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Sign Language recognition using image-based hand gesture recognition techniques

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Abstract :*Touch is one of the most common forms of sign language used in oral communication. It is most commonly used by deaf and dumb people who have difficulty hearing or speaking. Communication between them or ordinary people. Various sign-language programs have been developed by many manufacturers around the world, but they are relatively flexible and affordable for end users. Therefore, this paper has presented software that introduces a type of system that can automatically detect sign language to help deaf and mute people communicate better with other people or ordinary people. Pattern recognition and hand recognition are developing fields of research. Being an integral part of meaningless hand-to-hand communication plays a major role in our daily lives. The handwriting system gives us a new, natural, easy-to-use communication system with a computer that is very common to humans. Considering the similarity of the human condition with four fingers and one thumb, the software aims to introduce a real-time hand recognition system based on the acquisition of some of the structural features such as position, mass centroid, finger position, thumb instead of raised or folded finger.*

Keywords *–Communication System, hand recognition, pattern, sign language, Touch*

I. INTRODUCTION

Deaf people are often deprived of normal contact with other people in the community. It has been shown that they sometimes find it difficult to communicate with ordinary people with their hands, as very few of them are seen by most people. Since people with hearing or hearing problems cannot speak as normal people so they should rely on some form of visual communication most of the time. Sign language is a major means of communication in a deaf and dumb community. Like any other language it has acquired a grammar and vocabulary but uses a visual exchange system. The problem arises when mute or deaf people try to express their feelings to others with the help of these sign language programs. This is because ordinary people usually do not know these grammars. As a result, it has been found that contact with a deaf person is limited only to his family or to the deaf community. The importance of sign language is emphasized by the growing public acceptance and funding of the international project. In this age of Technology, the need for computer-based programming is in dire need of a dumb community. However, researchers have been attacking the problem for some time now and the results show some promise.

The technology of interest is designed for speech recognition but no real marketing product of brand recognition is actually available in the current market. The idea is to make computers understand human language and develop a user-friendly computer interface (HCI). Making a computer understand speech, facial expressions, and touch is a step in the right direction. Gestures are information that can be exchanged with words. One can make countless movements at a time. As human touch is seen visually, it is a matter of great interest to computer-generated researchers. This project aims to determine human mobility by performing HCI. Coding of these actions in machine language requires a complex programming algorithm. In our project we focus on Image Analysis and Template Matching to find the best product.

II. LITERATURE REVIEW

As illustrated in Figure 1, hand gestures for human–computer interaction (HCI) started with the invention of the data glove sensor. It provided simple computer recognition instructions.The gloves have used a variety of sensors to capture the movement of the hand and its position by finding the right links for the palm area and the fingers. The various sensors that used the same process based on the bending angle were the bending sensor, the small migration sensor, the optical fibre transducer, the flexible sensors and the accelerometer sensor. These sensors exploit different physical principles according to their type.

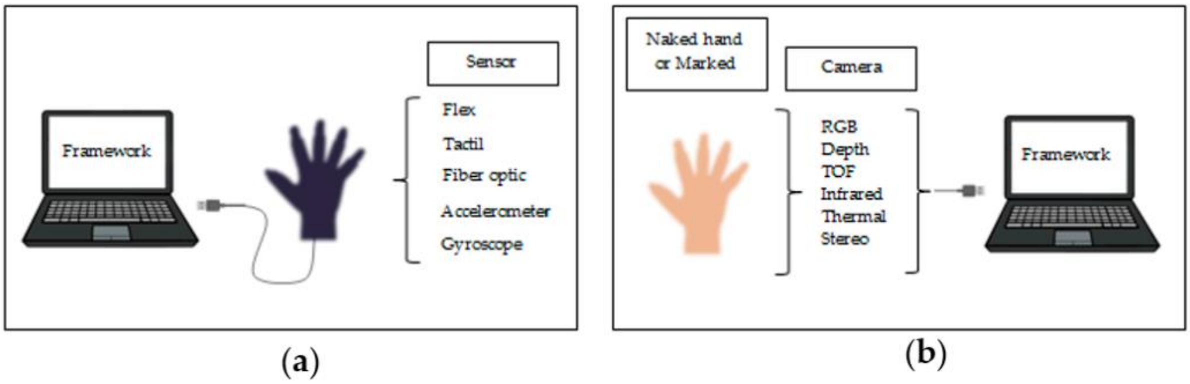


Figure 1. Different techniques for hand gestures. (a) Glove-based attached sensor either connected to the computer or portable; (b) computer vision–based camera using a marked glove or just a naked

Although the techniques mentioned above have provided good outcomes, they have variouslimitations that make them eligible for the elderly, who may experience discomfort and confusion due to wire connection problems. In addition, older people suffering from chronic diseases that lead to loss of muscle function may not be able to wear and take off their gloves, making them uncomfortable and preventing them from using them for long periods of time*[1]*. These sensors may also cause skin damage, infectionor inappropriate reactions in people with sensitive skin or those who have burns. In addition, some sensors are quite expensive. Some of these problems were discussed in a study by Lamberti and Camastra, who developed a computer-vision system based on coloured marked gloves. Although this study did not require the attachment of sensors, it still required coloured gloves to be worn.
The most effective commercial glove is by far the VPL Data Glove*[2]*.Built by Zimmerman during the 1970's. It is based upon patented optical fiber sensors along the back of the fingers. Star-ner and Pentland developed a glove-environmental system that can detect 40 signals fromAmerican Sign Language (ASL) at 5Hz.

Another research is by Hyeon-Kyu Lee and Jin H. Kim presented work on real-time hand-gesture ecognition using HMM (Hidden Markov Model). Kjeldsen and Kendersi devised a technique for doing skin-tone mentation in HSV space, depending on the basis that the skin tone in the images takes on the volume attached to the HSV space. They also started a program that uses a neural network of back distribution to detect touch from hand-separated images*[1]*.Etsuko Ueda and Jososhio Matsumoto have outlined the process of the novel a possible rating scaleused for human-based communication, in this way, hand circuits are extracted from multiple images acquired a multi-idea camera system, and creating a voxel Model*[12]*.

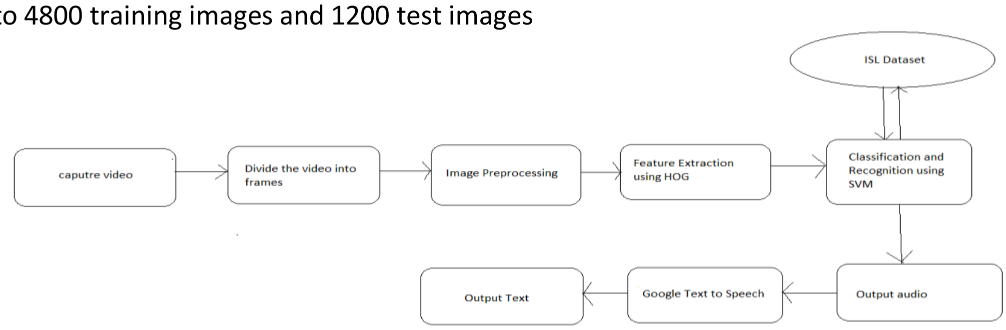
This paper also discusses these methods in detail and summarizes some modern research under different considerations (type of camera used, image or video editing, type of method, partition algorithm used, recognition rate, type of region of interest processing, number of gestures, application area,limitation or invariant factor, and detection range achieved and in some cases data set use, runtimespeed, hardware run, type of error). In addition, the review highlights the most popular applicationsassociated with this topic

III. HAND GESTURE METHODS

The proposed plan consists of two main categories: (1) Hand separation (2) Hand sign recognition. The block diagram shows the effectiveness of the proposed system. Hand features are an important criterion for separation to distinguish between hand touches. These elements must be able to adapt to different hands and touches by different people. In this system, we used histograms of targeted gradients (HOG) as an element adjective. It is better than other definitions because it is able to adapt to changing light and rotation of objects. We do not look at the whole picture, but we divide it into smaller cells and then the pixels inside the cells on the edge or gradient direction histogram are calculated

3.1Preparing the dataset

We have made a database of 26 English-language alphabets in Indian Sign Language. Each sign it is made up of two different people with a different structure of conditions in different lighting conditions. Videos are recorded on camera and each video is framed by frame to photos and then arranged in 100 frames and added to get about 250 photos for each sign. The data was then divided into 4800 training images and 1200 test images



3.2 Image Processing and edge detection

Before performing a feature, the images should be processed in such a way that only the most important details are considered and the unwanted, disturbing and overpowering details are ignored. Images are first converted to 100 * 100-pixel size for fast countdown*[3]*. The image is then converted to Gray and finally converted to a binary image. At the same time, skin colour is obtained using the Y-Cb-Cr model. Finally, the edge detection was done with a Canny edge detector. The process is illustrated in figure below

(a) (b) (c)

Output of skin colour detection: a) Original cropped image, b) Grey scale converted image, c) Skin colour detection output

3.3 Feature Extraction

Extracting data from data is a critical part of any acquisition process. It can be done using various methods such as Fourier Descriptor, Scale Invariant Feature Transform (SIFT) or Principle Component Analysis (PCA). Histogram of Oriented Gradients (HOG) is another effective way to extract a feature. In this paper, we used the HOG method to extract the feature. The basic idea of HOG is that an object or shape within an image can be represented by strong distribution gradients or edge indicators. In this way, the image is divided into smaller cells and calculates the gradient histogram of each cell. It creates a barrel and incorporates a histogram of different samples depending on the size and angle. To improve accuracy, all cells in the image are normal so that they are not affected by light contrast. Finally, the HOG feature vector counts for the whole image.

3.4 Template matching and sign recognition

The element vector generated in the above step is inserted into the image separator. In this paper, we have used Support Vector Machine (SVM) to distinguish. By using SVM fragmentation we can increase accuracy and avoid data overload. In SVM data objects are arranged in a n-dimensional space where n is the number of elements. Each feature is associated with a link value. It then acquires a hyperplane that separates the classes. The model is kept in sign language recognition in real time.

3.5 Text to speech conversion

This section falls under Artificial Intelligence*[9]* where the template matching function becomessuccessfully the same image and then translated into text and audio format. For this purpose, the methods described earlierused for conversion.

We used the Google to Speech API text to convert sign language into audio. It is one of the best texts in the API talk available. Unlike other TTS APIs, this API creates a human-like voice. Sign language is translated using the steps above and the result is given to write a speech function that converts it into sound. In this system, we see and hear simultaneous sign-language translations that make it much easier to use.

IV. ALPHABET RECOGNITION

Following table shows the values assigned to each finger.*[8]* Binary Alphabet calculation: It is possible to display total (2^5-1) i.e.31 gestures using the fingers of a single hand, and ($2^{10}-1$) i.e. 1023 gestures if both hands are used.

Figure show binary finger tapping tool showing the significant values assigned to fingers by referring to gesture table shows code of each alphabet.

SR NO	RED	GREEN	BLUE	YELLOW	PURPLE	ALPHABETS
1	0	0	0	0	1	A
2	0	0	0	1	0	B
3	0	0	0	1	1	C
4	0	0	1	0	0	D
5	0	0	1	0	1	E
6	0	0	1	1	0	F
7	0	0	1	1	1	G
8	0	1	0	0	0	H
9	0	1	0	0	1	I
10	0	1	0	1	0	J
11	0	1	0	1	1	K
12	0	1	1	0	0	L
13	0	1	1	0	1	M
14	0	1	1	1	0	N
15	0	1	1	1	1	O
16	1	0	0	0	0	P
17	1	0	0	0	1	Q
18	1	0	0	1	0	R
19	1	0	0	1	1	S
20	1	0	1	0	0	T
21	1	0	1	0	1	U
22	1	0	1	1	0	V
23	1	0	1	1	1	W
24	1	1	0	0	0	X
25	1	1	0	0	1	Y
26	1	1	0	1	0	Z

Alphabet code

Fig 8.(a) Fig 8.(b) Fig 8.(c)

Fig.8 Gesture of alphabet G from table 2.

Fig 8.a shows the original image where values of red and green color are 0 and rest of the color values are 1. Fig 8.b shows the binary image after Thresholding and Fig 8.c shows image in which only the marker bands are highlighted.

V. CONCLUSION

In this paper, we have explained the implementation of a system which recognize Sign Language and translated to English. We discussed the importance of an ISL translator for communicating with the deaf and dumb. In this system, a hand-held photo frame is captured using a webcam.

Our project aims to bridge the gap by introducing an inexpensive computer in the communication path so that the sign language can be automatically captured, recognized and translated to speech for the benefit of blind people. In the other direction, speech must be analysed and converted to either sign or textual display on the screen for the benefit of the hearing impaired.

These frameworks are being processed to obtain improved features. A feature is then added to the subtraction and segmentation algorithms to translate the token language into English text. This translation is converted to speech using text to speech API. The program used the above algorithms to obtain the final result. The proposed model is tested by a database containing 26 symbols from two different individuals. The results show a complete accuracy of the system to be 88%. Our future research will work towards implementing this model on a mobile application.

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