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A Dual-Channel Communication System Using Emotion-Aware TTS and ISL Mapping

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Abstract: *In this paper, we propose an innovative accessibility system that enhances communication for individuals with hearing impairments by enabling emotion-aware text-to-speech conversion. The system employs a machine learning–based classifier (specifically, a support vector machine using TF-IDF text embeddings) to analyze the sentiment of input text and adjust speech synthesis parameters (such as rate, volume, and pitch) accordingly. This ensures that the generated speech conveys the underlying emotion of the text (e.g. happiness, sadness, anger). Additionally, the system includes a text-to-Indian Sign Language (ISL) translation module that converts textual input into a sequence of static ISL sign images, each corresponding to an alphabet letter, rendered in a distinctive "Ghibli" animation style. The implementation uses the Flask web framework and the pyttsx3 speech engine to integrate these components into a web application with accessible audio playback controls and sign sequence display. Experimental evaluation demonstrates that our approach achieves high emotion recognition accuracy (≈85%) and produces clear, emotionally expressive speech, while reliably generating the corresponding sign sequences. These findings highlight the potential of combining machine learning and multimedia techniques to develop more inclusive communication tools for people with disabilities.*

Keywords: accessibility, emotion detection, Indian Sign Language, machine learning, text-to-speech

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