

Sign Language Recognition and Response via Virtual Reality

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Abstract- The main objective of this project is to use a prototype Unity and Python system to give voiceless people a voice. The previously mentioned work focuses on the issue of real-time gesture recognition using sign language among the deaf community. Using colour segmentation, skin detection, image segmentation, image filtering, and template matching techniques, digital image processing is the basis of the problem being addressed. This system can identify the alphabet and a portion of the vocabulary in Indian Sign Language (ISL) through gestures.

Keywords- Indian Sign Language(ISL), gesture recognition, real-time processing, digital image processing, Unity, Python, skin detection, color segmentation, template matching, voiceless communication

I. INTRODUCTION

In our day-to-day life, communication plays an important role in conveying information from one person to another. But it becomes very difficult for people who are deaf and dumb to communicate with normal people. Sign language is the only way to communicate with them. But normal people are unaware of sign language. So there is only one way: to convert sign language into text, speech, and vice versa. That is known as sign recognition. Sign language is a combination of body language, hand gestures, and facial expressions. Among those, hand gestures provide the majority of the information, and hence, the majority of the research is focused on decoding hand gestures. Normal people can communicate their thoughts and ideas to others through speech. The only means of communication for the hearing-impaired community is the use of sign language. The hearing impaired community has developed its own culture and methods to communicate with each other and with

spoken language, but serving the same function. It is often very difficult for the hearing-impaired community to communicate their ideas and creativity to normal humans. This system was inspired by a special group of people who have difficulties communicating in verbal form. It is designed with ease of use for deaf or hearing-impaired people. The use of sign language is not only limited to individuals with impaired hearing or speech to communicate with each other or non-sign-language speakers, but it is often considered a prominent medium of communication. Instead of acoustically conveyed sound patterns, sign language uses manual communication to convey meaning. It combines hand gestures and facial expressions with movements of other body parts, such as eyes, legs, etc. This project proposes a system for recognizing signs used in ASL and interpreting them. American Sign Language (ASL) is a natural language that serves as the predominant sign language of deaf communities. Each sign in ASL is composed of many distinctive components, generally referred to as parameters.

Ordinary people use sign gestures. Instead of conveying their thoughts and ideas acoustically, they convey them through sign patterns. Sign gestures are a non-verbal visual language, different from the

II. LITERATURE SURVEY

Title: Sign Language Recognition for Static and Dynamic Gestures

Author: Jay Suthar, Devansh Parikh, Tanya Sharma
Year: 2021

Description: Humans are called social animals, which makes communication a very important part of human life. Humans use signs and non-verbal forms of language for communication purposes, but not all humans can give oral speech. Hearing-impaired and mute people. Sign language became consequently advanced for them and, nevertheless, impairs communication. Therefore, this paper proposes a system that uses streams to use CNN networks for the classification of alphabets and numbers. Alphabet and number gestures are static gestures in Indian sign language, and CNN is used because it provides very good results for Image classification. Use hand-masked (skin segmented) images for model training. For dynamic hand gestures, the system uses the LSTM network for classification tasks. LSTMs are known for their accurate prediction of time zone distributed data.

Title: Hand Gesture Recognition for Human Computer Interaction

Author: ArchanasriSubramaniana
Year: 2022

Description: A Natural, modern, and innovative way of non-verbal communication can be achieved by using a hand gesture recognition system. The main aim of this paper is to discuss the novel approach of hand gesture recognition, which is based on detecting the features of the shapes. The system setup comprises a camera that is used to capture the gesture given by the user and take the image formed as the input to the proposed algorithm. The algorithm is divided into four steps, and they are segmentation, orientation detection, feature extraction, and classification. This algorithm need not have any trained sample data as it is independent of user characteristics. 390 images have been tested using the proposed algorithm, and the rate of recognition produced is about 92 percent, and the average elapsed time is approximately 2.76 seconds. The computation time taken by this

algorithm is less when compared with other approaches.

Title: Real-Time Vernacular Sign Language Recognition Using Media Pipe and Machine Learning

Author: Arpita Haldera, Akshit Tayadeb
Year: 2021

Description: The deaf-mute community has undeniable communication problems in their daily life. Recent developments in artificial intelligence tear down this communication barrier. The main purpose of this paper is to demonstrate a methodology that simplifies Sign Language Recognition using Media Pipe's open source framework and machine learning algorithm. The predictive model is lightweight and adaptable to smart devices. Multiple sign language datasets, such as American, Indian, Italian, and Turkey, are used for training purposes to analyze the capability of the framework. With an average accuracy of 99%, the proposed model is efficient, precise, and robust. Real-time, accurate detection using the Support Vector Machine (SVM) algorithm without any wearable sensors makes use of this technology more comfortable and easier.

III. DESIRED OUTCOME

The development of a system that enables two-way communication between individuals who use American Sign Language (ASL) and those who do not understand sign language is essential. This system aims to bridge the communication gap between the deaf and hearing communities, allowing for more effective and natural interaction. The system should be capable of recognizing and interpreting ASL gestures in real-time and converting them into text or speech that is understandable to non-sign language speakers. Conversely, it should also be able to convert text or speech input into corresponding ASL gestures for those who are deaf or hard of hearing. The proposed system should integrate advanced computer vision and machine learning techniques to accurately detect, track, and classify ASL gestures. It should be designed to work in a VR environment, providing an immersive experience that facilitates the learning and practice of sign

language. The system should be capable of handling complex sentences and be able to recognize and interpret gestures that are not pre-programmed into the system, demonstrating the ability to recognize new or unseen gestures through a combination of word element recombination and the use of AI.

IV. METHODOLOGY

1. Digital Image Processing Techniques

The system utilizes digital image processing techniques such as color segmentation, skin detection, image segmentation, image filtering, and template matching to recognize sign language gestures in real-time. These techniques are crucial for accurately identifying and interpreting sign language gestures captured through a camera.

2. Gesture Recognition and Classification

The system employs machine learning algorithms, specifically a random forest classifier, to recognize and classify sign language gestures. This involves analyzing features extracted from the sign language gestures to match them with a database of known gestures. The system is designed to recognize gestures of Indian Sign Language (ISL), including the alphabet and a subset of its words.

3. Two-Way Communication Interface

The system provides a two-way communication interface, allowing for both sign language-to-text conversion and text-to-sign language conversion. This is achieved by mapping.

Natural language input to equivalent sign language gestures and vice versa. The system uses APIs like Google Text-to-Speech (TTS) and Google Speech-to-Text (STT) to facilitate this conversion process.

4. Integration of Computer Vision and Machine Learning

The system integrates computer vision algorithms for detecting and tracking sign language gestures with machine learning algorithms for classifying these gestures. This integration is essential for accurately recognizing and interpreting sign language gestures in real-time. The system uses convolutional neural networks (CNN) models for

prediction, demonstrating high accuracy in sign language recognition and sentence-level understanding.

5. Virtual Reality (VR) Interface:

The system incorporates a VR interface for displaying sign recognition results and facilitating direct typing by non-signers. This VR interface allows for a more immersive and interactive experience, making it easier for individuals who do not use sign language to communicate with sign language users. The VR space also enables two-way remote communication, linking the AI front end for sign language recognition with the VR interface for a comprehensive communication solution.

V. RESULT

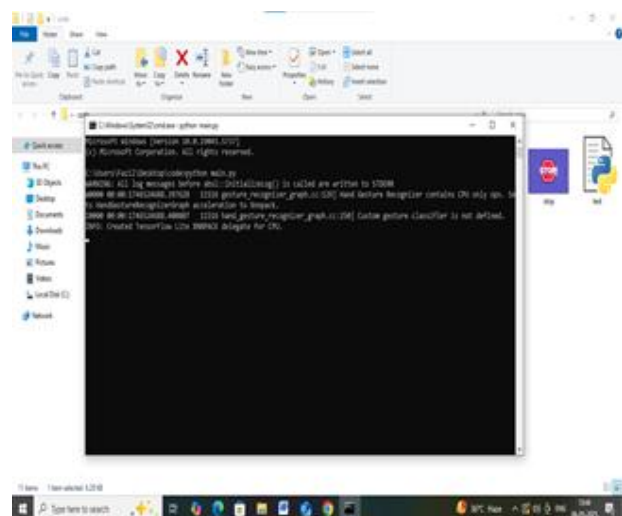


Fig. 1: Initializing the server

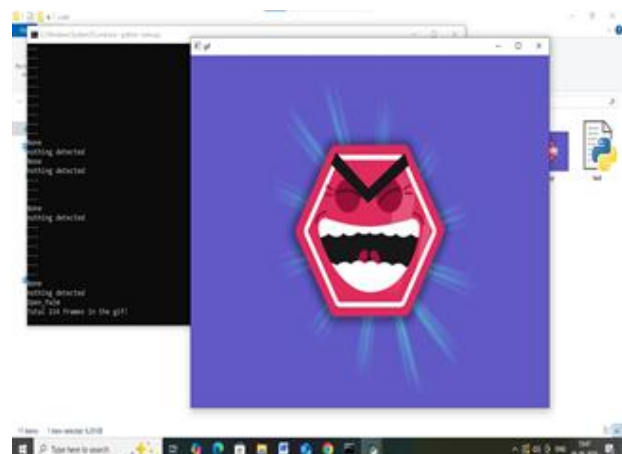


Fig 2: Stop

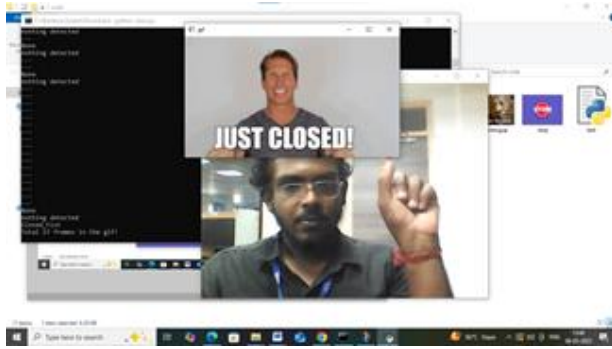


Fig 3:Closed

VI. CONCLUSION

The deaf and dumb are not sitting in the house as past, they are working outside and doing great. So an efficient system must be set up to interact with them. Sign language is very popular among them, and hand gesture recognition is just a small part of it. The proposed system aims to bridge the communication gap between two strata of society. A considerable amount of work has been done previously in this domain, but this paper adds a complete two-way communication efficiently because the system will be implemented as a handy mobile application. So, it truly serves its needs in all aspects. The above-specified strategies prove efficient in terms of time and accuracy. Further enhancements can be made in terms of implementing the communicator with other sign languages like Indian Sign Language.

Language, accent recognition for various accents throughout the globe, emotion recognition in sign language, and language translation. The proposed system fulfills the hand gesture recognition process, but with some limitations, as both hands cannot be used with this technique, and the results are not that efficient. Proper light conditions help in the easy detection of the region of interest. The system can be further expanded for the alphabet. Like numbers, each alphabet has its unique gesture.

Thus, detection and recognition would be efficient using this technique. Not only this, but the input can be taken in the form of videos. The videos can then be divided into frames. From those frames, the necessary hand region could be extracted using a

bounding box and then following the same procedure as mentioned in the proposed framework. Every language has its grammar. Sign language has it as well. By recognizing the frame images and using a proper parsing algorithm, a grammatical structure could be formed. This would take the system of hand gesture recognition a step ahead. This system can be made handy by incorporating it into a mobile phone. With just a click, the image is captured and the corresponding result is obtained. Thus, a more efficient way of interaction could be achieved. The system can be further expanded for the alphabet and numbers in gesture control. The input can also be taken in the form of videos, and the videos are divided into frames, and the frames can be converted into text. We can also add grammatical structure for sign language. The system can be made handy by incorporating it into a mobile phone.

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