Fatema Tuj Johora Faria

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Research Interests

Large Language Models, Large Vision Models, Computer Vision, Natural Language Processing, Medical Imaging Analysis, Generative Adversarial Networks, Explainable Artificial Intelligence, Machine Learning, Deep 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.*

- Built **Dexian Innovation Insights**, an LLM-based multi-agent recommendation system designed to identify emerging trends within a company's internal projects. The system analyzes previous project data in AI/ML technology and compares it with external data to provide valuable insights that help the company stay ahead of technological trends and assist decision-makers by offering data-driven guidance on project directions and potential areas for innovation.
- Designed **AgentDexi**, an LLMs-based multi-agent system and RAG solution that analyzes job demand across various companies to provide actionable insights. This innovative solution aims to assist technical recruiters in optimizing their hiring strategies by aligning recruitment efforts with current industry trends for better outcomes.
- Developed the **RFPMatcher**, an advanced RAG solution designed to extract key information and summaries from Request for Proposal (RFP) documents using domain-specific multitask prompts. The system evaluates responses to proposals and incorporates a Rubric Score for comparing bids. This functionality aids in determining potential win or loss outcomes.
- Currently working on **KnowledgeEngine**, an LLM-based Multi-Document innovative RAG Q&A system for retrieving early retirement insurance information. It analyzes internal reports and legal guidelines to provide context-aware answers with references. The system uses task-specific prompts to calculate retirement insurance costs, benefits, and tax implications.

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.

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 Phase 2 of an A* Rank Conference]**
- Saidur Rahman Sujon, Ahmadul Karim Chowdhury, **Fatema Tuj Johora Faria**, Mukaffi Bin Moin, and Faisal Muhammad Shah. **"Tackling Hallucination in Bengali NLP: Enhancing Paraphrase Generation, Reading Comprehension, and Formal Application Writing Using LLMs with Few-Shot Learning, Fine-Tuning, and RAG."** **[Under Review in an A* Rank Conference]**

Journals

- **Fatema Tuj Johora Faria**; Laith H. Baniata; Sangwoo Kang. **"Investigating the Predominance of Large Language Models in Low-Resource Bangla Language Over Transformer Models for Hate Speech Detection: A Comparative Analysis."** Preprints 2024, 2024101348. https://doi.org/10.20944/preprints202410.1348.v1 ****Accepted in MDPI Mathematics (Q1)** [Preprint]**
- **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 Neurocomputing (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

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

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
- **Cloud Services:** Azure OpenAI, Azure Blob Storage, Azure Container Registry
- **Others:** LangChain, LlamaIndex, Vector Database, 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]**