A Novel Approach of Sign Recognition for Indian Sign Language

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ABSTRACT

A Novel Approach of sign recognition for Indian sign language is proposed in this work to dual way communication system for deaf -dumb & normal people. . Sign language is only essential communicating tool for deaf & dumb people. It is a subset of gestures or signs made with fingers, hands, head and face etc. Each gesture in SL has a specific meaning & that is assigned to it. Deaf –dumb & normal people directly not communicate with each other. Every country has developed its own SL. In India, this sign language is called as "Indian Sign Language (ISL)". In this approach first gesture is converted into text and then voice format, So normal people understand the meaning of that gesture. Second, Voice is converted into text and then gesture, so physically impaired people can understand it .In this vision based approach used with the dynamic gesture. Pre-processing, Segmentation, Feature extraction, Classification these four are the main steps to recognize hand gesture. In this approach key frame extraction with histogram analysis is used for extract the main frame which has a sign & removes the unwanted frame.

Keywords: Indian Sign Language, Gesture acquisition, Hand Gesture Recognition, Segmentation, Feature Extraction

I. INTRODUCTION

Sign language is vital communicating device for Deaf –Dumb people. Sign language is broadly used by people that can't communicate and listen or individuals who can listen but cannot communicate. According to the survey taken by government of India, it is reported that in year 2011 census data over 2.68 crore of people in India suffer from some form of the disability. Out of this 18.9% people have speech and 7.5% people have hearing disability [1].A sign language is composed of numerous gestures fashioned by using exclusive hand shapes, actions and orientations of hands or body, or facial expressions. Those gestures are utilized by the deaf human beings to express their thoughts. Those gesture are only used by deaf – dumb Community, other person never try to learn this sign language. There are 143 existing different sign languages all over the world, mainly American Sign Language, British Sign Language, French Sign Language, Japanese Sign Language, and Indian Sign Language [2]. The gestures are mainly separated into two types: Static gestures and Dynamic Gestures. Static gestures consist of only poses and configurations. Static gestures are gestures that do not rely upon motion. Static gesture does not alternate the position of hand. Whereas Dynamic gestures encompass strokes, pre-strokes, postures and phases. Dynamic gestures rely upon motion. The dynamic gestures frequently encompass movement of body parts. It could additionally encompass feelings relying on the meaning that gesture conveys [6].

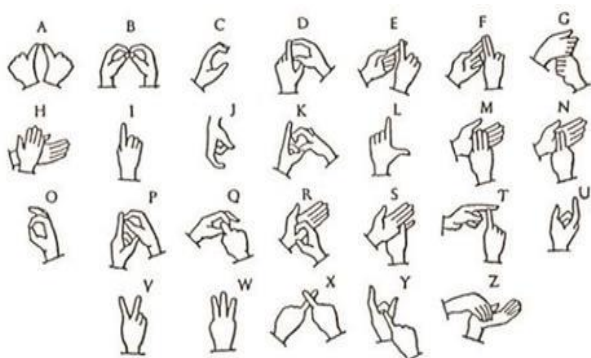ISL alphabets and numeric signs [8] are represented in Figure 1 and Figure 2 respectively.

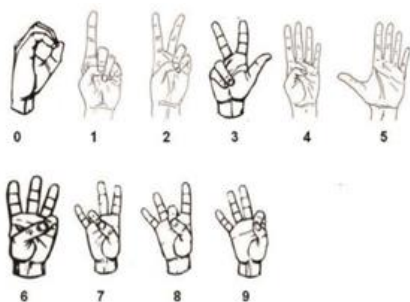**Figure 1.** Representation of ISL Alphabets [8].

Figure 2. Representation of ISL numerals[8].

Developing such automatic hand gesture recognition system for ISL is greater tough than different exclusive sign languages because of the following reasons:

- In ISL both static and dynamic hand gestures are used.
- One hand moves faster than the other in dynamic hand gesture.
- Facial expressions also are included in ISL.
- Complex hand shapes.
- Head/Body postures.

Fingerprint systems are widely used in applications like:

- Human Computer Interface
- Video gaming
- To interpret Sign Language.
- Security and biometric applications.

- Driver alertness system and so on.

II. PROPOSED METHODOLOGY

In this process, we have used a technique for sign recognition which uses video pre-processing, Skin color filtering, Key frame extraction with histogram analysis, Feature Extraction and classification techniques. In pre-processing, we have used skin color filtering for noise removal and hand detection. In feature Extraction, we have used Eigen value & eigen vector to extract the feature of the image. In Classification, we have used to Euclidean distance to recognize the sign.

1) Video Pre-processing

In Video Pre- processing first video is converted into frames. Then after process all the frames for detect the hand shape or sign in next phase. In this phase only video is converted into frames.

2) Skin Color Filtering

In Skin Color filtering process first RGB Frame is converted into HSV image. HSV image is less illumination rather than RGB image. Then after Noise removal & smoothening the image. For that purpose Gaussian low pass filter is used. Then after that image is converted into the Binary image. From that image only biggest object is taken. Sometimes other skin color pixel & shadow is present in the image .so that only hand region is taken from that image using Biggest BLOB (Binary link object).

3) Key Frame Extraction with histogram analysis

In key frame extraction extract the main frame which has an image of sign. First video is converted into frames, so that so many frames are created from the video. Using key frame extraction main frame which has a sign are taken from the video frames. In key frame extraction first histogram difference is calculated from all the consecutive frames. Then after threshold is calculated from mean & standard deviation of the frame difference. If the frame

difference is greater than the threshold value then this frames are taken as a key frames. Then after this frames are going to next stage of feature extraction.

4) Feature Extraction.

In feature extraction main feature are taken from that image. Key frames are taken & it is unidentified sign than last frame is chosen as a reference frame.

i) Let, the last frame is assumed as 'X', 'X' has to be change the size using dimension m*m.

ii) Calculate the mean 'M',

$$M = E\{X\}$$

iii) Calculate the covariance 'C',

$$C = E\{(X - M)(X - M)'\}.$$

iv) From the above covariance 'C' calculate the Eigen values and Eigen vectors and arrange the Eigen value in descending order according to the Eigen vector.

v) Take only first 5 principles vectors from total m Eigen vectors that reduces the dimension of the matrix without much loss of information.

Figure 3. Proposed Algorithm.

5) Classification

Classification stage is used to recognize the hand gesture. For classification Euclidean distance technique is used. Following step are included in classification stage.

i) Euclidean distance is calculated from testing frame & training image.

$$ED = \sqrt{\sum_{n=1}^{m}(EV1(n) - EV2(n))^2}$$

where, EV1 is the Eigen vector of testing phase frame and EV2 is the Eigen vector of the database image.

ii) Find out the dissimilarity among the Eigen value of the database image and the Eigen value of the existing video frame.

iii) Multiply above dissimilarity with the Euclidean distance.

iv) Check the minimum distance from all. The minimum distance is recognized the sign.

6) Text to speech & speech to text Conversion.

In this stage recognized sign is converted into text. Text is map with the audio & it is converted into speech. Another is the speech to text in that audio is mapped with the text & then after text is converted into gesture.
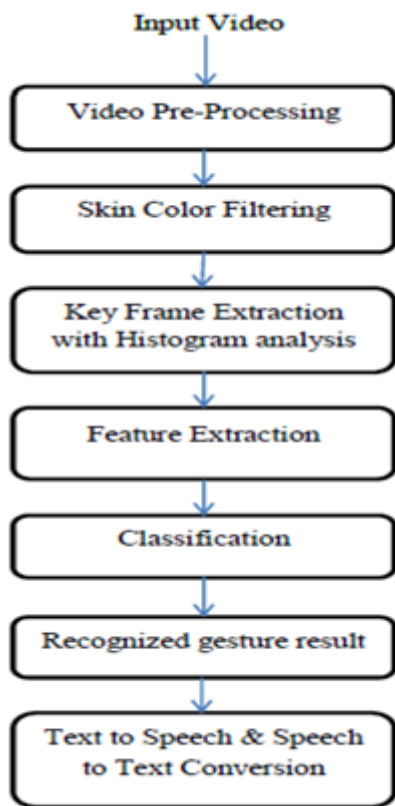
III. RESULT ANALYSIS

In this approach first dataset is created for ISL numbers. Video is converted into frames. Then after Skin Color Filtering process is apply on the frames. Skin color Filtering Process is shown figure 4. key frames is shown in figure 5. then after feature extraction & classification is applied to the images. Recognized gesture result is shown in figure 6 & figure 7.
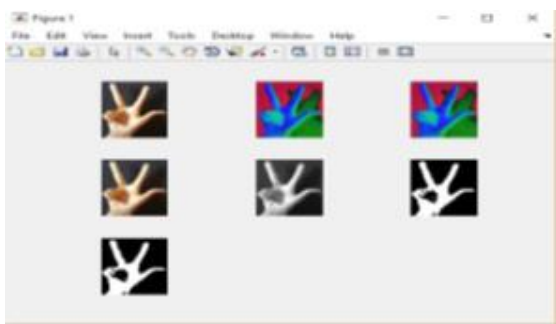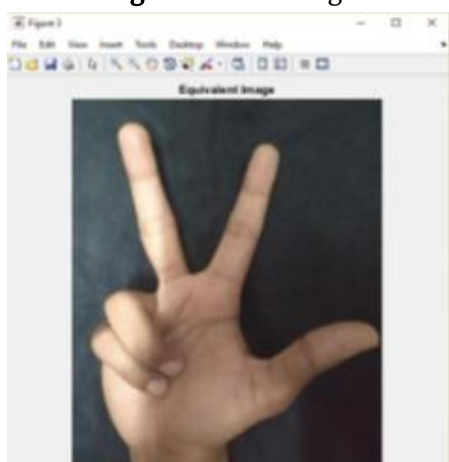
Figure 4: Skin Color Filtering

Figure 5: Key frames

Figure 6: Test Image

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Figure 7. Equivalent Image

III. CONCLUSION

This paper presents a novel approach of sign recognition for Indian Sign Language. The main aim of the sign recognition is remove the communication gap between deaf-dumb & normal people. More work has been carried out in static sign recognition. Only little work has been carried out for dynamic hand gesture .This paper present dynamic sign recognition system. In future there is possibility to do more work in dynamic sign, word, and sentences of ISL.

IV. REFERENCES

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