Image Based Sign Language Recognition using Neuro - Fuzzy Approach

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ABSTRACT

Sign language is the language of deaf & dumb people. They expressed their thoughts in the form of sign language. This paper proposed sign language recognition (SLR) system which is the computerized system useful for translation of sign language into English language in the form of text. It will be use video data of deaf & dumb people and translate into English text. Proposed system recognizes both hand movements including face. Various image processing techniques are defined in this paper which will use for process the images. Convex hull feature extraction method will be applied for extract features which will classify by Neuro-Fuzzy classification approach. Recognized words will be inputted into NLP (Natural Language Processing) engine to format into the sentence.

Keywords: NLP, SLR

I. INTRODUCTION

Language that is used by deaf and dumb people is called Sign Language. Deaf and dumb people, who cannot speak or listen but only can see, are using this language to express their thought. They are talk with each other by sign Language. Normal People cannot identify that exactly what Deaf people wants to say. So here we need either a translator who can translate signs into normal language or normal people have to learn this sign language.

At each time we cannot get translator/Interpreter easily. Because availability of translator is limited and expensive also. So the solution of this problem is that we have to use some automatic system that can automatically translate signs into spoken language.

Sign Language Recognition system is the automatic computerized system that automatically recognize signs and translate into normal language. This system is technically sound but also very important in Human Society. Deaf and dumb people can easily communication with normal people, express their ideas, thoughts etc. SLR system can be used in verity of ways in daily life, like this system can be used in Bank, Post Office, and Shopping Mall etc. In this type of places deaf people can easily communicate with other people and fulfill their requirements. In Education also this system very useful where deaf people can also become a teacher. This can improve confidence of Deaf and Dumb people to live in society.

II. RELATED STUDY

M. V. D. Prasad, P. V. V. Kishore, E. Kiran Kumar, D. Anil Kumar [1], presented methods for Indian Sign Language Recognition. Wavelet based fusion of two weak edge detection models. One is morphological subtraction model and the other is gradient based canny edge operator. Elliptical Fourier descriptors provide shape models used with optimized number of shape descriptors. Principle components determined find the feature vector to a minimum to accommodate all the frames in the video sequence. Classification of the signs is done by Back Propagation Neural Network Algorithm. The recognition rate stands at 92.34%.

Suriya M. , Sathyapriya N. ,Srinithi M. ,Yesodha V [2], this four persons presented system that recognizing sign language of 26 hand gestures in Indian sign language using MAT LAB. By using image processing the segmentation can be done. Some of the features are extracted such as Eigen values and Eigen vectors which are used in recognition. The Linear Discriminant Analysis (LDA) algorithm was used for gesture recognition and recognized gesture is converted into text.

Amitkumar Shinde, Ramesh Kagalkar [3], provide a system includes efficient and robust hand segmentation and tracking algorithm to recognize 43 isolated words from the Standard Marathi sign language. In their system they recognize some very basic elements of sign language and to translate them to text and vice versa in Marathi language. The different images were tested and result found that new technique of classification gives 90% accuracy.

Vision-Based Approach for American Sign Language Recognition has been developed by Jayshree R. Pansare, Maya Ingle [4], using Edge Orientation Histogram feature vector methods. They identified signs of A to Z alphabets from Images using K-Cluster EOH-Match algorithm with accuracy of 88.26%.

Ananya Choudhury, Anjan Kumar Talukdar and Kandarpa Kumar Sarma developed A Conditional Random Field based Indian Sign Language Recognition System under Complex Background [5]. They used both one hand gesture and two hand gestures. They applied Skin Color Segmentation, Frame Differencing for image processing, and Contour Matching algorithm, Calculation of centroids for feature extraction. Classification of signs has been done using conditional random filed algorithm and achieved 90% for one hand and 86% for two hand gestures.

Qing Chen and N.D. Georganas [6], proposed a new approach to solve the problem of real-time vision-based hand gesture recognition with the combination of statistical and syntactic analysis.

G. R. S. Murthy and R. S. Jadon [7] designed method for recognizing specific hand gestures and use them to convey information.

N.A.Ibrahim and R. Z. Khan [8], proposed a method which can recognize specific human gestures and use them to convey information or for device control.
G. Deepa and G. Bhaskar Phani Ram [9], proposed system emotion is derived automatically from hand gestures captured by camera. The data recorded from hand gestures are coupled with musical emotion.

III. PROPOSED SYSTEM MODEL

Proposed system model is classified into four Parts:
  A. Extract & processed the images of sign taken from video using Image Processing techniques
  B. Extract features from images using feature extraction technique
  C. Classified and Indentified word of sign on the base of extracted features using classification technique
  D. Apply NLP to collected words and format the sentence

A. Extract & processed the images of sign taken from video using Image processing techniques
In this model only one person will be considered. Taking video by camera and input into the system. In this paper both one hand and two hand gesture including face are consider.
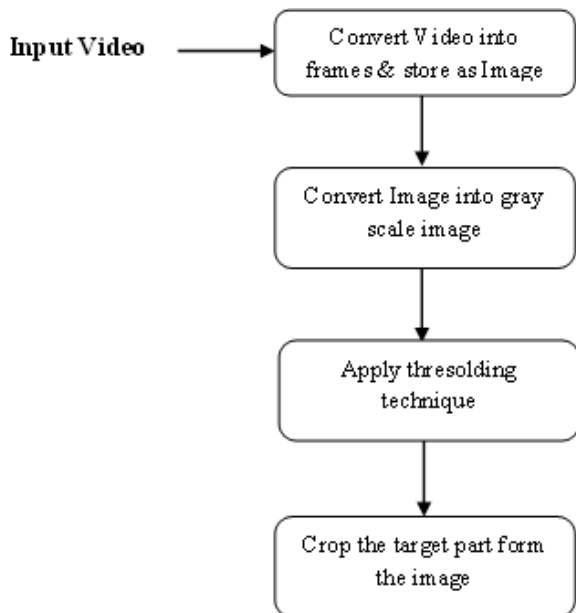
Figure 1. Filter and process the image of sign

As shown in Figure 1 frame Extraction will do by Video Capture Object. Then frames will be saved in jpeg image. Image will be converted into gray scale image. Apply otsu's thresolding technique on gray scale image to convert into the binary image. Then crop the target part from the image using skin color based segmentation.

B. Extract features from images using feature extraction technique
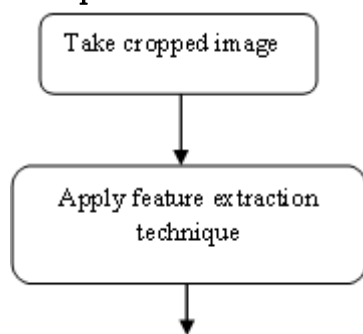
Collect different features of sign

Figure 2. Find Features of sign

Figure 2 shows that feature extraction method is apply on processed and target cropped images to extract features. This paper mention that we will going to use convex hull method to extract features like shape, area, angle, curve, exterior coordinates, and orientation for accurately recognize the word.

C. Classified and Indentified word of sign using classification technique
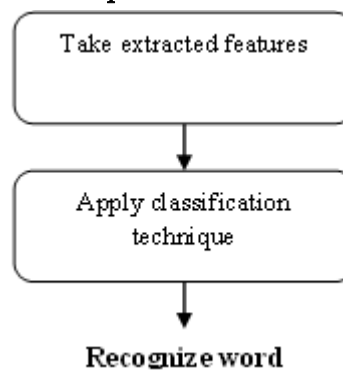

Recognize word

Figure 3. Recognize word using classification technique

- As shown in Figure 3, extracted features will be taken as inputs into classification technique which will perform reorganization and output should be the word.
- Current work will use Neuro-fuzzy classifier as classification technique to recognize the word by using of extracted features. A Neuro-fuzzy approach is termed as Neuro-fuzzy system. It is a hybrid of neural network and Fuzzy Logic (If-Then-Else Rules) shown below in figure 4.
- As shown in following figure-4, a Neuro-fuzzy system can be viewed as a 5-layer feed forward neural network. The first layer represents input variables, the middle (hidden) layer (combine by 3 layers) represents fuzzy system and the third layer represents output variables. Fuzzy sets are encoded as (fuzzy) connection weights.
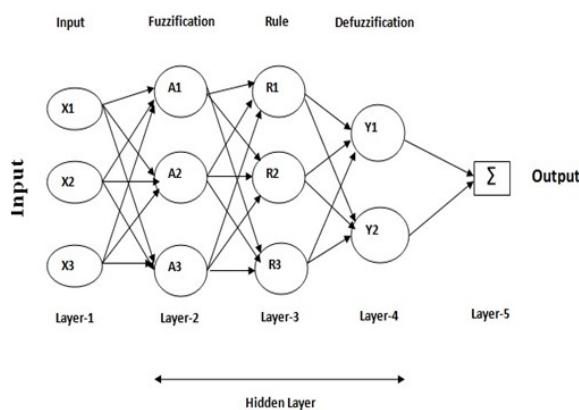

Figure 4. Neuro-Fuzzy System

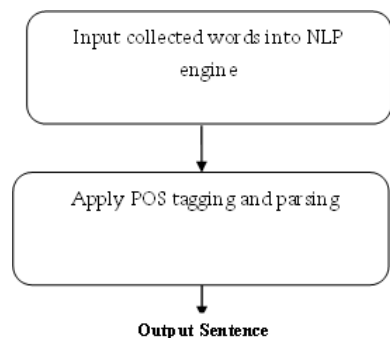## D. Apply NLP to collected words and format the sentence

Figure 5. Tagging and Parsing to format the sentence)
As per above Figure 5 Collected words will input into NLP engine then apply POS tagging and parsing.

- **POS tagging**

  Stanford POS tagging tool will be used to tag the word [10]. POS tagger tags the words by one of the part of speech like noun, pronoun, verb, adjective, adverb, preposition, conjunction, and interjection.

- **Parsing**

  Tagged words will apply to format the sentence. This model will use LR parser to parsing the meaningful sentence.

IV. ADVANTAGES OF TECHNIQUES

Table 1. Advantages of techniques

Methods	Techniques	Advantages
Segmentation	Otsu's thresolding	Useful in simple as well as complex background and also give fast response.
Future Extraction	Convex Hull	It is sensitive algorithm, give fast response and less memory usage. Easily extract convex points of hand segment as well as head segment.
Classification	Neuro-fuzzy Approach	Combination of Neural Network and
		Fuzzy logic can improve the efficiency of system. Both can overcome the limitation of each other by implementing together. This algorithm accurately recognizes word of sign from image by comparing with database.
POS tagging	Stanford POS Tagging tool	Easily Allot tags to the words for example noun, adjective, conjunction.
Parsing	LR parser	This algorithm easily handles language parsing and also better at error reporting. Accurately make the formation of sentence by adding verbs.

V. PREDICTABLE RESULT

Figure 6. Example of Sign Language Recognition system

VI. CONCLUSION

Main objective of this paper is to develop the system which translates sign of deaf & dumb people into English language for better communication between normal people and deaf & dumb people. Work is going on this system with the use of different methods/techniques. This paper proposed various methods like framing, Otsu's thresolding for segmentation, Convex Hull method for feature extraction, POS tagging, LR parsing. For classification of words we will go to use Neuro-Fuzzy System which is the combination of Neural Network and Fuzzy logic which can classify the various words of sign easily because of their efficiency. This system will be very useful to our society. Apart from proposed methods/techniques, we can also apply another image processing methods and various machine learning techniques to make this system better.

VII. REFERENCES

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