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Real Time Indian Sign Language Recognition System using SVM Classifier

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ABSTRACT : *In the field of Human Computer Interaction (HCI) lot of research has been done. One of the system sign language recognition give a solution for HCI. The system which we design called sign language recognition system. This gives the solution to build the Human Computer Interaction (HCI) where the computer is used as interpreters. These systems are used to recognize the real time static & dynamic sign convention by using MATLAB. Sign are captured using web camera & PCA technique is used for feature extraction. This proposed system can use for real time application due to the use of simple logic condition applied to recognize the sign.*

Keywords- *database; Covariance; PCA; SVM; Web Camera*

I. INTRODUCTION

In the day to day life communication is the main part of exchanging the information. Normal people can communicate with each other easily, but for the Communication between signing people and normal people Sign language Recognition or interpreter is helpful. In India around 60 million people are mute & deaf. Most people use signs during communication with these peoples. It is very difficult to understand & exchange the information between them. So between this gap there is need of interpreter required for communication between them. This interpreter can be performed the operation of translating the gesture into text or speech A sign language is a language that uses signs or action to communicate instead of sounds, but there is some problem occurs when they communicate due to in an absence of physical interpreter this sign language is helpful for both communities for communication purpose. This will provide opportunities for this people industry jobs, IT sector jobs and Government jobs etch. This Indian sign language is more suitable than traditional data flow system. The typical system can consist of mainly four modules Gesture acquisition, segmentation and tracking, feature extraction and description, classification and recognition.

In normally, sign language is understandable for the signer and the person who know the sign language but it is so much difficult for who does not know the sign language or meaning of any gesture [4].

A Sign language recognition system is developed into mainly two step first is database acquisition and second is classification. In our project we used images of Indian sign language as database and the system display the English alphabet, which the mute, deaf people want to tell. A regular camera with 5MP is used for acquiring this sign. For developing this project we need sign database with 26 English alphabets sign & 9 Numeric sign with proper images. Every number or every alphabet is assigned with a particular image. These images are in the form of .jpg

In feature extracting image which consists of large amounts of data can be automatically extracted from the image and also it is the process which is useful for collecting feature and image classification. In feature extraction method the original image is converted into grey scale. These excreted images are needed as input for classification. There are a number of classifier techniques available which are used for classifying the image. Classifier is the identification of input data with set of training data. In our work we use SVM classifier for image classification. SVM is a support vector machine used for the supervised learning model with an associated algorithm that analyzed data used for classification and analysis. SVM classifier is the method of performing the classification task. A total 30 second timer is used for these systems. First 5 seconds are used for capturing background and next 25 seconds are used for capturing the real time image. These captured images are then compared with the trained database and result display on screen.

II. LITERATURE REVIEW

There are different theories used for Indian Sign Convention presented by different authors. The surveyed literature on Sign Convention is as follows:

Rekha J, [2] proposed a system for static and dynamic alphabet sign. This system was used 23 static ISL alphabet signs from 40 different signers are collected as training samples and 25 videos are used as testing samples. The images are extracted by the method of Principle Curvature Based Region Detector. Multi class SVM, DTW & non-linear KNN are used as sign classifiers. The experiment result for static 94.4% and for dynamics it was 86.4%.

Geetha, M, and U C Manjusha [4] proposed a vision based recognition of Indian Sign Language characters and numerals using B-Spine approximations. This data set consists 50 samples of every alphabet and numbers The extracted boundary from the region of interest from image signs into a B-Spline curve by taking the Maximum Curvature Points (MCPs) as the Control points are used as features extraction technique. To classify input sign Support Vector Machine classifier is used and the recognition result is obtained around 90.00%.

Around 5% of the world community in all parts of the world is using sign language as a medium of communication [5]. After analysis of work by different authors some drawback is found. The first drawback is a dataset which is not in the standard form. Due to non standard dataset experiment conducted by researcher are not clear. The system which we are planned to be used in public places different types of noises or background present in acquiring sign. The second drawback which we found is that all the databases were developed in some laboratory. So the laboratory required more processing power or higher cost.

III. METHODOLOGY

The main aim of the project is "To analyze the Indian sign language character recognition with normal people." The objectives which will be fulfilled from the proposed system are:

1) Image Capturing
2) Image pre-processing
3) Segmentation
4) Input database
5) Feature extraction
6) Classification
7) Result and discussion

The proposed system is shown in the figure 1. If no standard data set is available to experiment on automatic recognition of ISL gestures, then Two data sets of ISL character signs are created. First set contains gestures belongs to alphanumeric character for Indian Sign Language and the second set contains ten digit number for Indian Sign Language. The details of acquiring of the data set are given in data set creation section.

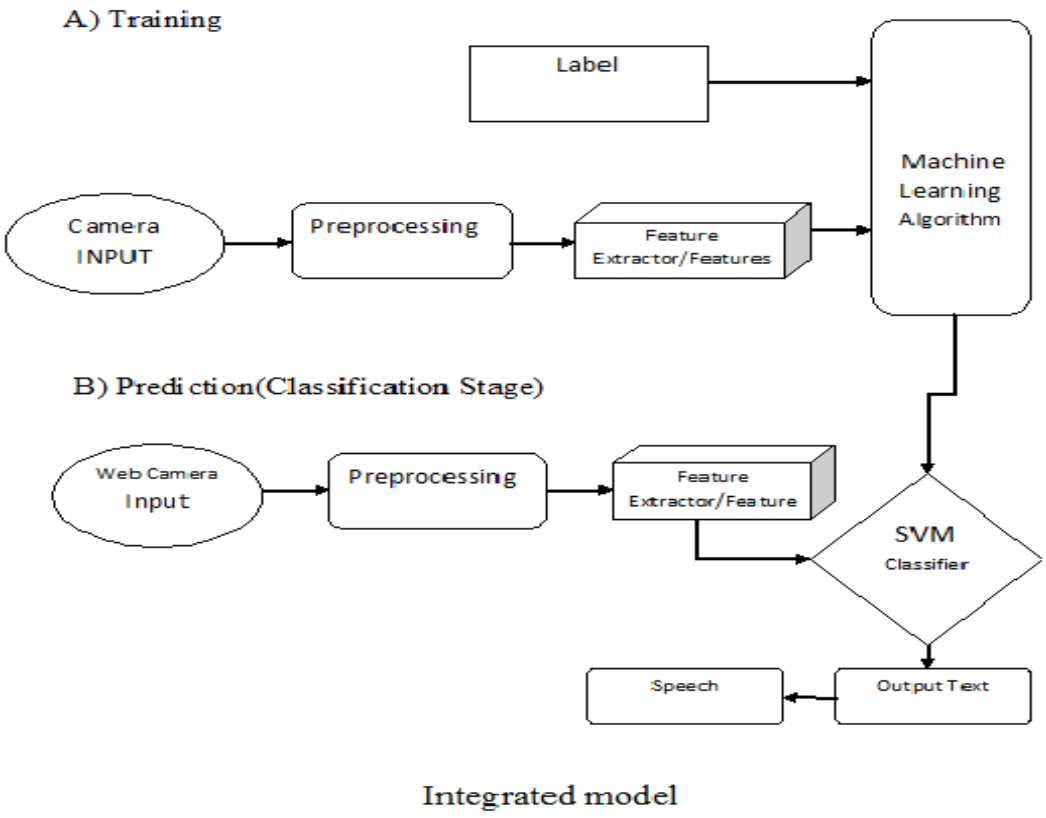

Fig1. Overview of proposed system

3.1 Image capturing –

Two types of dataset are creating for this experiment. In this dataset 10 images of single & double handed images are captured using a digital camera for each number with white background. These captured images are saved as input image in the form of 680X480 RGB pixel size. We adjusted 30 second time period for acquiring the image after start the web camera. These images are collected from single mute male person for each character. The webcam is used to capture the video as we give the command and it has given the degree of freedom to get the movement of hand gesture which is very essential part of communication with the machine. We use this images in the JPG format because it is very easy to extract the image in different hardware and software environment. The memory required for this dataset is nearly 40 KB. These images are flat rectangular shape in structure. For making of database web camera is activated with the "returned color space" property. This property is specified the color space as we want in the image box. When webcam will start it uses capture one frame with one trigger.fig show the captured image for the number of one, two and five.

Fig 2
Real time Captured image of One, Two and Five

3.2 Preprocessing –

After collecting the database from the user we need to preprocess that image. For removing low-frequency background noise, normalizing the intensity of the individual particle *images we use the preprocessing technique*, by using MATLAB Firstly, we convert RGB images into grey scale images (rgb to gray converter). This will convert RGB images to high intensity Grey scale images. In this step we can perform noise removal and segmentation operation. The main aim of preprocessing is to reduce unwanted distortion and an improvement in input data (sign language images). The Image preprocessing technique uses the considerable redundancy in images. Neighboring pixel corresponding to one object in real image has adjusted some or similar brightness value. For preprocessing median filter is used for reduce 'salt and pepper' noise in images. By using median filter smoothing, sharpening and edge enhancement operation are performed. The main use of median filter is that it can run through signal entry by entry or it can replace each entry with median of neighboring entries. Each output pixel contains the median value in the 3-by-3 neighborhood around the corresponding pixel in the input image.

3.3 Segmentation:-

The captured image converts the gray scale image into binary (black and white) image by using dithering. The output image replaces all pixels in the input image with luminance greater than level with the value 1 (white) and replaces all other pixels with the value 0 (black).image is resized with 256X256 number of rows and column by using the bilinear transformation method.

These methods can convert analog to digital filter conversion for mathematical mapping of variable. In digital filtering it is standard method of mapping the s analog plane into z digital plane.

Fig3
Segmentation result of Captured image of One, Two and Five

3.4 Input Database:-

Input database is the part of training of the images. Every number consist of the 10 preprocessed images for each number used for database of particular number with scaling rotation. This preprocessed images are stored in one folder known as trained database. For the process of training, every image is stored with the extension of .bmp (eg 1_1.bmp,1_2.bmp, 1_*.bmp etc.)in white background for getting more accurate result. After starting the webcam video we adjust the timer of 30 second for acquired the image as input data. First 5 seconds are used for detect the background.

Fig4
Database for input image one

3.5 Feature Extraction:

Every image consists of large amounts of data, for reducing these data automatically extracted from the images is called as feature extraction. Here we use the Principal component analysis method for extracting the features from images. The input data which are to be processed is transformed into a reduced representation set of features. This is referred as feature extraction technique. The Feature Extraction stage is necessary because certain features have to be extracted so that they are unique for each gesture or sign [8].

PCA (Principal Component Analysis):

Linear Discriminant Analysis (LDA), Independent Component Analysis and PCA are some of the techniques used for feature extraction, among them PCA is a powerful method in image formation, Data patterns, similarities and differences between them are identified efficiently.

The other main advantage of PCA is dimension will be reduced by avoiding redundant information, (Daugman,1993) without much loss. Better understanding of principal component analysis is through statistics and some of the mathematical techniques which are Eigen values, Eigen vectors. PCA is a useful statistical and common technique that has found application in fields such as image recognition and compression. Principal Component Analysis (PCA) is a mathematical procedure that uses linear.

PCA is a technique which can use mathematical procedure for transformations to map data from high dimensional space to low dimensional space. The low dimensional space can be determined by Eigenvectors and Eigenvalue of the covariance matrix.

The steps involved in PCA include:

• The mean value S of the given data set "S" is found and Eigen vector of giving dataset are "U"
• Subtract the mean value say from S. from these values a new matrix is obtained. Let say "A"
• Covariance is obtained from the matrix, i.e., C =AAT Eigen values are obtained from the covariance matrixes that are V1V2V3V4…VN,
• Finally Eigenvectors are calculated for covariance matrix C
• Any vector S or S S − can be written as linear combination of Eigen vectors shown in Eq. 5
• Because covariance matrix is symmetric it form basis V1V2V3V4…VN S S − = b1u1+b2u2+b3u3+…+bNuN (5)
• Only Largest Eigenvalues are kept to form lower dimensional data set (Eq. 6):

lS S b u ; l N ɵ − = < ∑i 0 = l l (6)

For performing the PCA operation step by step function implemented are

1] Function [U, S, X_reduce] = PCA(X, n)

Where X_reduce are the dataset with n dimension size, X is dataset with each instance as a row & n has reduced dimensions size which has default value 50.

2] m = size(X, 1);

Sigma = (1/m)*(X'*X);

Sigma calculates the singular values of the frequency response of a dynamic system.

3] [U S] = svd(sigma);

The svd command computes the matrix singular value decomposition.

4] For making the database firstly convert the matrix n dimension into zeroes.

5] Calculate the Eigenvectors for the database.

6] Display on command window as "PCA operations". For each image of database, perform the PCA operation.

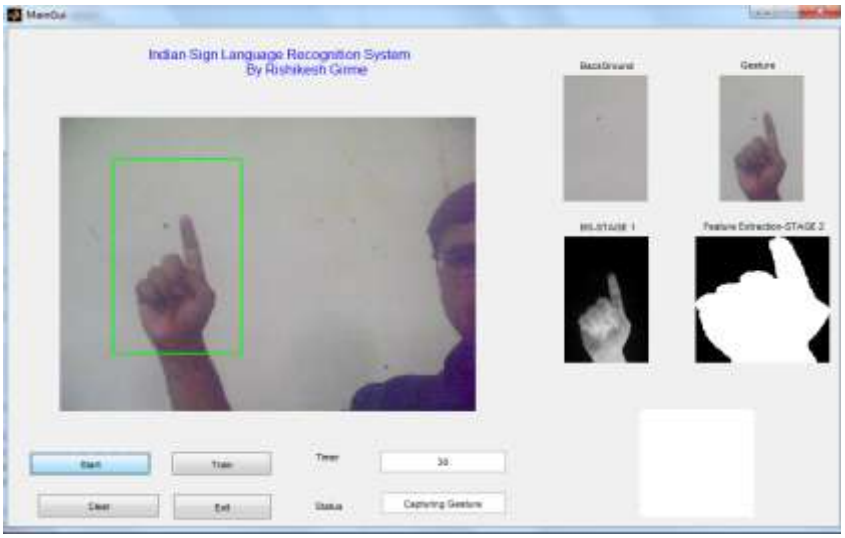

Fig5
Processing stage for input image ONE

3.6 Classification:

For performing a classification task many types of technique are available, but we use here multiclass SVM classifier i.e. Support vector Machine. Multi SVM is a Models has given training set with a corresponding group vector and classifies a given test set using an SVM classifier according to a one vs. all relation. First, we find the unique value of the array of group train, then finds the number of elements along the largest dimension of an array. Then build the model for Vectorized statement that binaries Group where 1 is the current class and 0 is all other classes.

The support vector machine searches for the closest path known as "support Vector". Once it found the closest point, then the SVM draws a line for connecting them. The support vector machine, then declares best separating line which bisect and perpendicular to connecting lines. We perform classification by finding the hyper plane for differentiating between two classes. Support vector machine are simply the coordinate of individual observation. SVM classifier classifies each row of the data in Sample, a matrix of data, using the information in a support vector machine classifier structure as SVM Struct, created using the svm train function. Like the training data used for create SVMStruct, Sample is a matrix where each row corresponds to an observation or replicate, and each column corresponds to a feature or variable. Therefore, Sample must have the same number of columns as the training data. This is because the number of columns defines the number of features

7] Display result

The recognized hand gestures are display in the form of Number Image, character Image or audio. Figure 6 shows the display result of sign one, two and five format. Experiment are performed on ten different numbers. The accuracy of the above system is greater than 90%.

Fig6
Shows the result of input image for the number of one, two and five

IV. Conclusion

The general performance metrics such as False Accept Rate, False Reject Rate are chooses for performance analysis of proposed Systems. The False Acceptance Rate and False Rejection Rate for these systems are below 2%. In the dynamic recognition method for the real time (10 times or 10 for each class) of 10 images are incurred. we get 100 images for the database. For the testing time, expect 5 sign all the images are give the correct result. The sign recognition result recognition rate is 95%. Different testing sample give the different result recognition rate. This Recognizing system is capable numerical sign with high accuracy using SVM (Support Vector Machine) Classifier. The coding is done in real time environment with the uniform light condition and plain, white background.

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