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A System for Recognition of Indian Sign Language for Deaf People using Otsu's Algorithm

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Abstract *- Sign Language Recognition System is one of the important researches today in engineering field. Number of methods are been developed recently in the field of Sign Language Recognition for deaf and dumb people. It is very useful to the deaf and dumb people to convey their message to other people. In this paper we proposed some methods, through which the recognition of the signs becomes easy for peoples while communication. We use the different symbols of signs to convey the meanings. And the result of those symbols signs will be converted into the text. In this project, we are capturing hand gestures through webcam and convert this image into gray scale image. The segmentation of gray scale image of a hand gesture is performed using Otsu thresholding algorithm.. Total image level is divided into two classes one is hand and other is background. The optimal threshold value is determined by computing the ratio between class variance and total class variance. To find the boundary of hand gesture in image Canny edge detection technique is used.*

Keywords: *Indian Sign Language, Feature Extraction, Edge Detection, Sign recognition, Color, Texture .*

1. INTRODUCTION

It has been observed that Dumb people find it really difficult at times to communicate with normal people with their gestures, as only a very few of those are recognized by most people. Since people with hearing impairment or deaf people cannot talk like normal people so they have to depend on some sort of visual communication in most of the time. [2].
There are many ways to define a sign .Sign Language can be defined as structured code gesture and every every gesture has meaning assigned to it.

Sign Language is the only one technique for communication for deaf people. With the advancement of science and technology many methods have been developed to minimize the problem of deaf people and also to implement it in different fields. Many research works related to Sign languages have been done as for example the American Sign Language, the British Sign Language, the Japanese Sign Language, and so on. But very few works has been done in Indian Sign Language recognition till date.[1]

It becomes difficult finding a well experienced and educated translator for the sign language every time and everywhere but human computer interaction system for this can be installed anywhere possible. The motivation for developing such helpful application came from the fact that it would prove to be of utmost importance for socially aiding people and how it would help increasingly for social awareness as well. Sign languages can be categories in different types like, Indian Sign Language, British Sign Language, American Sign Language etc. In our approach, we are capturing symbol of sign language using webcam. Then, the system compares the input sign with signs stored in the system database, and presents the most similar signs to the user in text form. The user can then view the results and decide which (if any) of those results is correct.

2. GESTURES

A gesture may be defined as a movement, usually of hand or face that expresses an idea, sentiment or emotion e.g. rising of eyebrows, shrugging of shoulders is some of the gestures we use in our day to day life. Sign language is a more organized and defined way of communication in which every word or alphabet is assigned some gesture. In American Sign Language (ASL) each alphabet of English vocabulary, A-Z, is assigned a unique gesture. Sign language is mostly used by the deaf, dumb or people with any other kind of disabilities. With the rapid advancements in technology, the use of computers in our daily life has increased manifolds. Our aim is to design a Human Computer Interface (HCI) system that can understand the sign language accurately so that the signing people may communicate with the non signing people without the need of an interpreter.[3] It can be used to generate speech or text. Unfortunately, there has not been any system with these capabilities so far. A huge population in India alone is of the deaf and dumb. It is our social responsibility to make this community more independent in life so that they can also be a part of this growing technology world. In this work a sample sign language [4] has been used for the purpose of testing.

It is hard to settle on a specific useful definition of gestures due to its wide variety of applications and a statement can only specify a particular domain of gestures. Many researchers had tried to define gestures but their actual

meaning is still arbitrary. Bobick and Wilson have defined gestures as the motion of the body that is intended to communicate with other agents. For a successful communication, a sender and a receiver must have the same set of information for a particular gesture.

As per the context of the project, gesture is defined as an expressive movement of body parts which has a particular message, to be communicated precisely between a sender and a receiver. A gesture is scientifically categorized into two distinctive categories: dynamic and static .

3. SIGN LANGUAGE

Sign languages are the natural form of languages that being used from when the first theories of sign languages appeared in history. It has started to use even before the human being does not know the spoken languages. Since then the sign language has evolved and been adopted as an integral part of our day to day communication process. Now a days, sign languages are being used extensively in international sign use of deaf and dumb, in the world of sports, for religious practices and also at work places. Gestures are one of the first forms of communication when a child learns to express its need for food, warmth and comfort. It enhances the emphasis of spoken language and helps in expressing thoughts and feelings effectively.
There are many area of application where sign language is usefull like airline area ,sports etc. .In airports, a predefined set of gestures makes people on the ground able to communicate with the pilots and thereby give directions to the pilots of how to get off and on the run-way and the 5 reference in almost any sport uses gestures to communicate his decisions. In the world of sports gestures are common. The pitcher in baseball receives a series of gestures from the coach to help him in deciding the type of throw he is about to give. Hearing impaired people have over the years developed a gestural language where all defined gestures have an assigned meaning. The language allows them to communicate with each other and the world they live in.
A functioning sign language recognition system could provide an opportunity for the deaf to communicate with non-signing people without the need for an interpreter. It could be used to generate speech or text making the deaf more independent. Unfortunately there has not been any system with these capabilities so far. In this project our aim is to develop a system which can classify sign language accurately

4.CANNY EDGE DETECTOR

The segmentation techniques used in our project are 1)Edge based 2)Threshold based.In Edge Based Segmention method
Boundaries of regions are sufficiently different from each other and from the background to allow boundary detection based on local discontinuities in intensity.

4.1 Edge based Segmentation:

The Canny edge detection algorithm is known to many as the optimal edge detector. Canny's intentions were to enhance the many edge detectors already out at the time he started his work. He was very successful in achieving his goal and his ideas and methods can be found in his paper, "A Computational Approach to Edge Detection"[5]. In his paper, he followed a list of criteria to improve current methods of edge detection. The first and most obvious is low error rate. It is important that edges occurring in images should not be missed and that there be no responses to non-edges. The second criterion is that the edge points be well localized.
In other words, the distance between the edge pixels as found by the detector and the actual edge is to be at a minimum. A third criterion is to have only one response to a single edge. This was implemented because the first two were not substantial enough to completely eliminate the possibility of multiple responses to an edge. [6]

Three basic objectives of canny edge detector are:
1)Low error rate – All edges should be found and there should be no spurious responses. That is, the edges detected must be as close as possible to the true edges.
2)Edge points should be well loacalized – The edges located must be as close as possibly to the true edges. That is, the distance between a point marked as an edge by the detector and the center of the true edge should be minimum.
3)Single edge point response –The detector should return only one point for each true edge point. That is the number of local maxima around the true edge should be minimum. This means that the detector should not identify multiple edge pixels where only a single edge point exists.

4.2 Threshold Based Segmentation

It creates binary images from grey-level ones by turning all pixels below of the threshold value to zero and all pixel above threshold to one. We are using otsu's method for threshold based segmentation
The method is optimum in the sense that it maximizes the between-class variance, a well-known measure use in statistical discriminate analysis. The basic idea is that well-threshold classes should be distinct with respect to the intensity value of their pixels and conversely , that a threshold giving the best separation between classes in terms of their intensity values would be the best (optimum) threshold . In addition to its optimality, otsu's

methods has the important property that it is based entirely on computation perform on the histogram of and image, an easily obtainable 1-D array.

5. METHODOLGY

The methodology follows has following main steps
1) Generation of Database
2) Algorithm for Edge Based Segmentation
3) Otsu's Global Thresholding Algorithm
4) Window Design

5.1 Generation Of Database

In this project all operations are performed on gray scale image. We have captured images through web cam and to generate database we have stored the row weights of the images in Excel sheet. The database consists of 25 hand gesture of Indian sign language. The letter j, z have been discarded for their dynamic content .The system works offline recognition i.e. We give test image as input to the system and system tells us which gesture image we have given as input. The system is purely data dependent.
We take gray scale image here for ease of segmentation problem. A uniform black background is placed behind the performer to cover all of the workspace. The user is required to wear a black bandage around the arm reaching from the wrist to the shoulder. By covering the arm in a color similar to the background the segmentation process is fairly straight forward.
A web camera is used to capture the hand gesture performed by performer. The resolution of grabbed image is 640*480. Each of the gestures/signs is performed in front of a dark background and the user's arm is covered with a similar black piece of cloth, hence easy segmentation of the hand is possible.

5.2 Algorithm for Edge Based Segmentation

Let f(x,y) denote the input image &G(x.y) denote the Gaussian function:
$G(x,y)=e-((x2+y2)/2a2)$
$fs(x,y)= G(x,y)*f(x,y)$
This operation is followed by computing the gradient magnitude and direction (angle)
Magnitude, $M(x,y) = \sqrt{(gx2+gy2)}$
And Direction, $\alpha(x,y) = \tan-1(gy/gx)$
With $gx = \delta f/\delta x$ and $gy = \delta fs/\delta y$
M(x,y) & α(x,y) are arrays of the same size as the image from which they are computed. Because it is generated using the gradient, M(x,y), typically contains wide ridges around local maxima.

Next step is to thin ridges by using non-maxima suppression. This is to specify a number of discrete orienting of the edge normal.

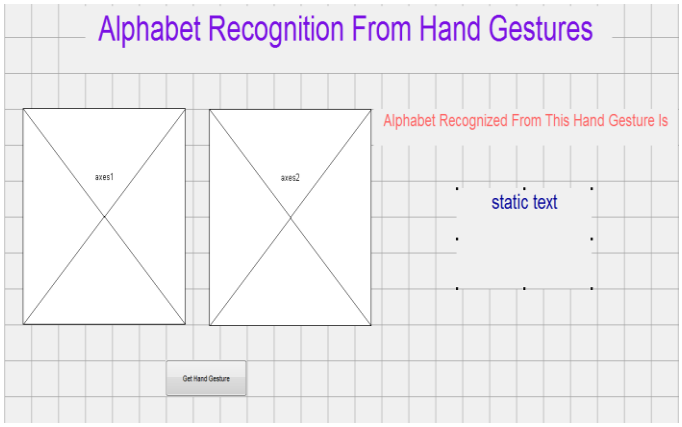
Let gN(x,y) = 0 (suppression) otherwise, let gN(x,y) = M(x,y)
Where, gN(x,y) is the non-maxima suppressed image.
Final step is to threshold gN(x,y) to reduce false edge points.
gNH(x,y) = gN(x,y) >= Th&gNL(x,y) = gN(x,y) >= Tl
After the thresholding operations, all strong pixels in gN(x,y) are assumed to be valid edge pixels & are so marked immediately.
Steps in canny edge detection algorithm:
1. Smooth the input image with a Gaussian filter
2. Compute the gradient magnitude & angle images
3. Apply non-maxima suppression to the gradient magnitude image
4. Use double thresholding & connectivity analysis to detect & link edges

5.3 OTSU'S Global Thresholding Algorithm

Here [7], author described 1D Otsu algorithm. This algorithm is widely used because of its simple calculation and stability. Here the algorithm works on only gray value of the image. The 1D Otsu algorithm only consider the pixel's gray-level information without considering the pixel's spatial neighborhood information , so it is difficult to obtain satisfactory segmentation result.
This algorithm fails, when the global distribution of the target and background vary widely.Also it gives good segmentation effect but never work on image when the two classes are very unequal.In this paper authors proposed a new method based on Entropy which gives better result compare to 1D Otsu algorithm[8].
Steps in otsu's global thresholding algorithm
1. Select an initial estimate for the global threshold T.
2. Segment the image using T. This will produce two groups of pixels; G1 consisting of all pixels with values >T, and G2 consisting of pixels with values <= T.
3. Compute the average (mean) intensity values m1 & m2 for the pixels in G1 & G2 respectively.
4. Compute a new threshold value: T = ½(m1+m2).
5. Repeat steps 2 through 4 until the difference between values of T in successive iterations is smaller than a predefined parameter ΔT.

5.4 Window Design

Graphics and graphical user interface programming MATLAB supports developing applications with graphical user interface features. MATLAB includes GUIDE (GUI development environment) for graphically designing GUIs. It also has tightly integrated graph-plotting features.
The constructional view of GUI & its property inspector are show as shown in following figures



In our project we have created GUI as shown in above fig. We have taken two axes control to show captured image and the edge detected image of the input image. We have created the push button to capture the image through webcam and also added the static text box to show the corresponding text of the gesture.

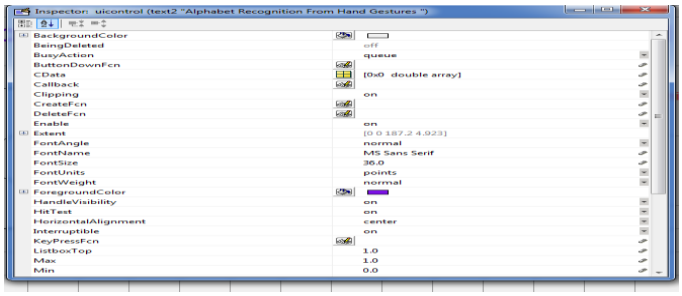


Fig.1 Property inspector

Results

OUTPUT WINDOW:

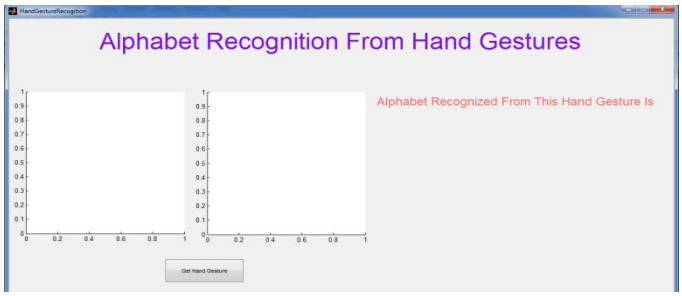


Fig 2: Initial Output window

SELECTING GESTURE:

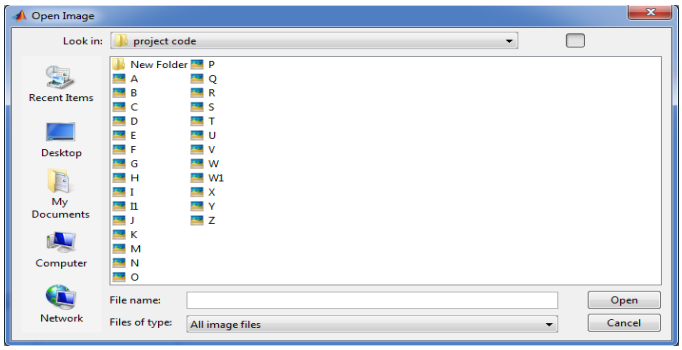


Fig 3: Selecting gesture

RESULT:

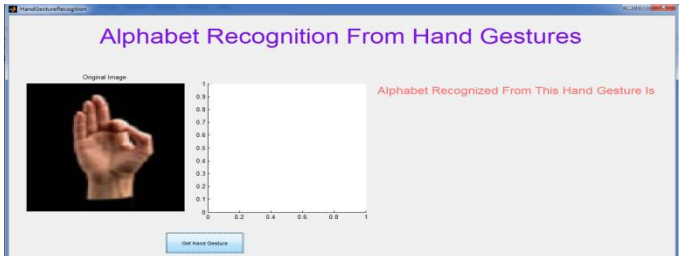


Fig 4. First output screen

Fig 5 Final result

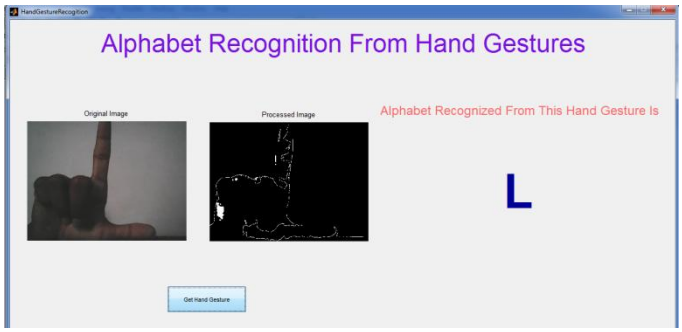


Fig 6 Real time output

In above figures we have shown two types of result. Fig 5 shows the result by processing database images and fig 6 shows the result for real time image captured by webcam.

7. CONCLUSION

From last few years a lot of research has been going on in gesture recognition area. The aim of this project was to develop an offline Gesture recognition system. We have shown in this project that gesture recognition system can be designed using Image processing . One can use offline gesture or online that real time gesture. The processing includes the first steps of generating a database of symbols of sign language.
Otsu algorithm is used for segmentation purpose and gray scale images are converted into binary image consisting hand or background. We have successfully recognize symbol of hand gestures and converted it to display into corresponding text.

REFERENCES

[1]Joyeeta Singha, Karen Das, "Indian Sign Language Recognition Using Eigen Value Weighted Euclidean Distance Based Classification Technique," (IJACSA) International Journal of Advanced Computer Science and Applications, Vol. 4, No. 2, 2013

[2] Sawant Pramada1, Deshpande Saylee 2, Nale Pranita3, Nerkar Samiksha4 Mrs.Archana S. Vaidya, "Intelligent Sign Language Recognition Using Image Processing ",IOSR Journal of Engineering (IOSRJEN) e-ISSN: 2250-3021, p-ISSN: 2278-8719 Vol. 3, Issue 2 (Feb. 2013), ||V2|| PP 45-51

[3]Er. Aditi Kalsh1, Dr. N.S. Garewal "Sign Language Recognition System," International Journal of Computational Engineering Research||Vol, 03||Issue, 6||.

[4]Panwar.M. Hand Gesture Recognition System based on Shape parameters. In Proc. International Conference, Feb 2012

[5]J.F.Canny."A computational approach to edgedetection". IEEE Trans. Pattern Anal. Machine Intell., vol. PAMI-8, no. 6, pp. 679-697, 1986

[6]Raman Maini & Dr. Himanshu Aggarwa, "Study and Comparison of Various Image Edge Detection Techniques

[7]Zhong Qu andLi Hang" Research on Iimage Segmentation Based on the Improved Otsu Algorithm",2010

[8] Miss Hetal J. Vala,Prof.Astha Baxi , "A Review on Otsu Image Segmentation Algorithm,"I SSN: 2278 – 1323International Journal of Advanced Research in Computer Engineering & Technology (IJARCET)Volume 2, Issue 2, February 2013.

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