SpeakMySign: An ISL-to-Speech Translator Using Machine Learning and Large Language Models

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*Abstract*— Communication is crucial in our day-to-day lives. It is the basis for all human interactions. The communication gap between the hearing and speech-impaired populations especially is a very large and extremely populated country like India continues to be a major obstacle. Such a person would use sign language to communicate, but sign language is not known by everyone. To bridge this communication gap a translation system is required and SpeakMySign offers to do the same. SpeakMySign is an end-to-end translation system that converts Indian Sign Language (ISL) to English, Hindi and Kannada speech based on a mix of computer vision, deep learning, and language models.

Keywords— Indian Sign Language (ISL), Sign Language Translation, Speech Synthesis, Computer Vision, Deep Learning, Human-Computer Interaction, Multilingual Communication, Accessibility Technology.

# Introduction

In recent years, the global community has made strides in promoting inclusivity for individuals with disabilities, particularly those with hearing and speech impairments. Indian Sign Language (ISL) serves as the primary mode of communication for millions of people in India, yet the lack of effective communication between ISL users and non-ISL speakers remains a significant challenge. The barriers in communication not only impede social interaction but also hinder access to essential services such as education, healthcare, and employment.

This paper proposes the development of an AI-powered system aimed at bridging the communication gap between ISL users and non-ISL speakers. The system leverages advanced computer vision models to recognize ISL gestures, which are then translated into text using fine-tuned large language models (LLMs) that are specifically designed to understand the grammar and syntax of ISL. To enhance the accuracy and contextual understanding of the translation, we integrate Retrieval-Augmented Generation (RAG), a technique that improves the quality of responses by leveraging external information, thus refining the sentence structure and capturing the nuances of sign language.

The output text is then converted into natural-sounding speech through the use of text-to-speech (TTS) models, facilitating real-time communication for ISL users in various contexts such as education, healthcare, workplaces, and public services. This innovative system aims to offer a more adaptive and context-aware translation solution compared to traditional ISL translation systems, ensuring that diverse scenarios are accurately interpreted and conveyed.

By incorporating state-of-the-art AI techniques, this project aims to empower individuals with hearing impairments, providing them with an accessible and inclusive tool for seamless communication with the broader society. The successful implementation of this system promises to enhance the quality of life for ISL users, promoting greater inclusivity and breaking down communication barriers in a variety of settings.

# Literature Survey

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*a**b* 

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