

Sabbir Hossain Ujjal

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Education

University of Massachusetts Amherst 

PhD in Electrical and Computer Engineering

Amherst, MA, USA

September 2026 - Present

Bangladesh University of Engineering and Technology (BUET) 

BSc in Electrical and Electronic Engineering (EEE)

Dhaka, Bangladesh

March 2018 - May 2023

Major in Communication & Signal Processing (CSP)

CGPA - 3.75/4.00 | 2x Dean's List Award | 3x Merit Stipend

Research Interest

Natural Language Processing | Multimodal Large Language Model | Robust & Trustworthy AI

Research Experience

Listen to the Layers: Mitigating Hallucinations with Inter-Layer Disagreement Sept 2025 – Aug 2026

- Proposed CoCoA, a training-free decoding strategy that mitigates LLM hallucinations by **detecting inter-layer disagreement in model's internal representations**, demonstrating improved factual correctness across multiple model families (Llama-3, Qwen-2.5, Mistral) and tasks (QA, summarization, code generation).

Enhancing Open-Source LLM Agents for Robotic System Control via MetaTool Framework

[Manuscript under review]

April 2023 - Aug 2025

- Designed an enhanced ROSA-based robotic control architecture integrating a novel **"MetaTool"** mechanism that improved task completion rates for open-source LLMs on complex sequential reasoning tasks. The MetaTool utilizes ReAct architecture and forces structured pseudo-code planning before execution, reducing looping behaviors and improves overall performance. The proposed methods were validated on a custom-built mobile robot platform with multimodal perception, navigation, and facial expression capabilities and the task completion rate is around 90-95% (5-10% point improvement compared to baseline).

Development of a Voice-Controlled Multilingual Conversational Agent Using Deep Learning and Natural Language Processing [\[Poster\]](#)

May 2022 - May 2023

- Developed a task-oriented virtual assistant that handles both Bengali and English commands integrating wav2vec2-based ASR, **BERT-LaBSE** based NER, and RASA based dialogue management system. Our designed system achieved 93% user intent recognition and 99.4% task completion accuracy, making voice technology more accessible for Bengali speakers.

Publications

- Listen to the Layers: Mitigating Hallucinations with Inter-Layer Disagreement.**
K Subbalakshmi, **SH Ujjal**, VKT Mangichetty, NJ Soofi, [arXiv:2602.09486](#) (2026)
- mTOVA: A Multilingual Task Oriented Virtual Assistant for Human-Computer Communication**
S. H. Ujjal, A. F. M. M. Kabir and M. A. Haque, IEEE ICTP-2023, DOI: [10.1109/ICTP60248.2023.10490454](#)

Work Experience

Advanced Chemical Industries (ACI) Limited 

Dhaka, Bangladesh

Machine Learning Engineer (Team Lead)

Aug 2024 - Aug 2025

Led a cross-functional team of **16** talented machine learning engineers in developing and deploying machine learning solutions that serve our internal businesses.

Selected Projects:

- ACI HR Agent Hub:** Designed a Multi-Agent System (MAS) with multi-step reasoning for end-to-end HR automation, integrating document parsing, resume understanding, LLM-powered dynamic candidate testing, generating structured job descriptions, and personalized management development plan creation to guide employee career growth.
- Prescription OCR:** Developed a two-stage OCR framework to address the challenge of deciphering unconstrained handwritten medical text. Trained **YOLO** for precise ROI segmentation and **TrOCR** for text detection, for information extraction from complex prescription layouts.[\[Demo Video\]](#)
- ACI Insight Explorer:** Implemented an LLM-based **agentic system** utilizing **AutoGen** to understand and analyze complex tabular data. This system generates actionable business insights while maintaining security of data.

Selected Projects:

- **Virtual Assistant:** Developed a bilingual (Bengali/English) virtual assistant using a Whisper-based **ASR**, novel **RAG** architecture with a Qdrant vector database, and **TTS** and integrated with **Langchain** to automate and accurately resolve customer inquiries and reducing average response time from 2.2 minutes to under 45 seconds [[Demo Video](#)]
- **ACI SpeechHub:** Developed a comprehensive voice-based system (ACI SpeechHub) by fine-tuning Whisper, T5, and BERT for automated audio transcription, summarization, and keyword extraction. [[Demo Video](#)].
- **Voice-Based Ordering System:** Streamlined sales operations for 3,000 representatives by engineering a voice-based ordering system utilizing ACI SpeechHub system that cut order processing time by **50%**.

AIEdgeInside – AI Startup

Tokyo, Japan [Remote]

Machine Learning Engineer

Aug 2023 - Oct 2023

- Experimented and developed computer vision solutions for business process automation, such as a **document error detection**, **detecting empty cells in documents**, etc. Experimented with diffusion-based video frame generation system with ControlNet for enhanced frame consistency.

Competitions & Achievements

- **2nd Runner-up**, The 2nd iCNS/ECE Symposium on AI Research and Innovations poster presentation. 2025
- **Champion, Robi Datathon 3** Bangladesh's largest data science competition [[Media](#)] [[Presentation](#)] 2024
- **1st Runner-up**, IUT National ICT Fest 2024 Datathon [[Leaderboard](#)] [[Presentation](#)] 2024
- **2nd Runner-up**, 2nd AVA Challenge@IEEE MIPR 2024 [[Leaderboard](#)] [[Presentation](#)] 2024
- **Bronze Medalist** [Global: 59th — National: 4th], Bengali.AI Speech Recognition [[Leaderboard](#)] 2023
- **RISE Student Research Grant Award** 2023

Open Source Contributions

- **Awesome Bangla Datasets** [[Repository](#)] - Established the first centralized repository for Bengali language datasets, enabling accessible data resources for Bengali deep learning research and development.
- **banglanlp toolkit** [[PyPi Package](#)] [[≈ 61,000 downloads](#)] - A comprehensive Bengali NLP toolkit, featuring text normalization, tokenization, punctuation generation, and text augmentation capabilities.
- **faster-translate** [[PyPi Package](#)] [[≈ 15,000 downloads](#)] - A fast and efficient Bengali translation tool using ctranslate2 & vLLM, enabling rapid text translation with pre-trained translation models.

Selected Coursework Projects

- **PsycheCompass: An Adaptive Multi-Agent system for Mental Health Assessment & Therapeutic Support:** Proposed and developed a multi-agent collaborative system for structured mental health assessment and clinically aligned therapeutic support. The system integrates PHQ-8 clinical protocols, safety guidelines, and multi-dimensional evaluation frameworks. Our proposed method achieved competitive performance on mental health assessment and therapeutic quality (Overall: 4.64/5.0) across standardized benchmarks, demonstrating the effectiveness of agentic workflows in mental-health domains.
- **AI Generated Text Detection** [[Project Page](#)] - Developed a hybrid AI-generated text detection system that **fuses** deep learning and machine learning architectures, combining **DeBERTa-based** feature extraction with linguistic feature engineering for enhanced classification. The proposed system achieved an F1 score of 96.93% on out-of-distribution (**OOD**) data testing.
- **Bengali Name Extractor** [[Project Page](#)] [[Code](#)] - Implemented a robust NLP-based system using **BanglaBERT** for accurate person name extraction from Bengali text, addressing the unique challenges of Bengali named entity recognition. The model achieved an F1 score of 81.1% in identifying and extracting person names from unstructured Bengali content.
- **Bengali Punctuation Restoration** [[Code](#)] - Developed an automated punctuation restoration system for Bengali text using transformer-based token classification (XLM-RoBERTa + BiLSTM). The model achieved a 96.45% F1 score across 8 punctuation types, demonstrating strong performance on text normalization.

Technical Skills

- **Programming Languages:** Python, C, C++, MATLAB
- **Frameworks:** PyTorch, TensorFlow, Keras, RASA, Langchain, LlamaIndex, AutoGen, ROS
- **DevOps Services:** Git, GitHub, Bash, RESTapi, FastAPI, Flask, Uvicorn, Qdrant, Weaviate
- **Embedded Systems:** Verilog, STM32, Arduino