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Statıc Gesture Indian Sign Language Alphabet Recognition System Simulatıon

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ABSTRACT

This paper presents the simulation of static gesture Indian sign language alphabet recognition system. The simulation is done by using Euclidean Distance based classification technique for Indian sign language recognition system. This paper contains the proposed system comprising of four major modules: Data Acquisition System (DAS), Preprocessing, Feature Extraction and Classification. A special purpose image processing algorithm is proposed in this paper to recognize several signs of Indian Sign Language, which is based on Eigen vector and Euclidean Distance.

Keywords: Eigen vector Eigen value; Euclidean Distance; Recognition of Hand Gesture.

1. INTRODUCTİON

Sign Language Recognition (SLR) is one of the thriving fields of research today.The aim of SLR is to provide an efficient and accurate mechanism to transcribe sign language into text or speech. Recognition of different hand gestures are necessary for communication of deaf people. To accomplish this need, researchers have used several approaches for recognition of distinct gestures of hand, which were applied in many fields. The researchers have been used few approaches as: vision based, soft computing (ANN, GA, FL) and data glove based etc. There are three main categories of all approaches - Feature extraction, Hand segmentation and Gesture recognition.

For segmentation of hand gestures,many researchers [3-13] have been used skin filtering technique. Adaptive Boost algorithm is proposed byY. Fang et al.[14]. Researchers in [15-17] were presented external aid for segmentation purpose.the external aid used are data gloves, color gloves.

The Xtion PRO LIVE sensor was proposed by Zhou Ren et al. [26].
C.W.Ng and S.Ranganath [18] used Fourier descriptors to represent the shape of blobs.The findings of N.Tanibata et al. [24] used the extracted features.

D.Kelly et al. [25] are presenting a novel user independent framework. This framework is used to representand recognize the hand postures in sign language. It has been observed that there is a significant improvement in performance with proposed eigenspace Size Function.
The motive is to generate silhouette images [27, 28] Jagdish L. Raheja et al. [7] describes a unique method of fingertips.
S. Saengsri et al. [15] and M. V. Lamar et al. [19] used ANN for recognizing gestures.

For classification purpose, Gopalan et al. [3] are used to Support Vector Machine (SVM) in their paper. The paper explains that the linear non separable data becomes separable by the use of SVM.
Kim et al. [22] were presented the Korean Sign Language Recognition using Fuzzy

logic. Each set comprised ofdifferent speeds of the moving hand. Accuracy rate obtained was 94% but computation complexity was the drawback. Motivated by these works, the author of this paper proposed a special purpose image processing algorithm.The propose algorithm is based on Eigen vector and Euclidean Distance to recognize numerous signs of Indian Sign Language. Experiments weredone with bare handstoeliminate the problems of using the gloves.

Mathematically, Eigen values are used to measures the variance of data to get new coordinate system. The compression of the data is required in this paper. Therefore, few significant Eigen values were selected for compression of the data. The dimension of the data is also reduced by the compression process.

If matrix x is having n rows with one column vector.Consider [A] is a square matrix of dimension n by n.Therefore, the resultant column vector y matrix is the product of matrix Ax.

$$\begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} \rightarrow \begin{bmatrix} A_{11} & A_{12} & \cdots & A_{1n} \\ A_{21} & A_{22} & & A_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ A_{n1} & A_{n2} & \cdots & A_{nn} \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix} = \begin{bmatrix} y_1 \\ y_2 \\ \vdots \\ y_n \end{bmatrix} (1)$$

2.2 PROPOSED SYSTEM

Below Fig.1is the block diagram of the proposed system. This block diagram consist of following phases: Image Preprocessing, Image Segmentation, Feature Extraction and Classifier.The captured input image is processed through all four stages of the block diagram to produce the desired result from the output unit.

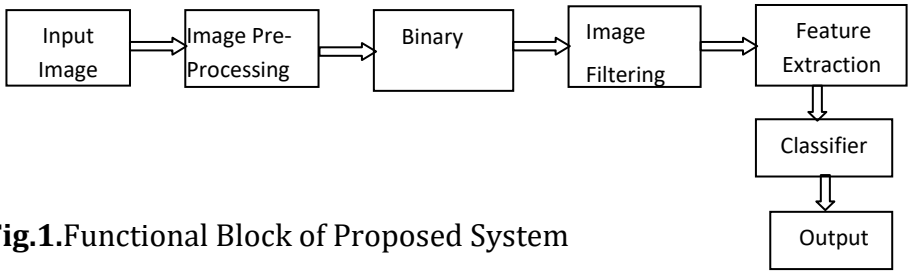

Fig.1. Functional Block of Proposed System

The proposed system of the paper has been taken 24 alphabets of Indian Sign Language.The 10 specimen are picked up for each alphabet. Thus, a aggregate number of images shoot by the camera is 240. Fig.2 shows the few database images for each alphabet. These hand gestures of Indian Sign Language (ISL) are usedfor recognition purpose. The images are saved in jpeg format. The experimental setuprequires a simple plain background. The specific part of this paper is that the user is not required to wear any special type clothes for prevention of the projection of arms. Because the proposed method does not include any wrist cropping technique.

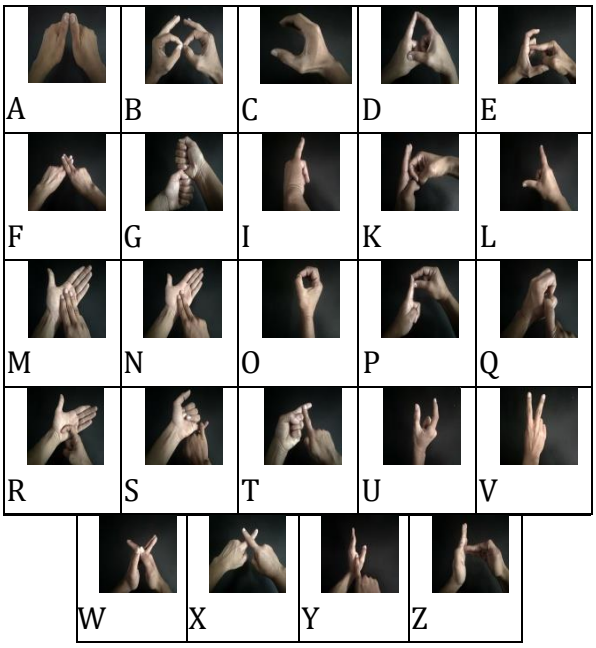

Fig.2. Selected database images

2.3 GRAYSCALE IMAGE

The captured hand gestures are in RGB color space. By using a function of MATLAB, the RGB image is converted in to gray scale images as the operations are easier to apply in a gray scale image.

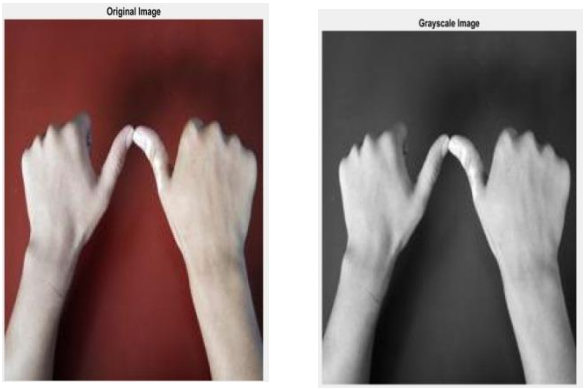

Fig.3. RGB Image and Grayscale Image

2.4 BİNARY IMAGE

In Fig. 4, the horizontal axis of the histogram is presented. In Fig.5, shows the obtained binaryimage after applying the thresholding operation.The vertical axis of Fig.5 represents frequency and horizontal axis represents response variable.

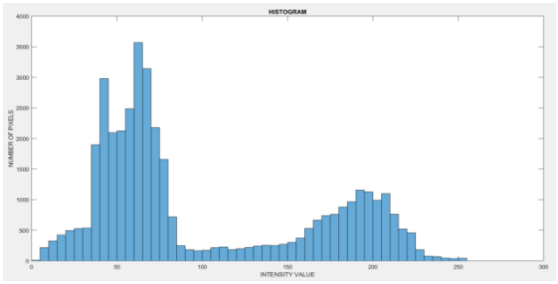

Fig.4. Histogram

Fig.5. Binary ımage

2.5 IMAGE FILTERING

The binary image is obtained after image segmentation process.But the image

Fig.5. Filtred Image

contains a salt and pepper noise that means when dark pixel is in bright region and light pixel is in dark region.

2.6 FEATURE EXTRACTION

The following mathematical steps are used to find theEigen values and Eigen vectors:

- Let X is input data as filtered image. The dimension of input image is 50 by50.
- The expected value (or mean value)of the vector X is computed by equation (2) as:

  $M = E\{X\}$ (2)
- Assume C is the covariance matrix and it was determined by equation (3) as:

  $C = E\{(X - M)(X - M)'\}$ (3)
- The covariance matrix C of equation (3) is used to compute the Eigen vectors and the Eigen values.
- The eigen vectors are organized in descending order corresponding to eigen values.

  In this paper, only five random eigen vectors has been considered out of 50.

2.7 CLASSIFIER

The Euclidean distances (ED) is computed by below equation (4) as:

$$ED = \sqrt{\sum_{n=1}^{m}(EV1(n) - EV2(n))^2} \quad (4)$$

where, EV1 = Eigen vectors of the test image.

EV2 = Eigen vectors of the database image.

3 RESULTS AND DISCUSSIONS

Different images of the Indian Sign Language (ISL) were tested. Table 2 presents Euclidean distance based classification to identify the gestures. The results of Table

2 were obtained by testing some images with other database images. Also, success rates of the classification are shown in Table 1 for all the signs of Indian Sign Language.

Table 1. Success rates of the Euclidean distance classification

Used Sy	No. of images for experin tion	Success rate in percentage
A	10	100%
B	10	90%
C	10	100%
D	10	70%
E	10	80%
F	10	90%
G	10	100%
I	10	80%
K	10	80%
L	10	90%
M	10	60%
N	10	60%
O	10	100%
P	10	80%
Q	10	90%
R	10	70%
S	10	70%
T	10	80%
U	10	70%
V	10	70%
W	10	80%
X	10	80%
Y	10	80%
Z	10	100%

From the above classification and table of success rates, the researchers were designed a system that was able to recognize different symbol alphabets of Indian Sign Language.

Table 2. Euclidean distance based classification

Test image	Database image	Euclidean Distance	Recog-nized Sym-bol
	A	0.0272	"A"
	B	0.7663	
	C	0.8058	
	D	1.2966	
	E	9.7540	
	F	2.8595	
	G	4.4216	
	I	9.7540	
	K	6.4854	
	L	1.5852	
	M	9.2814	
	N	7.3524	
	O	3.5132	
	P	3.3448	
	Q	2.2699	
	R	7.5291	
	S	0.1850	
	T	2.6170	

U	0.3531
V	6.8971
W	6.4153
X	2.3844
Y	3.0797
Z	**7.3962**

4 CONCLUSION AND FUTURE WORK

The simulation of the proposed system is carried out using twenty four static gesture alphabets of ındian sign language. The symbol recognition success rate for different alphabets was in the range of 60% to 100%. The proposed ındian sign language recognition system could be enhanced further to include recognition of dynamic gesture alphabets 'h' and 'j'.the algorithmused in this paper is succesfully implemented to meet the objective of the proposed system.

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