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, Machine Learning and its applications.

Education

B. Sc. in Computer Science and Engineering *July 2019 – December 2023*
Ahsanullah University of Science and Technology *Dhaka, Bangladesh*
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*
CGPA: *3.302*

Research Experience

Research Assistant *June 2024 – Present*
Supervisor: *Dr. Laith H. Baniata, Research Professor, Gachon University, South Korea*

- 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.
- 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.
- Currently working on the research titled **"Dissecting the Reasoning Capabilities of Vision-Language Models in Medical Visual Question Answering: An Zero-shot Chain-of-Thought Approach"**.

Work Experience

Dexian (Bangladesh) Limited. *May 2024 – Present*
Application Developer (AI/ML) *Dhaka, Bangladesh*

- **Project 1: RFPMatcher**
  - Developed a RAG solution to extract key information from Request for Proposal (RFP) documents
  - Built a system using in-context learning to generate a Past Experience Matcher score for evaluating new RFPs against previous responses
  - Compared bids from previous Requests for Responses using Chain-of-Thought Prompting to systematically predict potential win or loss outcomes for new proposals
  - Generated Tables of Contents based on new Request for Proposal documents to assist in writing proposals for new bids
    Technologies Used: Python, LlamaIndex, Azure OpenAI, AlloyDB, CouchDB, React JS, FastAPI
- **Project 2: Org Info**
  - Implemented a VLM-based agent for extracting hierarchical information from organizational organograms
  - Created a relational database to store organizational hierarchy data
  - Converted natural language queries into SQL using Self-Consistency Prompting and executed them to retrieve relevant data from the database
  - Developed an OrgChart framework to intuitively display hierarchical information based on user-selected organization name and department
  - Built an chat interface enabling users to interact with specific organizational hierarchical information
  - Set up scheduled jobs to fetch organizational data from Bullhorn every 30 days and visualized organizational information in OrgChart
    Technologies Used: Python, LangChain, LangGraph, Azure OpenAI, OpenCV, Azure SQL, React JS, FastAPI

- **Project 3: CaseAligner**
  - Built an LLM-powered application that generates PowerPoint presentations for case studies based on selected practice areas and industries
  - Implemented an interactive chat interface allowing users to query specific slide content and receive instant contextual responses
  - Developed comprehensive search functionality to locate information across all generated case studies
  - Created export capabilities for downloading slides in company's official template
  - Designed an admin panel for authorized users to download and edit the knowledge base of case studies
    Technologies Used: Python, LlamaIndex, Azure OpenAI, React JS, FastAPI
- **Project 4: AgentDexi**
  - Designed an LLM-based multi-agent system to generate customer intelligence by analyzing job demand
  - Developed an RAG solution to identify technological trends in job descriptions across external companies
  - Created interactive graphical charts to help technical recruiters view insights and optimize hiring strategies
    Technologies Used: Python, LangChain, CrewAI, Azure OpenAI, React JS, FastAPI
- **Project 5: KnowledgeEngine**
  - Developed an LLM-based, multi-document RAG Q&A system for internal document information retrieval
  - Implemented a chat conversation interface with document page references for information sources
  - Ensured data security with dedicated knowledge bases for each user session
  - Created an admin panel with document upload functionality and comprehensive document management capabilities
    Technologies Used: Python, LlamaIndex, Azure OpenAI, AlloyDB, React JS, FastAPI

Publications (denotes equal contribution) [Google Scholar]*

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 2025 9th International Conference on Vision, Image and Signal Processing]**
- 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 2025 IEEE 9th International Conference on Software Engineering & Computer Systems (ICSECS)]**

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:2405.073 38 (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:2405.07 332 (2024). **[Under Review in Engineering Journal (Q3)]** **[Preprint]**

Ongoing Research Projects

- MindSpeak-Bangla: A Domain-Specific Dataset for Automatic Chain-of-Thought Adaptation in Mental Health Support for Low-Resource Bengali Language Settings
- BanglaMedQA: A Comprehensive Dataset for Adapting Zero-Shot Chain-of-Thought Reasoning in Bengali Medical Question Answering
- BanglaDialect-Synth: An Approach for Synthetic Corpus Expansion of Bangla Regional Dialects Through Few-Shot Learning with Large Language Models

Technical skills

Programming Languages	Python (NumPy, SciPy, Matplotlib, Pandas, Seaborn), Java, C++
Web Development	HTML5, CSS3, JavaScript, FastAPI, Flask, React, Streamlit
Database	MySQL, MongoDB
Deep Learning Frameworks	TensorFlow, Keras, PyTorch
LLM Application Frameworks	LangChain, LangGraph, LlamaIndex
LLM Evaluation Frameworks	LangSmith, DeepEval
Vector Database:	ChromaDB, FAISS
Cloud Services	Azure OpenAI, Azure SQL Database, Azure App Service
Others	Apache Airflow, Docker, CrewAI, Prompt Engineering, OpenCV

Awards & Achievements

Poster Presentation *5th August 2023*
RESEARCH SYMPOSIUM 2023: AN INTRA-AUST RESEARCH EXHIBITION *Dhaka, Bangladesh*

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