International Journal of Interdisciplinary Innovative Research &Development (IJIIRD)
ISSN: 2456-236X
Vol. **08** Special Issue **01** | **2023**

Sign Language Recognition System for Deaf and Mute People

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ABSTRACT

This Sign Language Recognition System for Mute and Deaf People is an avant grade technology that intents to serve the communication bridge between Mute and Deaf Peoples and the one who hear. This framework uses machine learning algorithms and computer vision techniques to recognize and construe sign language gestures instaneously. Facilitating their formation and participation in society and persist to research development. The convolution Neural Network(CNNs)model is also trained onthe pre-process data and weed on the test to extent its performance to this system construction we are using the OpenCV, keras,uuid and Mediapipe libraries in python, and it can be drawn out to solemnization signs from other sign languages. .In the above review paper we a team of four students under the guidance of our project guide are just giving rough improvement and adding some automation with machine learning and computer vision through which we are attempting to create the Indian Sign Language Detection algorithm through neural network. The main aim of this project is to create a simple, easy and ready to use application that predicts the symbol shown by the user in front of camera and the machine learning model in the backend predicts the output and shows it live on the screen.

Keyword: - Communication, Sign Language, Machine Learning, Convolution Neural Network (CNNs)

1. INTRODUCTION

The Sign Language Recognition System is evolving technologies that have the potential to transform the way deaf and mute peoples communicate with the auditory perception. This research paper aims to study the development, implementation, and impact of sign language recognition systems regarding the lives of people with hearing and speech handicap. Sign language detection technology intent to understand and recognize sign language gestures using various methods, such as computer vision-based approaches. This technology has the probable to enable Communication between listening reduce peoples and the broader society, including in settings such as healthcare, education, and social interactions. One leading challenge in sign language detection is the deep variety of sign languages that continue around the world. The larger population of society does not understand sign language. The speech, and hearing disabled usuallydepend on thehuman translator.

The availability and affordability of using a human especially might not be possible all the time. The best replacement would be an automated translator system that can read and interpret sign language and convert it into an easy form. This translator would reduce the communication gap that exists among people in society. The SLR should be trained with many sign language data and its grammar for a flowing and uninterrupted sign language conversion. Each gesture created so much has a specific meaning and an application. SLR can be considered as a modified HC model, where the system can read and process thehands' movement.

2. LITERATURE SURVEY

Jaiswal.et.al[1] This paper represents, the various challenges in sign language recognition, such as the high degree of variability in signs, the need to detect and track multiple body parts, and the need to account for different signing styles and regional variations. They then provide an overview of the various techniques used for sign language recognition, including computer vision-based approaches, sensor-based approaches, and data-driven approaches. Computer vision-based approaches use cameras to capture sign language gestures and use image and video processing techniques to recognize them. Sensor-based approaches use devices such as gloves or accelerometers to capture motion data and recognize signs based on the captured data. Data-driven approaches use machine learning algorithms torecognize signs based on large datasets of sign language videos and annotations.

Koller.et.al[2] The paper presents a method for recognizing human actions in still images. The proposed method combines information about the gestures of the people in the image with contextual information about the scene in which the action is taking place. The authors argue that this combination of gesture and scene context can improve the recognition accuracy of the system. The method proposed in the paper involves first detecting people in the image and extracting their body parts. Then, the gestures of the people are classified using a set of predefined gesture models.

G. Aliskan.et.al[3] The paper "Sign Language Recognition Using a Deep Neural Network" by G. Aliskan and R.M. Haralick presents a deep neural network-based approach for sign language recognition. The paper addresses the challenges of recognizing sign language gestures, which can be highly complex and variable. The proposed approach uses a convolutional neural network (CNN) to extract features from video frames of sign language gestures. The CNN consists of multiple convolutional layers followed by pooling layers, which help to reduce the dimensionalityof the feature maps.

Nakul Nagpal.et.al[4] The proposed communication aid uses a combination of speech recognition and sign language recognition to enable communication between the deaf and dumb person and the hearing person. The system consists of a mobile application that can be installed on a smartphone and a wearable device worn by the deaf and dumb person. The wearable device captures the sign language gestures made by the deaf and dumb person and sends them to the mobile application. The mobile application then uses speech recognition to convert the sign language gestures into spoken words. The spoken words are then played back to the hearing person via the smartphone's speaker.

Neelam K. Gilorkar.et.al[5] The proposed system consists of two main components: hand gesture detection and gesture recognition. The hand gesture detection component uses the SIFT feature extraction technique to identify hand keypoints in the image. These keypoints are then used to extract the hand gesture from the image.

Cruz Sanchez.et.al[6] This paper describes a project which involved a community of practice of five higher-education foreign language teachers at four different universities in three countries. The project had two main goals. Firstly, to broaden teaching practices in order to meet students' needs and to help students become effective social agents. Secondly, to explore new ways of applying the innovative mediation construct that the CEFR Companion Volume offers to language learning.

2.1 Problem Statement

This project is based on Dumb people use hand signs to communicate, hence normal people face problem in recognizing their language by signs made. Hence there is a need of the systems which recognizes the different signs and conveys the information to the normal people. This can be very helpful for the deaf and dumb people in communicating with others as knowing sign language is not something that is common to all, moreover, this can be extended to creating automatic editors, where the person can easily write byjust their hand gestures.

2.2 Aim and Objective:

The aim of a sign language recognition system project is to develop a technology that can accurately interpret and translate sign language into written or spoken language. The primary objective is to create a system that can facilitate communication between sign language users and non-sign language users, thereby increasing accessibility for the deaf and hard of hearing community. The primary objective of the project is to develop a system that can accurately recognize and interpret sign language. The system should be able to detect and interpret different types of signs and gestures, and translate them into written or spoken language. The system should be able to recognize and interpret sign language in real-time, enabling smooth and efficient communication between sign language users and non-sign language users.

3. PROPOSED SYSTEM

The proposed sign language recognition system project involves developing a computer-based system that can recognize and interpret sign language in real-time. The system will consist of two main components: a gesture recognition module and a translation module. The gesture recognition module will use computer vision techniques such as image processing and machine learning to recognize and interpret sign language gestures. The module will capture video input from a camera or webcam and analyze the video frames to detect the location and movement of the user's hands and fingers. The system will consist of a CNN-based gesture recognition module and a translation module. The gesture recognition module will use a deep learning architecture that is specifically designed for image recognition tasks, such as a CNN, to detect and recognize sign language gestures from video input. The input to the gesture recognition module will be a sequence of images that capture the movement of the user's hands and fingers. The module will analyze the image sequence using a series of convolutional layers to extract features that represent the movement and shape of the user'shands and fingers.

These features will then be fed into a fully connected neural network to recognize the sign language gesture. The translation module will use natural language processing techniques to translate the recognized sign language gesture into written or spoken language.

The system will also include a user-friendly interface that allows users to select their preferred sign language and spoken language. The interface will display recognized gestures in real-time and provide a translated text or speech output. The proposed system will be trained on a large dataset of sign language gestures to ensure its accuracy and reliability. The system will be designed to be robust and able to recognize sign language gestures accurately in different lighting conditions and environments.The proposed system using CNNs will provide an efficient and reliable means of communication between sign language users andnon-sign language users, increasing accessibilityfor the deaf andhard of hearing community.

4. SYSTEM ARCHITECTURE:

Developing a sign language recognition system using convolutional neural network (CNN) architecture can be a challenging but rewarding project. Here is an outline of the steps involved in building such a system:

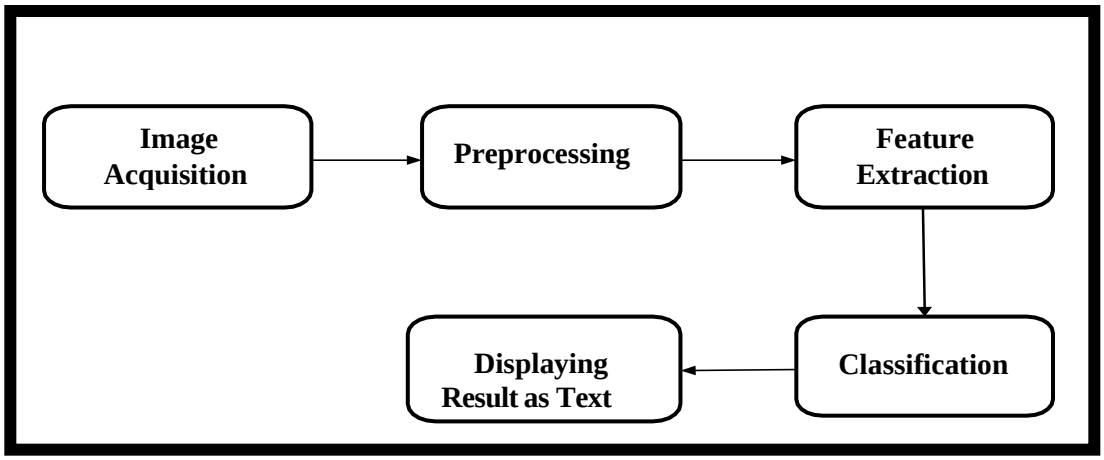

Fig -4.1: System Architecture Diagram for Sign Language Recognition System.

- ✓ **Dataset collection:** The first step is to collect a dataset of sign language images and their corresponding labels. This dataset can be obtained from online resources, or you may need to create your own dataset by capturing images of sign language gestures.
- ✓ **Data preprocessing:** The collected dataset needs to be preprocessed before it can be used to train a CNN model. This includes resizing the images, normalizing pixel values, and splitting the dataset into training, validation, and testing sets.
- ✓ **Model building:** The next step is to build a CNN model architecture that can learn to recognize sign language gestures. This involves designing the layers of the CNN, including the convolutional layers, pooling layers, and fully connected layers. You may also need to experiment with different hyper parameters to optimize the model's performance.
- ✓ **Model evaluation:** After training the model, you need to evaluate its performance on a test set. This involves measuring the model's accuracy, precision, recall, and F1 score. You may also need to perform additional analysis toidentifythe model's strengths and weaknesses.
- ✓ **Deployment:** Finally, you can deploy the trained model as a sign language recognition system that can be used in real-world applications. This may involve integrating the model with a user interface, such as a web application or mobile app, users to input sign language gestures and receive corresponding text or audio output.

5. IMPLEMENTATION

The stages involved in vision-based sign language recognition (SLR) can be categorized into five stages:

Image acquisition, image pre-processing, feature extraction, and classification. Image acquisition is the first stage in sign language recognition that can be acquired through self-created or available public datasets. The second stage is preprocessing to eliminate unwanted noise and enhanced the quality of the image. Next, after preprocessing step is to segment and extract the region of interest from the entire image. The fourth stage is feature extraction, which transforms the input image region into feature vectors for recognition. The last stage in vision-based SLR is classification, which involves matching the features of the new sign image with the stored features in the database for recognition of the given sign.

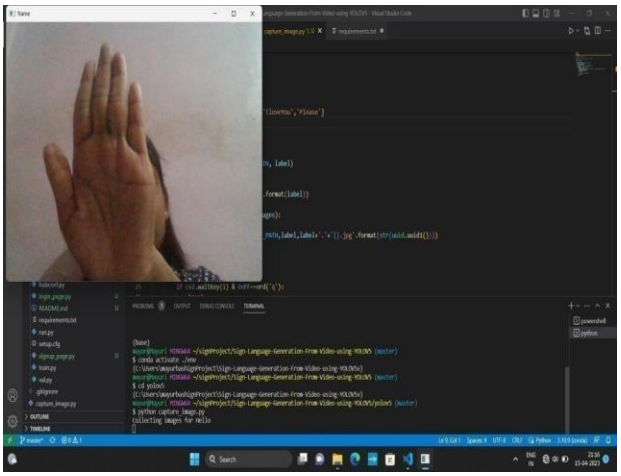

Fig 5.1- System captured Image

Fig 5.2- System Captured Gesture

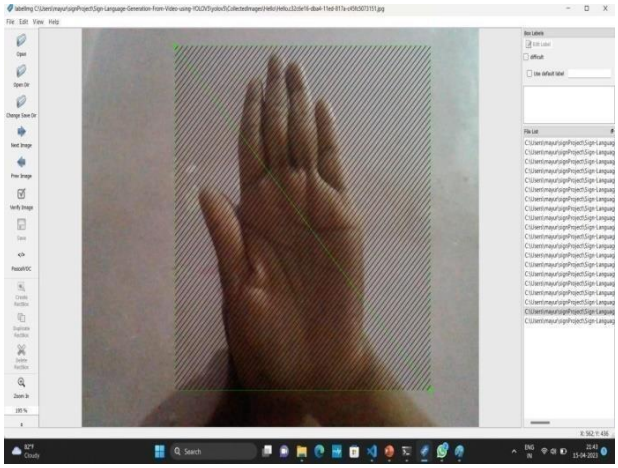

Fig 5.3- Extract Gesture

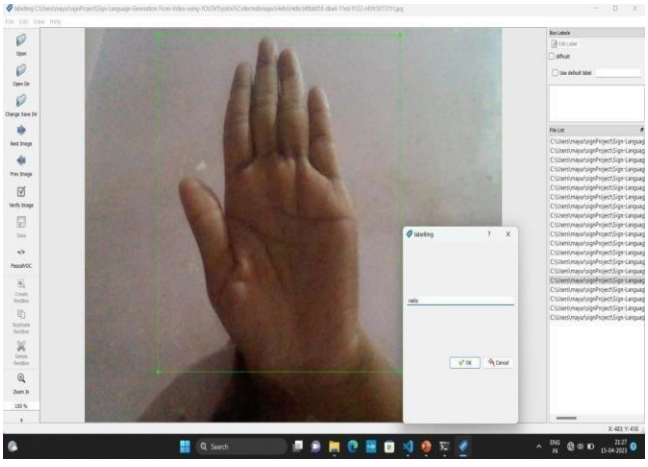

Fig 5.4- Match Feature

6. RESULT AND DISCUSSION

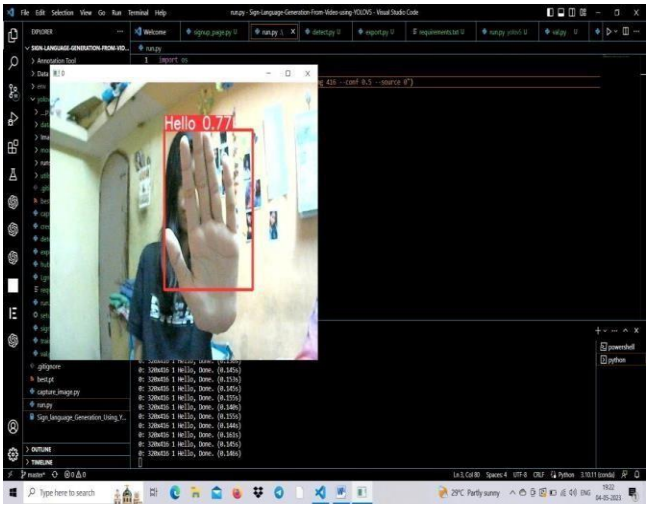

Fig 6.1- Displaying Result of Hello Sign

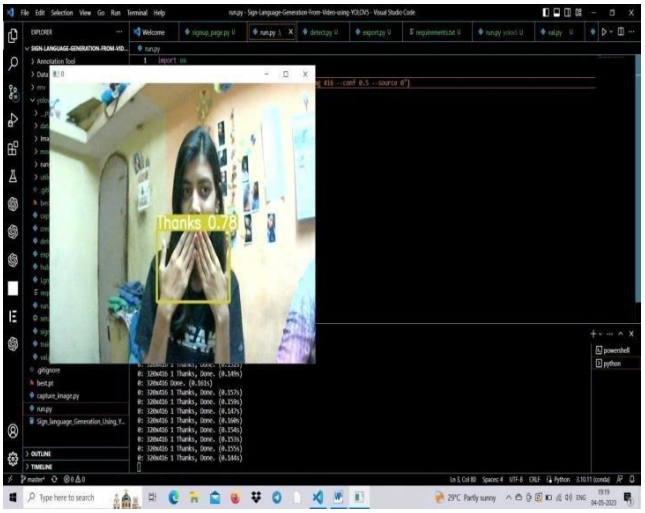

Fig 6.2- Displaying Result of Thanks Sign

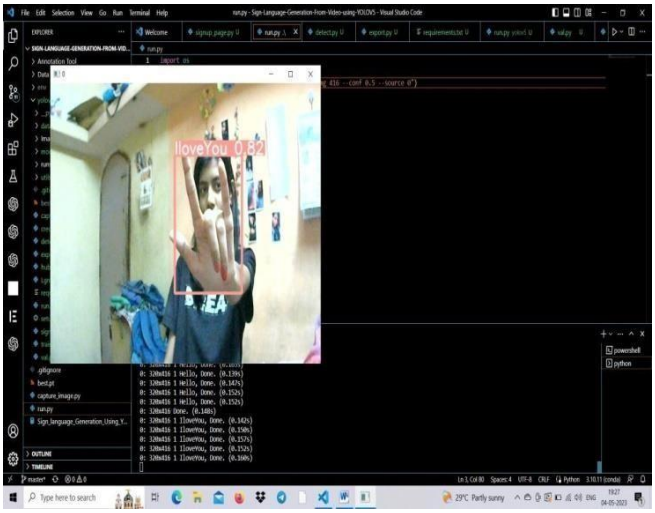

Fig 6.3- Displaying Result of I Love You sign

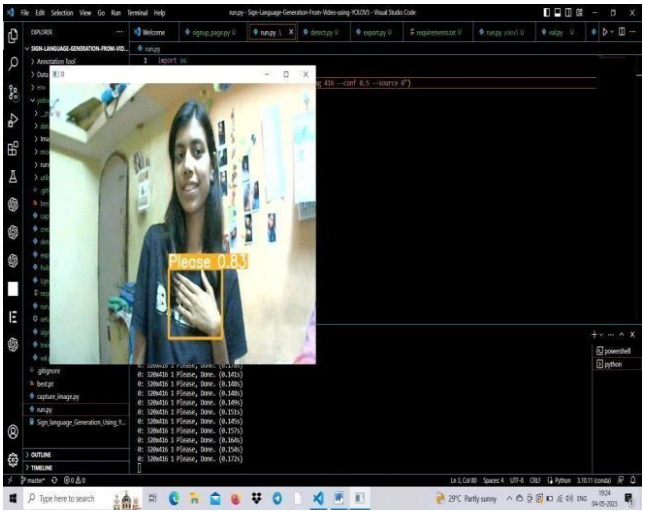

Fig 6.4- Displaying Result of Please Sign

7. CONCLUSIONS

In this project, we proposed a solution for feasible communication between hearing impaired and normal people with help of Deep learning and Machine learning approach. Sign language recognition system is fully successful onewith an accuracy rate at 85% (approx.). There are still challenges that need to be addressed, such as the recognition of complex gestures, variations in lighting and background, and individual differences in sign language usage. Continued research and development in this area can help overcome these challenges and improve the accuracy and reliability of sign language recognition systems, making them more accessible and useful for people who rely on sign language to communicate.

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