

Research Statement

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Introduction

I am a computer science graduate, currently working as an NLP engineer in a software company called Verbex AI. Here, we do extensive research and develop voice-based AI solutions driven by the motto, "*making technology accessible to all.*" As of today, according to UNESCO, around 739 million people remain digitally illiterate. We aim to bridging this gap and try to make sure that everyone can get benefited from technology, especially in underserved communities.

Previous Research Experience

My undergraduate thesis was focused on object detection titled "*Plant Disease Detection Based on YOLOv3 and YOLOv4.*" As Bangladesh is an agricultural country, every year our farmers incur a significant amount of economic loss due to plant diseases. We can reduce this loss remarkably if we can detect these diseases early and by providing farmers with economical expert knowledge. So it was an attempt to address this problem with the computer vision approach and provide a faster and more accurate plant disease detection model with 30 different classes. This work resulted in a peer-reviewed IEEE conference publication on the topic in 2021.

Over the last year, we worked extensively on analyzing and optimizing language models, as well as setting the framework for the first major pretrained Bangla LLMs in my current organization. While doing that, our most challenging task was to collect enough quality data from different sources, and it seemed there was not enough (still lacking) over the internet. We needed to use different translation methods to translate data from various sources. But traditional translation models like, *GPT*, *Gemini*, *IndicTrans*, etc., were not capable enough to capture the semantic meaning and Bengali grammatical structure from the text properly. It led to the development of a new translation method that would enable us to translate data from different sources while maintaining the semantic meaning of the sentence. Here, among other contributions, I contributed significantly to the development of a new translation mechanism called *EST (Expressive Semantic Translation)* using LLMs, where our system outperformed commercial models (e.g., GPT-4o, Gemini-1.5, and IndicTrans2) in terms of semantic fidelity of translations. Our collaborative efforts in this work, along with my amazing teammates, culminated in a peer-reviewed paper titled "*TituLLMs: A Family of Bangla LLMs with Comprehensive Benchmarking (Findings of ACL 2025).*"

Current Research

One of the major issues of an AI-based voice agent to properly detect exactly when the user finishes speaking so that our agent can start responding and replying back to the user. Already, different attempts have been made by many companies and the open-source community to tackle this problem. But none of these models works well on Bengali conversational data. Currently, I am working on building a Bengali *turn detection model*. We are using real-life conversational data, data generated synthetically, and data collected from different available sources so that our final dataset will maintain both the quality and the diversity. Different LLM-based training mechanisms

are also being explored to tackle this problem more efficiently. Right now, this stands as one of the main hurdles in offering a sophisticated AI-based voice agent with a seamless and natural experience in the Bengali language. But I am confident that we will be able to overcome this challenge soon.

Future Goals

In the long term, I want to build my career in academia. I am driven to contribute positively to society and enhance people's lives through my contributions. I want to have my own research lab someday where I will be fostering a collaborative environment so that young researchers can learn, innovate, and grow together. I see research as a journey of discovery. It is guided by curiosity and driven by the desire to understand. My aim is to create a space where ideas can thrive and become beneficial to society.