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SIGN LANGUAGE RECOGNITION USING PYTHON AND OPEN CV

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Abstract

The Sign Detector, which detects hand gestures of Sign Language. It is very helpful for the deaf and dumb people in communicating with others. The challenge faced by deaf and dumb people while communicating with others and it is dangerous to go alone. They cannot respond quickly and expressing themselves is hard. There is a need for systems that recognize the different signs and conveys the information to normal people. It aims to bridge the gap between speech and hearing impaired people and the normal people. This project is a camera based Sign Language Recognition System(SLRS),that converts sign language gestures to text. By introducing webcam in communication path so, that sign language can be automatically captured, recognized, translated to text and displayed. This project focuses on the development of a Sign Language Recognition system using Python and OpenCV. With the aim of enhancing accessibility for the hearing-impaired, our approach involves leveraging computer vision techniques. OpenCV is employed to capture and process realtime video input, extracting pertinent features from hand gestures. The system integrates machine learning algorithms, potentially incorporating deep learning frameworks, to classify these gestures into corresponding sign language symbols. The training dataset includes diverse sign gestures to ensure robust model performance. We address challenges such as dynamic hand movements, varying lighting conditions, and diverse backgrounds through preprocessing techniques. The user interface provides a seamless experience, displaying recognized signs in real-time. The system's performance is evaluated through metrics like accuracy, precision, recall, and F1 score. Extensive testing involves diverse signers and scenarios to ensure generalizability. The project contributes to fostering inclusivity by

offering an efficient, accurate, and real-time sign language interpretation solution, promoting communication accessibility for the hearing-impaired. The implementation is open-source, encouraging collaboration and further advancements in the field of sign language recognition.

KEYWORDS: Sign Language Recognition System (SLRS)

1. INTRODUCTION

1.1 INTRODUCTION

The recorded history of sign language in Western societies dates back to the 17th century, as a visual language or communicative form, although references to the forms of communication using sign language date back to the 5th century BC Greece. Sign language is made up of a system of general gestures, imitation, gestures and spelling, and the use of gestures to represent the letters of the alphabet. Symbols can also represent complete ideas or phrases, not just individual words. Many sign languages are native languages, distinct from the structure of spoken languages used near them, and are mainly used by deaf people to speak. Many sign languages have developed independently around the world, and no sign language can be identified. Both signed systems and handwritten characters have been found worldwide. Until the 19th century, much of what we know about historical sign languages is limited to the characters of the alphabet that were developed to facilitate the transfer of words from spoken language into sign language, rather than from the language itself. Talking to people with a hearing impairment is a major challenge. Deaf and mute people use sign language to communicate, which is why ordinary people face the problem of recognizing their sign language. There is therefore a need for programs that recognize different signals and transmit information to ordinary people. Gesture analysis is a scientific field that can recognise gestures such as hand, arm, head, and even structural motions that usually entail a certain posture and/or motion. Using hand gestures, the individual may send out more information in a shorter amount of time. Several approaches were explored to apply computer-vision ideas to the real-time processing of gesture outputs.

[2]. The Computer Vision study concentrates on gesture recognition in the open CV framework using the Python language. Language is a huge part in communication. Languages are useless to a person with a disability. Gesture is a vital

and meaningful mode of communication for the visually impaired person . So here is the computer-based method for regular people to understand what the differently abled individual is trying to say. For monitoring, there are various similar algorithms and object recognition systems. This allows the identification of gestures, which overcomes the boundaries and limitations of earlier systems.

1.2 MOTIVATION

There are (1.3) million people having "hearing impairment", according to the 2011 Indian Cen-sus. Contrasting people with this figure from the Deaf Association of India, it is estimated that 18 million out of people make up about 1Because these speech and hearing impairments require a system The right channel is needed to communicate with the general public. Not everyone can understand the sign language. Therefore, our project aims to convert sign language gestures into text that ordinary people can understand.

1.3 PROBLEM STATEMENT

A sign detector is used to detect hand and other gestures where these gestures are a part of the sign language. The detector then displays messages for the specially aided people based on these specific movements. The concepts of Computer vision and Machine learning algorithms can be used in this regard

1.4 PROJECT OBJECTIVES

The project aims at building a Machine Learning model that will be able to classify the various hand gestures used for fingerspelling in sign language, we will develop a sign detector, which detects the signs and hand gestures. Sign gestures can be classified as static and dynamic. In our project we basically focus on producing a model which can recognize Fingerspelling based hand gestures in order to form a complete word by combining each gesture. The core objective of the system is to accurately classify sign language gestures using a trained deep learning model. The system leverages the power of deep learning algorithms to learn and recognize patterns in the preprocessed hand images. By utilizing a trained model, the system predicts the corresponding sign language gesture for each input image, providing real-time interpretation. The objective is to empower individuals with a reliable, efficient, and independent means of communication, promoting inclusivity and fostering greater

understanding between different linguistic communities.

2 . LITERATURE SURVEY

In Literature, We went through additional comparable studies that are performed in the domain of the sign language recognition. The following are summaries of each of the project's works:

A.METHODS OF HAND-GESTURE RECOGNITION IN SIGN LANGUAGE RECOGNITION (SURVEY):

Given paper focused on methods used in the prior Sign Language Recognition systems. Based on our review, HMM-based approaches have been extensively explored in prior research, including its modifications. Deep Learning, such as Convolutional Neural Networks, has been popular in the past five years. Hybrid CNN-HMM and completely deep learning systems have yielded encouraging results and provide avenues for additional research. Clustering and high computational needs, however, continue to stymie their adoption. We believe that the research's future focus should be on developing a simplified network that can reach high performance while requiring little CPU resources, and that embeds the feature learner within the classification in a multi layered neural network approach.

B. NORMAL PEOPLE AND DEAF-DUMB PEOPLE COMMUNICATION:

The overall purpose project is facilitate the interaction between deaf and dumb people and normal people to makes the communication between normal people and dumb people easier, by translate the sign language to voice or text with high accuracy [9]. The dumb and deaf communicate via sign language, which is hard to decipher for those who are not familiar with it. As a result, it is necessary to develop a device that can translate gestures into speech and text. This will be a significant step in allowing deaf and dumb people to communicate with the broader population.

C. IMAGE PROCESSING FOR INTELLIGENT SIGN LANGUAGE RECOGNITION:

HMMs are suited for full sign recognition of ASL, because to their inherent time-varying nature. Because a series of several of the 36 basic hand shapes may be used to gesture most ASL signs. The continuous indications can be split, with the fundamental hand shapes retrieved as the input to the HMM processor. The

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fundamental hand shapes may then be identified and chained as ASL words' output. With the approaches presented in this work, the system may be expanded to a full-sign recognition system.

D. SIGN LANGUAGE INTERPRETER USING MACHINE LEARNING AND IMAGE PROCESSING:

Pham Microsoft Kinect is used by the Hai to interpret Vietnamese Sign Language. The user must align himself with Kinect's field of view and then conduct sign language movements in the suggested system. Using multi-class Support Vector Machine, it can distinguish both dynamic and static gestures. The gesture features are retrieved, filtered out and normalize on Euclidean distance during recognition.

E.HAND-GESTURE RECOGNITION BY USING DIGITAL IMAGE PROCESSING USING MATLAB:

The introduction of modern techniques significantly expands the possibilities of traditional microscopic procedures in the forensic field, allowing for the acquisition of necessary quantitative data in forensic analysis.

3 . SYSTEM DESIGN

3.1 SYSTEM ARCHITECTURE

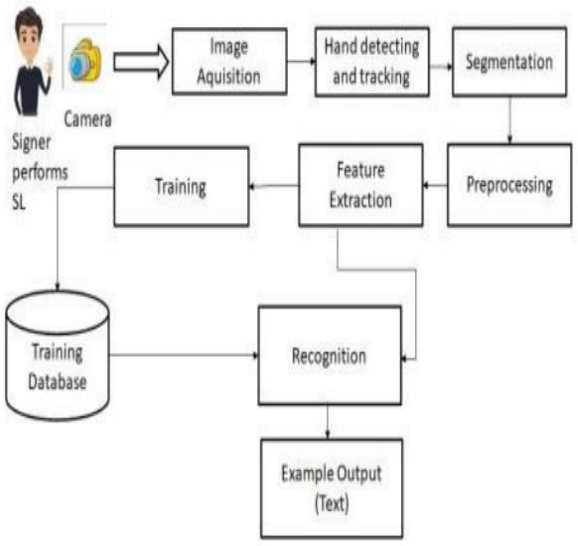

Fig 1: System Architecture of Sign language Recognition System

In the sign language recognition model, the architecture provides a blueprint and ideal techniques to follow so as to developed a well-structured application as per our requirement. This architecture mainly involves three phases:

PHASE 1- DATA COLLECTION PHASE:

A model is being built and a sequence of images is being fed to the model. This phase is useful to further train the model based on the type of symbol.

PHASE 2- TRAINING AND TESTING PHASE:

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This phase involves a set of inputs to the model and a particular output is being expected. Based on the outputs, the accuracy of the model is being identified.

PHASE 3- RECOGNITION OF OUTPUT:

In this phase, an image is being given as input to the model. Based on the images being trained to the model, it matches the image with a particular output and generates

a message. The sign being identified in the above phase has a particular meaning and a message is being assigned in the training phase. The meaning is displayed to the user.

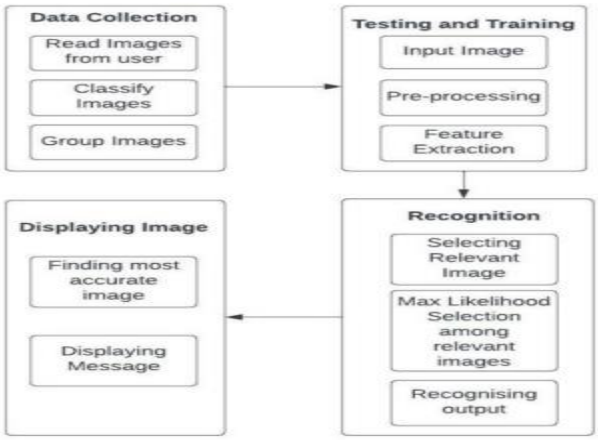

Fig 2: Architectural model

4 . OUTPUT SCREENS

TESTCASE -1

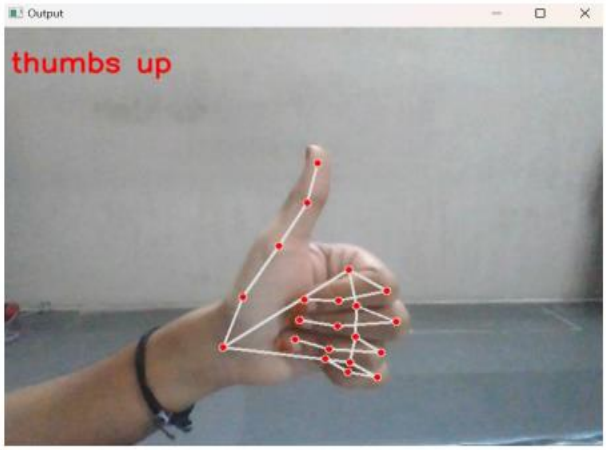

Fig 3: Indicating sign thumps up

TESTCASE -2

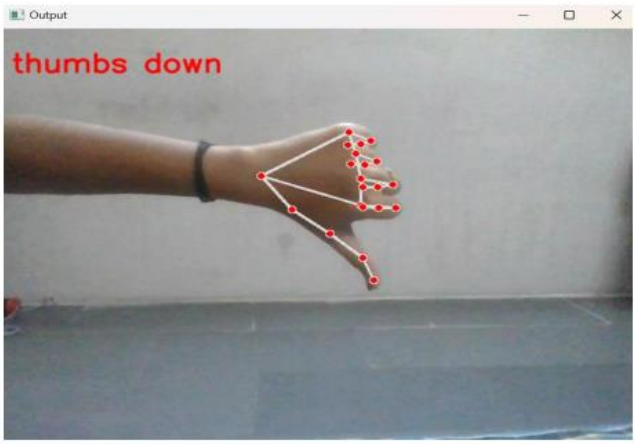

Fig 4: Indicating sign thumps down

TESTCASE -3

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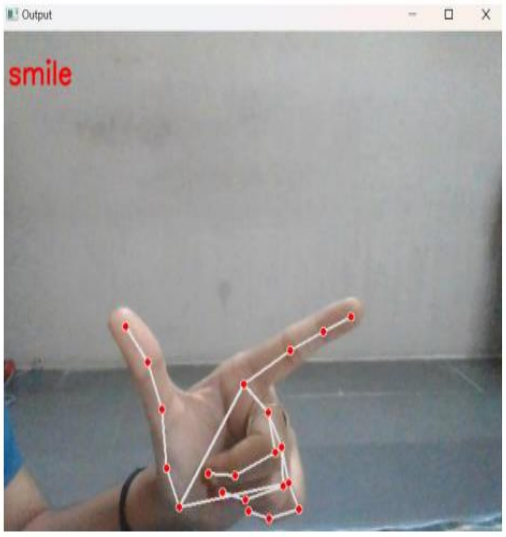

Fig 5: Indicating sign smile

TESTCASE -4

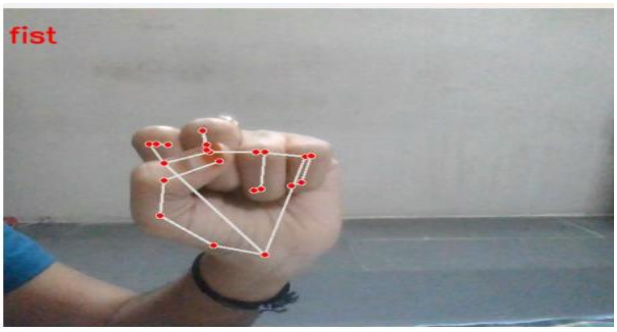

Fig 6: Indicating sign fist

TESTCASE -5

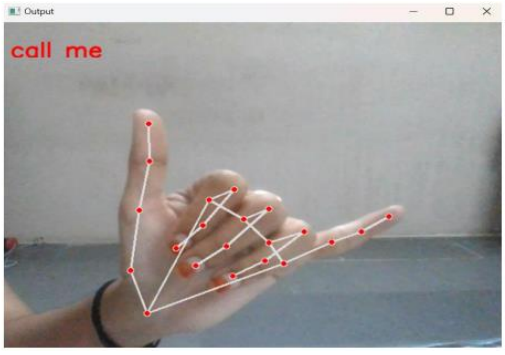

Fig 7: Indicating sign call me

TESTCASE-6

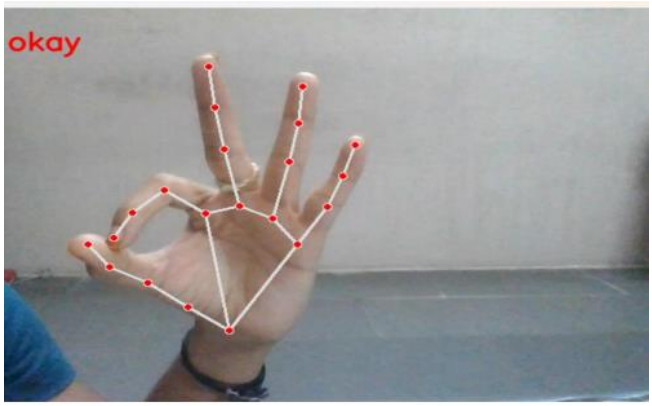

Fig 8: Indicating sign okay

5 . CONCLUSION

Nowadays, applications require a wide variety of images as a source of information for interpretation and analysis. There are many features to remove to run various applications. When an image is converted from one form to another such as digitizing, scanning and communication, storage etc. Therefore, the output image undergoes a process called image correction, which consists of a set of methods that try to enhance the appearance of the image. Image enhancement is basically about clarifying or raising awareness of information in images for the human audience and providing better input for other automated image processing systems. The image feature is extracted using various forms to make the computer image more readable. Sign language

recognition system is a powerful tool to prepare an expert knowledge, edge detect and the combination of inaccurate information from different sources. the intend of convolution neural network is to get the appropriate classification. We have successfully developed sign language recognition project. This is an interesting machine learning python project to gain expertise. The system does not require the background to be perfectly black. It works on any plain background. Sign language recognition is a hard problem if we consider all the possible combinations of gestures that a system of this kind needs to understand and translate. That being said, probably the best way to solve this problem is to divide it into simpler problems, and the system presented here would correspond to a possible solution to one of them. The system didn't perform too well but it was demonstrated that it can be built a first-person sign language translation system using only cameras and convolutional neural networks. Our project aims to make communication simpler between deaf and dumb people by introducing Computer in communication path so that sign language can be automatically captured, recognized, translated to text and displayed it on LCD. We used CNN to classify the sign gestures, we got an accuracy of 81%. The Project is successfully recognizing hand gestures and giving respective gestures in text

6 . FUTURE ENHANCEMENT

The proposed sign language recognition system used to recognize sign language letters can be further extended to recognize gestures facial expressions. It would be more appropriate to display sentences as more accurate translations of the language than to display letter labels. This also increases readability. The scope of different sign languages can be increased. More training data can be added to find the letter with more accuracy. This project can be expanded to convert symbols into speech.

7 . REFERENCES

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