides, and a robust search interface to locate information across generated case studies. Additionally, it enables users to regenerate specific slides for customization, automating content creation.
  Technologies Used: Python, LlamaIndex, Azure OpenAI, React JS, FastAPI
- Implemented **Org Info**, a vision-language model (VLM)-based application designed to simplify the extraction, management, and querying of organizational hierarchy data. The application automates the extraction of hierarchical information from uploaded images of organizational charts, stores the data in a structured database, and provides a chat interface for intuitive user interaction.
  Technologies Used: Python, LangChain, Azure OpenAI, OpenCV, Azure SQL, React JS, FastAPI
- Developed the **KnowledgeEngine**, an LLM-based, multi-document, innovative RAG Q&A system for retrieving information from internal documents. It analyzes internal reports and guidelines to provide context-aware answers. Users can upload documents and engage in a professional conversation with the system to extract relevant insights. The system ensures data security by maintaining a dedicated knowledge base for each user. Additionally, users can view references for the retrieved information and delete documents at any time.
  Technologies Used: Python, LlamaIndex, Azure OpenAI, AlloyDB, React JS, FastAPI

Research Experience

June 2024 to Present

Research Assistant

Supervisor: Dr. Laith H. Baniata, Assistant Professor, Gachon University, South Korea

- Conducted research on **"Investigating the Predominance of Large Language Models in Low-Resource Bangla Language Over Transformer Models for Hate Speech Detection: A Comparative Analysis"**. This work was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF), funded by the Ministry of Science and ICT under Grant NRF-2022R1A2C1005316.
- Carried out research on **"SentimentFormer: A Transformer-Based Multi-Modal Fusion Framework for Enhanced Sentiment Analysis of Memes in the Under-Resourced Bangla Language"**. This work was supported by the Basic Science Research Program of the National Research Foundation of Korea (NRF), funded by the Ministry of Science and ICT under the grant NRF-2022R1A2C1005316.

Publications (* denotes equal contribution)

Conference Proceedings

- **Fatema Tuj Johora Faria***, Mukaffi Bin Moin*, Rabeya Islam Mumu, Md Mahabubul Alam Abir, Abrar Nawar Alfy, and Mohammad Shafiul Alam., **"Motamot: A Dataset for Revealing the Supremacy of Large Language Models Over Transformer Models in Bengali Political Sentiment Analysis,"** 2024 IEEE Region 10 Symposium (TENSYMP), New Delhi, India, 2024, pp. 1-8, doi: 10.1109/TENSYMP61132.2024.10752197.
- **Fatema Tuj Johora Faria**, Mukaffi Bin Moin, Md Mahfuzur Rahman, Md Morshed Alam Shanto, Asif Iftekher Fahim, and Md Moinul Hoque. **"Uddessho: An Extensive Benchmark Dataset for Multimodal Author Intent Classification in Low-Resource Bangla Language."** arXiv preprint arXiv:2409.09504 (2024). ****Presented at ICITA 2024** [Preprint]**
- **Fatema Tuj Johora Faria**, Mukaffi Bin Moin, Asif Iftekher Fahim, Pronay Debnath, and Faisal Muhammad Shah. **"Unraveling the Dominance of Large Language Models Over Transformer Models for Bangla Natural Language Inference: A Comprehensive Study."** arXiv preprint arXiv:2405.02937 (2024). ****Presented at ICCCNet 2024** [Preprint]**
- Mukaffi Bin Moin, **Fatema Tuj Johora Faria**, Swarnajit Saha, Bushra Kamal Rafa, and Mohammad Shafiul Alam. **"Exploring Explainable AI Techniques for Improved Interpretability in Lung and Colon Cancer Classification."** arXiv preprint arXiv:2405.04610 (2024). ****Presented at ICCCNet 2024** [Preprint]**
- **Fatema Tuj Johora Faria**, Mukaffi Bin Moin, Ahmed Al Wase, Md Rabius Sani, Khan Md Hasib, and Mohammad Shafiul Alam. **"Classification of potato disease with digital image processing technique: a hybrid deep learning framework,"** 2023 IEEE 13th Annual Computing and Communication Workshop and Conference (CCWC), Las Vegas, NV, USA, 2023, pp. 0820-0826, doi: 10.1109/CCWC57344.2023.10099162.
- **Fatema Tuj Johora Faria**, Mukaffi Bin Moin, Asif Iftekher Fahim, Pronay Debnath, and Faisal Muhammad Shah. **"BanglaMemeEvidence: A Multimodal Benchmark Dataset for Explanatory Evidence Detection in Bengali Memes."** **[Under Review in an A* Rank Conference]**
- Saidur Rahman Sujon, Ahmadul Karim Chowdhury, **Fatema Tuj Johora Faria**, Mukaffi Bin Moin, and Faisal Muhammad Shah. **"Enhancing Bangla NLP Tasks with LLMs: A Study on Few-Shot Learning, RAG, and Fine-Tuning Techniques"** **[Under Review in an A* Rank Conference]**

Journals

- **Fatema Tuj Johora Faria**, Laith H. Baniata, Mohammad H. Baniata, Mohannad A. Khair, Ahmed Ibrahim Bani Ata, Chayut Bunterngchit, and Sangwoo Kang. 2025. **"SentimentFormer: A Transformer-Based Multimodal Fusion Framework for Enhanced Sentiment Analysis of Memes in Under-Resourced Bangla Language."** Electronics 14, no. 4: 799. https://doi.org/10.3390/electronics14040799.
- **Fatema Tuj Johora Faria**, Laith H. Baniata, and Sangwoo Kang. **"Investigating the Predominance of Large Language Models in Low-Resource Bangla Language over Transformer Models for Hate Speech Detection: A Comparative Analysis."** Mathematics 2024, 12, 3687. https://doi.org/10.3390/math12233687.
- **Fatema Tuj Johora Faria**, Mukaffi Bin Moin, Busra Kamal Rafa, Swarnajit Saha, Md. Mahfuzur Rahman, Khan

Md Hasib, and M. F. Mridha. **"BanglaCalamityMMD: A Comprehensive Benchmark Dataset for Multimodal Disaster Identification in the Low-Resource Bangla Language."**
****Under Review in International Journal of Disaster Risk Reduction (Q1)****

- **Fatema Tuj Johora Faria**, Mukaffi Bin Moin, Zayeed Hasan, Md Arafat Alam Khandaker, Niful Islam, Khan Md Hasib, and M. F. Mridha. **"MultiBanFakeDetect: Integrating Advanced Fusion Techniques for Multimodal Detection of Bangla Fake News in Under-Resourced Contexts."**
****Under Review in International Journal of Information Management Data Insights (Q1)****
- **Fatema Tuj Johora Faria**, Mukaffi Bin Moin, Pronay Debnath, Asif Iftekher Fahim, and Faisal Muhammad Shah. **"Explainable Convolutional Neural Networks for Retinal Fundus Classification and Cutting-Edge Segmentation Models for Retinal Blood Vessels from Fundus Images."** arXiv preprint arXiv:2405.07338 (2024). ****Under Review in Journal of Visual Communication and Image Representation (Q1)**** **[Preprint]**
- **Fatema Tuj Johora Faria**, Mukaffi Bin Moin, Ahmed Al Wase, Mehidi Ahmmed, Md Rabius Sani, and Tashreef Muhammad. **"Vashantor: a large-scale multilingual benchmark dataset for automated translation of bangla regional dialects to bangla language."** arXiv preprint arXiv:2311.11142 (2023).
****Under Review in Neural Computing and Applications (Q1)**** **[Preprint]**
- Mohammad Shafiul Alam*, **Fatema Tuj Johora Faria***, Mukaffi Bin Moin*, Ahmed Al Wase, Md Rabius Sani, and Khan Md Hasib. **"PotatoGANs: Utilizing Generative Adversarial Networks, Instance Segmentation, and Explainable AI for Enhanced Potato Disease Identification and Classification."** arXiv preprint arXiv:2405.07332 (2024). ****Under Review in Journal of Intelligent Information Systems (Q2)**** **[Preprint]**

Ongoing Research Projects

- BanglaMedQA: A Comprehensive Benchmark Dataset for Bangla Medical Question Answering
- Mental Health Advice Generation in Low-Resource Bangla Language
- Image-to-Text Generation for Agricultural Disease Diagnosis and Recommendations

Technical Skills

- **Programming Language:** Python, Java, C++
- **Web Development:** HTML5, CSS3, JavaScript, FastAPI, Flask, React, Streamlit
- **Database:** MySQL, MongoDB
- **Deep Learning Frameworks:** TensorFlow, Keras, PyTorch
- **LLM Application Frameworks:** LangChain, LlamaIndex
- **LLM Evaluation Frameworks:** LangSmith, DeepEval, Ragas
- **Cloud Services:** Azure OpenAI, Azure Blob Storage, Azure Container Registry
- **Others:** Docker, CrewAI, Prompt Engineering, OpenCV

Awards & Achievements

5th August, 2023

Poster Presentation

- "**Classification of Potato Disease with Digital Image Processing Technique: A Hybrid Deep Learning Framework**", secured 1st position in **"RESEARCH SYMPOSIUM 2023: AN INTRA-AUST RESEARCH EXHIBITION"** organized by AUST Research and Publication Club. **[Poster Link]**