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"CLASSIFICATION OF SIGN LANGUAGE CHARACTERS BY APPLYING A DEEP CONVOLUTIONAL NEURAL NETWORK"

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ABSTRACT:

Sign language is the only medium of communication for the speech-impaired community while the rest of the population communicate verbally. This project aims to bridge this communication gap by proposing a novel approach to interpret the static and dynamic signs in the Indian Sign Language and convert them to speech. A sensor glove, with flex sensors to detect the bending of each finger and an IMU to read the orientation of the hand, is used to collect data about the actions. This data is then wirelessly transmitted and classified into corresponding speech outputs. LSTM networks were studied and implemented for classification of gesture data because of their ability to learn long-term dependencies. The designed model could classify 26 gestures with an accuracy of 98%, showing the feasibility of using LSTM based neural networks for the purpose of sign language translation. To live in a society, it is very important to communicate with each other. But this poses a grave problem for people with hearing disabilities. As they can converse using only sign language, it becomes very difficult for others who don't know the sign language to understand them. So, the purpose of this paper is to create an interpreter which can convert american sign language into the Engilsh language. Through convolutional neural network we were able to create such an interpreter which can interpret the american sign language.

INTRODUCTION:

Sign language is a system of non-verbal communication using visual gestures, symbols, facial expressions, body language etc. without the need of vocal communication. Any sign language has three main level of communication[1]. The first one is the finger spelling which means that for every alphabet in the language, there are corresponding signs allocated. This is the most basic form of sign language. Every word can be spelled by the proper use of the signs in sequence. The second level of communication is that there are some special signs which correspond to a whole word to speed up the whole communication process.The third one is the communication through the body language, eye movement, facial expression etc. But this form of communication is usually not preferred due to its misinterpretation and tardiness. So, among these three, the first two level of communication are the most used by the hearing disabled community for its speed and reliability same, the sign languages can be different. For example, American Sign Language and British Sign Language are different sign lan guages. Similarly, Swiss German Sign Language (DSGS) and Ger man Sign Language (DGS) are different sign languages. One way to address the resource scarcity challenge is to develop methods that can exploit multiple sign language resources by overcoming the lim itations imposed by the differences between the sign languages. In the literature, there is limited work in that direction, more precisely with hand shape modeling only. It has been found that, given the HamNoSys annotation of produced signs, a global hand shape classifier can be trained by pooling resources from multiple sign lan guages and hand shape information based sign language recognition systems can be developed . However, hand shape is only one channel of information. There is need to model other channels such as, hand movement, which unlike hand shape is a continuous aspect or in other words are not inherently a discrete unit.

Fig1.1: Sign Language symbols.

Among the two types of communication known, Gestures is an instance of non-verbal which make use of body movements unlike the verbal one. As gestures are more interactive way of conversing, therefore people make use of them to express their feeling complimenting to sound conversation.

1) RELATED WORKS:

There have been primarily two approaches in solving the problem of gesture recognition. They can be broadly classified into the following categories:

A. Vision Based:

In vision based solutions, sign language gestures are translated to speech using image processing and computer vision techniques. Dutta, Raju K, Kumar G S and Swamy B proposed a system in which feature points of training images are stored in a database[7]. Sign language translation is done by comparing features of input images with the database to find the best match. J. Singha and K. Das proposed a method using Eigen value weighted Euclidean distance for classification of image data of Indian Sign Language[8]. This included skin filtering, hand cropping, feature extraction and classification. Deo, Rangnesh and Trivedi proposed a method of using Hidden 1 Markov models for recognizing dynamic hand gestures[2]. The paper also proposes a CNN-HMM hybrid mode which gives a better

recognition accuracy than traditional HMM.

B. Sensor Based:

The other approach to sign language translation is placing sensors directly on the hand to estimate its orientation while making sign language gestures. Each gesture in the sign language produces a set of sensor values corresponding to that gesture. These sensor values are then used to classify the gestures into corresponding text and speech. Abhishek, Qubeley and Ho presented a gesture recognition glove based on charge-transfer touch sensors[10]. The hand gestures cause the capacitive sensors to be selectively activated, thus employing a binary detection system. Thus the position of a finger is interpreted as binary 1 when the finger is unbent and binary 0 when the finger is bent. This approach could however only classify static gestures corresponding to letters and numbers and could not be extended to dynamic gestures also proposed a similar approach to gesture translation by comparing input with a database to identify the gesture. The difference was that this method used a state space representation of all the gestures instead of directly storing the data.

2) METHODOLOGY:

SLR can be done using one hand, two hands but the hearing impaired people also uses their facial expressions to represent their feelings. Therefore to understand the information, hearing and speech impaired people use signs which may include detection of face and hands which acts as an input for tracking in recognition of sign language symbols. The proposed system works on the critical aspects of sign language symbols such as position of hand on particular area of a face by taking the image in YCbCr format using Image processing toolbox of MatLab for performing skin color detection to make a template and then dividing the template to compute quad values which acts as threshold value to do matching and doing recognition of sign language symbols. The proposed SLR system is basically composed of two stages:

A. Initial Stage

The first step is to take the input as image in YCbCr format in order to do Skin color segmentation, then detect skin regions of face and hand centroids, which will become input for the tracking stage.

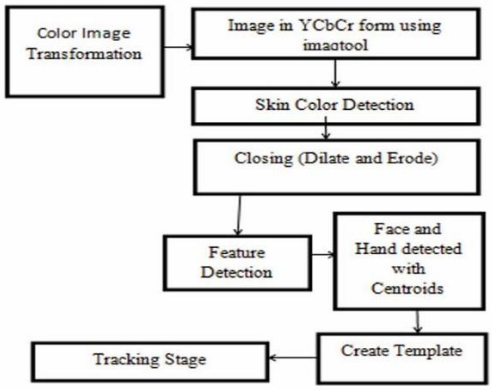

Fig3.1: Initial Stage.

B. Tracking Stage

The features extracted in initial stage and skin color segmented image is divided into four quadrants, which helps in tracking the position of hand on a face and performing recognition by applying a threshold value on quadrant values. The whole system framework includes various sub stages for the complete recognition of symbol and conversion to a text.

3) NEURAL NETWORK:

An artificial neural network consists of artificial neurons. The f igure 1, gives a simplified view how an artificial neuron works. Here, the X1, X2, X3 are the input data of a neuron. The inputs then are multiplied by unique weights W1, W2, W3 respectively and then summed together. The summation is passed through a threshold function.Theoretically, it should be a step function. When the sum value is more than the threshold value, the output is 1 otherwise it is 0. But a step function has only the value 1 and 0 which is not ideal for the real world. So, instead a sigmoid function is used. If a sigmoid function is used, it is not called a threshold function anymore. Rather, it is called an activation function. So, the whole function can be written as y= f(XW). These values of y's are then fed into the next neuron.

4) PROPOSED SYSTEM:

A novel system has been proposed on account of sign language translation and that will assist the deprived ones in an effective manner. This can do the real time translation from multiple Indian languages and English to sign language will help bridge this gap to large extent and can operate even without internet.

In Data Flow Diagram,we Show that flow of data in our system in DFD0 we show that base DFD in which rectangle present input as well as output and circle show our system,In DFD1 we show actual input and actual output of system input of our system is text or image and

output is rumor detected like wise in DFD 2 we present operation of user as well as admin.

1. USE CASE DIAGRAM:

Use case design for the proposed system is shown in which consists of usersign translator and informationas actors. The subsequent UseCase diagram provides high level view of Sign Translator application, additionally represents user interaction and user relationship with application.

Diagram

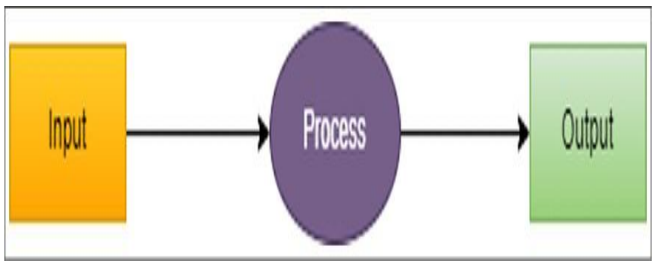

Fig5.1: Use case diagram.

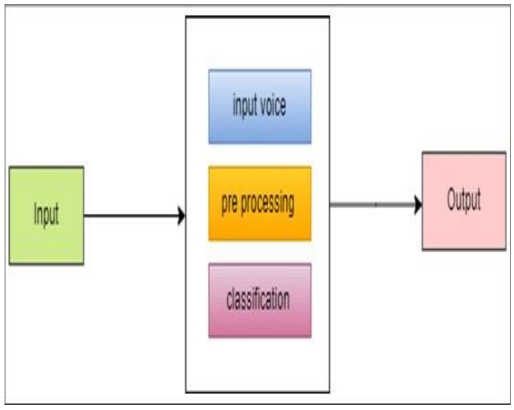

Fig5.2: Data Flow. (0)

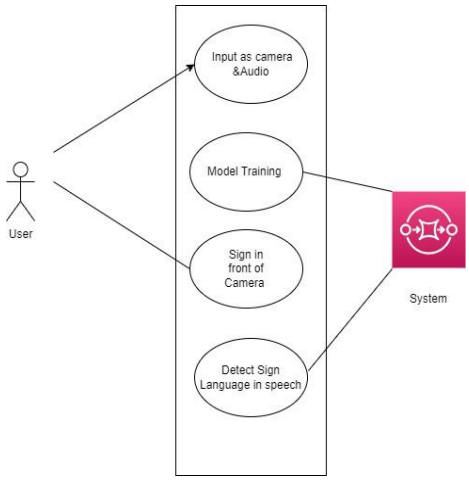

Fig5.3: Data Flow(1) diagram

The user are going to be logged in to application,Sign Translator will interpret the word entered by user,which will convert it into signing exploitation information.

2. Data Flow Diagram

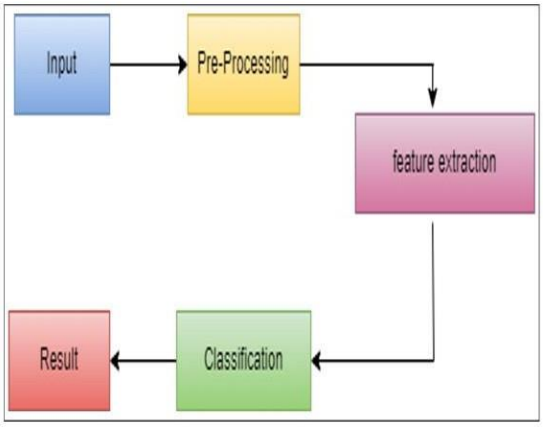

Fig5.4: Data Flow(2) diagram

5) CONCLUSION AND FUTURE WORK:

This paper investigated methods to model hand movement informa tion in a language independent manner using hand movement sub units obtained through HMMs. Our investigations showed that there is a performance gap when modeling hand movement information in a language independent manner and in a language dependent man ner. However, this gap is significantly reduced when combined with hand shape information and yields competitive systems. These find ings are promising and they pave the path for development of sign language processing systems by sharing multiple sign language re sources. Our future work will build upon these finding to address resource-constraint issues in sign language processing such as, de veloping systems with reduced number of signers and examples. In addition, we will also investigate whether such a multilingual ap proach can be applied for sign language assessment.

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