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Design of ASL Recognition System Using MATLAB

Nitesh S. Soni[1], Prof. Dr. M. S. Nagmode[2], Prof.R. D. Komati[3]

PG Student [VLSI& Embedded Systems], Dept. of E&Tc, MIT College of Engineering, Pune, Maharashtra, India[1]

Professor, Dept. of E&Tc, MIT College of Engineering, Pune, Maharashtra, India[2]

Asst. Professor, Dept. of E&Tc, MIT College of Engineering, Pune, Maharashtra, India[3]

ABSTRACT: The proposed system, helps to recognise gestures used in American Sign Language for the people unknown to it. This system provides an opportunity for deaf and those hard of hearing to communicate with normal people not knowing the sign language, as help of interpreters is not possible for everyone and everywhere. Many country's has own sign language, such as ASL, ISL, etc. This paper presents the use of MATLAB for implementation of the system. Here, the sign capturing is done using web cam. Pre-processing on the captured image is done and features are extracted using PCA. Comparison of the features is done using Euclidean Distance with the training sets. Minimum Euclidean distance helps to recognise the character. This system helps to bridge the barrier between the physically challenged persons and the normal.

KEYWORDS: Sign language, Euclidean Distance, PCA.

I.INTRODUCTION

Sign Language is not only used by those hard of hearing and the speech impaired persons to communicate either with each other or the normal persons, but it is used by many people to communicate. Sign language does not mean the use of hand gestures only, it can be any kind of sign using any part of body, it may be eyes, legs, etc. This language varies from country to country. Here, the Signs of ASL is used for development of the system for recognition of signs. Some of the challenges experienced by speech and hard of hearing people while communicating with normal people were social interaction, communication disparity, education, behavioural problems, mental health, and safety concerns [3]. The ways in which one can interact with computer are either by using devices like keyboard, mouse or via audio signals, while the former always needs a physical contact and the latter is prone to noise and disturbances [3].

Physical action carried by the hand, eye, or any part of the body can be considered as gesture. Hand gestures are the most suitable and easily interpretable for humans. Here, single handed gesture recognition system is proposed, it usesright handed gestures, and are classified and recognised for the specific character. Static gesture recognition system proposed here does not require any colour code. The sign recognition system proposed, recognizes the sign with great accuracy and with less features and lesser time.

II. LITERATURE SURVEY

Development of manynovel methods has been done in past few years, to facilitate interpretation of signs for special person's interaction with the normal people. Mrs.NeelaHarish, Dr.S.Poonguzhali [1], proposed a system which depends on flex sensors, accelerometers output values such as, co-ordinates given by accelerometer and the bending values given by the flex sensors, for the interpretation of signs. Depending on the. Suganya R, Dr.T.Meeradevi, [2] implemented a system using Feed Forward Neural Network, for identifying hand gestures characteristics & to train gestures captured.

DhananjaiBajpai, et al. [4], proposed a system enabled to decode more than 36 gestures using 6 flex sensors, to recognise corresponding alphabets, or corresponding features. Pre-requisite for using this system to perform gesture recognition and store it in the database is not needed. Vision based systems mainly uses colour information for detection of hand. They use skin colour models or different colour gloves [10].

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III.FLOW OF ALGORITHM

1. *Input image*

Input image can be captured using web cam. The images captured has there specified format, supported by the device. The resolution and the format supported by the connected device, i.e. web cam can be found using the command: "imaqhwinfo('winvideo')"
This command provides the details such as:
AdaptorDllName: [1x81 char]
AdaptorDllVersion: '4.5 (R2013a)'
AdaptorName: 'winvideo'
DeviceIDs: {[1]}
DeviceInfo: [1x1 struct]
Use of device ID we can made to get the supported format by the web cam for the image. The captured image has to be resized to the size of the stored images of the data set. Thusmatrix of the images are of same size and can be used for mathematical calculation of Euclidean distance.

2. *Pre-Processing*

Pre-processing is required on every image to enhance the functionality of image processing. Image segmentation is used to detect the object in the image of interest. Hand region can be located in the captured image usingimage segmentation. Background subtraction is the first step of pre-processing, rgb to grey conversion is the second step & finally segmentation using Otsu's thresholding method is done. Segmentation is done to divide image into two regions, background and the foreground containing region of interest i.e. hand region. The segmented image has the hand region with the pixel value '1' and the background as the '0'. This image is then used as a mask to get the hand region from the rgb image by multiplying the black and white image i.e. binary image with the original rgb image, plane by plane. The size of image is resized to reduce size of the matrix, used for the recognition process.

3. *Feature Extraction*

Feature extraction is the most significant step in recognition stage. Here, features are extracted using PCA technique, from the hand region cropped from the signer to recognize gestures, corresponding character. Firstly, column matrix of all the images is formed, mean is calculated and it is subtracted for normalisation, mean subtracted image is found. Eigen vectors and Eigen values can be found from the normalised matrix.

4. *Sign Recognition*

Detection of human hand in white background will enhance the performance of image pre-processing, in terms of accuracy and speed. Training phase and the recognition phase are two Sign recognition phases.

Training phase: In this training set for the system to recognise the specified gesture is done. During the generation of the training set the images are pre-processed and are stored. Column matrix is generated for each of the image of dataset. Using column matrix Eigen vector is calculated. Eigen vector matrix is then multiplied with each of the column vector formed of the dataset images.

Recognition phase: Input gesture is normalised with the mean calculated of the dataset, and Eigen vectors are used for projecting the input image on the dataset. Maximum score using Euclidean Distanceis calculated and the gesture is recognised to display therecognised character to corresponding input gesture.

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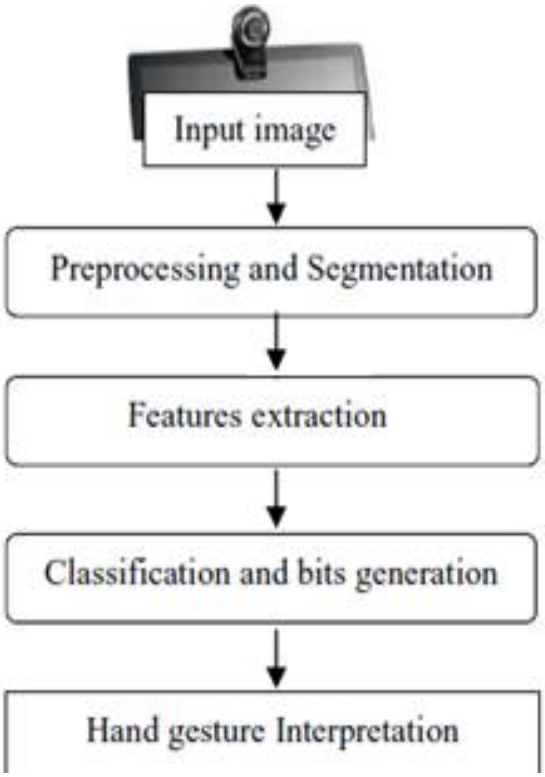

Fig.2 Flowchart of the implementing algorithm[3]

Steps to calculate Eigen vector are as follows[5]:

This steps are carried on the training set to find the features of stored images.

Step1: Create the database of the hand gestures to be recognised for the Signer. Here, we have created 10 images per gesture.

Step2: Each of the image in the database is transformed as the column vector and is stored with the dimensions as the count of the images in the dataset.

Step3: Mean vector is calculated and the mean is subtracted from each of the column vector to normalize the vectors. Mean is calculated using the formula as:

$$\mu = \frac{1}{M}\sum_{n=1}^{M} T_n$$

where, M is the number of column matrix.

Step4: Subtract the mean from each of the column vector of the database. This result is stored in the temp.

$$temp = T_i - \mu$$

Step5: Calculation of Eigen vector from the covariance matrix of the stored database.

Eigen values with significance are kept, rest of the values can be deleted as they explain least significant features.

Steps carried for the recognition phase are as follows:

Step1: Capture the input image using the web cam.

Step2: Input image is converted into column vector and normalised.

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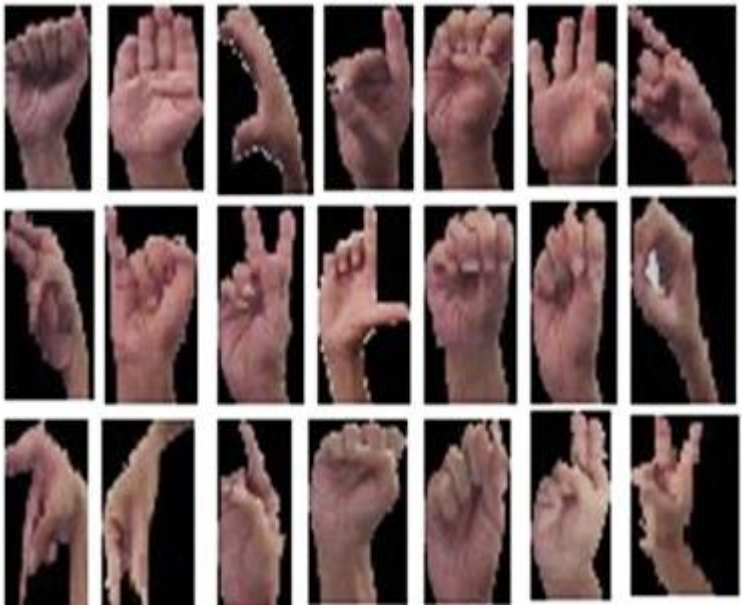
Step3: Now, using the Euclidean distance formulae, distance of the test vector (input image vector) with each of the vectors present in the dataset is calculated and character is recognised.

IV.RESULT

The dataset of 24 characters is shown below. This dataset is used for the training process. The dataset captured are of single person and with the same hand. The characters 'J' & 'Z' are not shown as they are the dynamic characters, while rest of the characters shown below are static.



Here the input image and the images after every transformation is shown only for the character 'L', as it is not possible to show for every character.

a) Input image

b) Grey image

c) Segmented image

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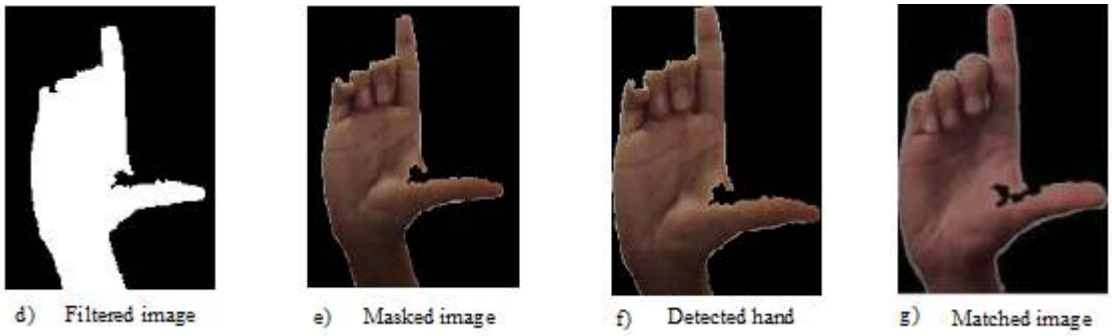
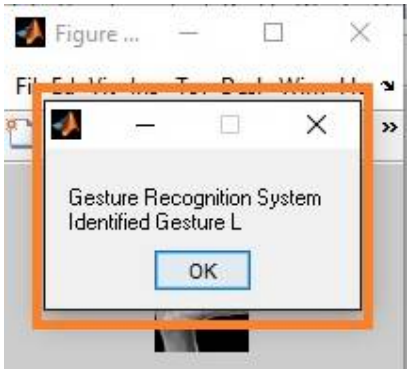


d) Filtered image e) Masked image f) Detected hand g) Matched image

Here, the image 'a' is the input image captured using the web cam. Then it is converted in to grey image 'b', image 'c' is the segmented image. After morphological operations image 'd' is generated. Hand region is detected using segmented image mask as shown in image 'e'.Image 'f' is cropped from the image captured 'a' to recognise the gesture. Image 'g' is the image with maximum matched score from the dataset. The dialogue box shows the character corresponding to the input gesture.



Recognised character

V. APPLICATION

Hard of hearing and speech impaired persons make use of sign language to communicate. The application of this system is to provide a platform with high accuracy to interpret the signs, enabling normal human being to understand gesture. The recognised character can be displayed as well as pronounced.

VI.CONCLUSION

Gesture recognition system using PCA technique is developed having comparable accuracy, i.e. with the other systems or implemented techniques. Mute and hard of hearing persons need interpreters to communicate, to remove the third party interference special persons can use this system to communicate directly with the normal people, with no knowledge of sign language.

REFERENCES

[1] Mrs.NeelaHarish ,Dr.S.Poonguzhali, "Design and development of hand gesture recognition system for speech impaired people",International Conference on Industrial Instrumentation and Control (ICIC) College of Engineering Pune, India. May 28-30, 2015.

[2] Suganya R, Dr.T.Meeradevi, "Design Of A Communication Aid For Physically Challenged",in IEEE Sponsored 2nd International Conference On Electronics And Communication System (Icecs 2015),2015.

[3] [3] P Raghu Veera Chowdary, M Nagendra Babu, ThadigotlaVenkataSubbareddy, BommepalliMadhava Reddy, V Elamaran, "Image Processing Algorithms for Gesture Recognition using MATLAB", IEEE International Conference on Advanced Communication Control and Computing Technologies (ICACCCT), 2014.

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[4] MeenakshiPanwar and Pawan Singh Mehra, "Hand Gesture Recognition for Human Computer Interaction", International Conference on Computing, Communication and Applications (ICCCA), Dindigul, Tamilnadu, India, Feburary 2012.
[5] Liton Chandra Paul, Abdulla Al Sumam, "Face Recognition Using Principal Component Analysis Method", in International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 1, Issue 9, November 2012.
[6] AdiIzharChe Ani, AnisDiyanaRosli, RohaizaBaharudin, MohdHussaini Abbas, MohdFirdaus Abdullah, "Preliminary Study of Recognizing Alphabet Letter via Hand Gesture", in Computational Science and Technology (ICCST), 2014 International Conference, Kota Kinabalu, India, August 2014.
[7] Meenakshi Panwar and Pawan Singh Mehra , "Hand Gesture Recognition for Human Computer Interaction", International Conference on Computing, Communication and Applications (ICCCA), Dindigul, Tamilnadu, India, Feburary 2012.
[8] SruthiUpendran, Thamizharasi. A, "American Sign Language Interpreter System for Deaf and Dumb Individuals" in International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT), 2014.
[9] A. SharmilaKonwar, B. Sagarika Borah, C. Dr.T.Tuithung, "An American Sign Language Detection System using HSV Color Model and Edge Detection", International Conference on Communication and Signal Processing, April 3-5, 2014.
[10] Pravin R Futane , Rajiv v Dharaskar,"Hasta Mudra anvinterpretatoin of Indian sign hand gestures", internationalconference on digital object identifier, vol.2, pp:377-380, IEEE,2011.
[11] AdiIzharChe Ani, AnisDiyanaRosli, RohaizaBaharudin, MohdHussaini Abbas, MohdFirdaus Abdullah, "Preliminary Study of Recognizing Alphabet Letter via Hand Gesture", International Conference on Computational Science and Technology (ICCST), 2014.
[12] Dhruva N. and Sudhir Rao Rupanagudi, Sachin S.K., Sthuthi B., Pavithra R. and Raghavendra, "Novel Segmentation Algorithm for Hand GestureRecognition", International Multi-Conference onAutomation, Computing, Communication, Control and Compressed Sensing (iMac4s), 2013.
[13] HaithamHasan, Sameem Abdul-Kareem, "Human-computerinteraction using vision-based hand gesture recognition systems:asurvey", Neural Comput&Applic, 2013.
[14] Paulo Trigueiros,Femando Ribeiro, Luis Paulo Reis"Generic System for Human-Computer Gesture Interaction",IEEE International Conference on Autonomous RobotSystems and Competitions (ICARSC). Espinho, Portugal.pp.175-180, May 2015.
[15] StergiosPoularakis and IoannisKatsavounidis, " FingerDetection And Hand Posture Recognition Based OnDepthInformation", IEEE International Conference onAcoustic, Speech and Signal Processing (ICASSP). pp. 4329-4333,2014.
[16] Ruize Xu, Shengli Zhou, and Wen J. Li, "MEMS Accelerometer Based Nonspecific-UserHand Gesture Recognition", IEEE Sensors Journal, Vol. 12, No. 5, May 2012.
[17] Zhou Ren, Junsong Yuan, JingjingMeng, and Zhengyou Zhang, Fellow, "Robust Part-Based Hand GestureRecognition Using Kinect Sensor", IEEE Transactions On Multimedia, Vol. 15, No. 5, August 2013.
[18] DharaniMazumdar, Anjan Kumar Talukdar,Kandarpa Kumar Sarma, "Gloved and free hand tracking based hand gesture recognition", 1st International Conference on Emerging Trends and Applications in Computer Science (ICETACS), 1st International Conference on 2013.