Speech to Sign Language Translation for Indian Languages

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Abstract-- **Hearing-impaired people and mute people face a lot of difficulty in communication while interacting with others in society. It may reduce their self-confidence and might make them feel isolated from others. Sign language acts as a communication medium between deaf people and ordinary people. Many technologies are used to convert the text to American Sign Language. There is a limited amount of research done on Indian Sign Language and is widely used by deaf people in India. This research aims at conversion of speech to Indian sign language for six Indian regional languages Telugu, Hindi, Malayalam, Marathi, Kannada and Tamil. The proposed model takes speech as the input and displays a sequence of corresponding gestures as the output. It involves speech recognition using Wavelet-based MFCC with GMM, text translation using LSTM and mapping the text with the sign language.**

Keywords— Sign Language, Speech Recognition, Text Translation, Gaussian Mixture Model, Expectation-Maximization, Long Short Term Memory, Indian Sign Language, Speech to Sign language.

I. INTRODUCTION

Sign Language involves visual gestures and signs, which deaf people and mute people use. It involves manual and non-manual signals, where manual signs involve fingers, hands, arms, and non-manual signs involve the face, head, eyes, and body. There are 18 million hearing-impaired in India; four in every 1000 children suffer from severe to profound hearing loss. Many firms are constantly searching for skilled and talented individuals, but the people who cannot talk and hear happen to lose many job opportunities. Deaf and mute people feel ostracized as they cannot communicate with ordinary people. It is challenging for ordinary people to communicate with deaf and mute people as they are unfamiliar with sign language. There are many sign languages in the world where each country has its sign language, such as American Sign Language (ASL) [1], Japanese Sign Language (JSL) [2], Indian Sign Language (ISL), Arabic Sign Language [3], Etc. American Sign Language uses one hand, whereas Indian Sign Language involves using both hands. Furthermore, Japanese sign language considers mouthing along with hand signs, while Arabic sign language is still developing. But, in India, ISL is more widely used than any other sign language. Many systems are built on ASL, but only a few are developed using ISL. Some ISL systems convert the sign language to speech, but no system converts the regional speech to Sign Language [4].

Much research has been conducted in the field of continuous Speech Recognition of Indian languages such as Telugu [5], [6], Tamil [7], [8], Kannada [9], Marathi [10], Malayalam [11], Hindi [12], Etc. Along with speech recognition, text translation has also been a field of research that has been active for an extended period. Many papers are present on Text Translation for various languages, such as Telugu [13], Marathi [14], Malayalam [15], Hindi [16], Etc. to English text. Some systems translate regional text into Indian sign language using LSTM models, while others convert regional speech to text by MFCC with HMM, Naïve Bayes, etc. However, no system directly translates regional speech to Indian Sign Language. This work builds a system that can convert the speech to ISL for six Indian regional languages such as Telugu, Hindi, Tamil, Malayalam, Kannada, and Marathi. It is implemented using wavelet-based Mel-Frequency Cepstral Coefficients(MFCC) with Gaussian Mixture Model(GMM) for Speech Recognition, Encoder-Decoder based Long Short Term Memory(LSTM) for Text Translation, and Indian Sign Language (ISL) generation. Research shows that Gaussian models outperform in recognition applications [17], [18].

The paper is divided into six sections. Section I gives a brief introduction to Indian Sign Language. Section II describes the related works in Speech Recognition and Text Translation. Section III gives a brief description of the proposed approach. Section IV shows the evaluation and