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An Approach to Hand Gesture Recognition for Devanagari Sign Language using Image Processing Tool Box

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Abstract - *In all over world, Sign languages are now recognized as a full fledges languages of the deaf communities that use them. The paper proposes a useful design system for hand gesture image recognition to give an easy method for communication between visually impaired and normal person. The Devanagari each alphabet is denoting as special hand gesture with number, Different alphabet for their own original alphabet meaning, This number identifies Devanagari alphabet with their own voice. This numbering method is trained to the deaf communities in their learning techniques or in their syllabus. The separate number identifies for a self or separate Devanagari alphabets. The aim of this paper to develop a system which convert single sign language to a number and then identify Devanagari alphabet. First off all the Devanagari Sign language or alphabet has their own meaning with a particular number & this is trained a system. The result mainly depends upon lighting conditions and any background but for more accuracy we can use white background or any & by considering any background distortion is occur , this can be remove by Filter, all this possibility our Devanagari system gives up to more percentage. We develop a system by using feature extraction method & image processing tool box.*

***Key Words*: Devanagari Sign language, Image processing tool Box, Graphical User Interface, Sign Acquiring Methods & Gaussian filter.**

1. INTRODUCTION

India is the 2nd most populated country in the world around one billion people with India. In this over million people are suffering from a problem of hearing and loss of vision also. In that one percent who are deaf and twelve percent for the hearing problems. But in previous days, there are many peoples are suffering from hard of hearing is more because of poor hygienic conditions in backward areas and lack of adequate medical services in rural areas at a particular time of any emergency, . Sign language system is one of the way to communicate between deaf and dumb people. By proper knowledge of hand gesture we can communicate or talk and hear properly without training of sign language. We cannot communicate with dumb people because of sign language is one of the way to communicate, training is must before communication with dumb people. A physical action by using hands & eye we can communicate. The proposed system which useful for dumb people in that each Devanagari alphabet is trained with a particular number (decimal number any character) then turn this number to Devanagari alphabets. The number indicating system is useful for many words or any sentence.

Hand gesture recognition is mainly of two types static and Dynamic in that static requires image processing and video processing for Dynamic. In this paper the main area of focus is static for communication. Communication between hearing impaired peoples are having different sign language for their respective countries. Devanagari sign language is used as interactive language in India. The samples of hand gestures for Devanagari sign language which includes 13 swaras & 33 vyanjan. This paper stream upon converting Devanagari gesture into a particular number, in that there are around 200 images are collect in database each alphabet denote with a number for training purpose, then the voice is recorded by this number and when image is captured then the voice for the particular alphabet.

2. LITERATURE REVIEW

Among the relevant research contribution the J. R. pansare and S. H. Gawande proposed the hand gesture recognition system for recognition of American Sign Language. In this paper, there are many combinations of algorithms used. Most of the images are stored in the database for more accuracy [1]. Sign language is combination of different hand gestures and hand movements, eye expression. Deaf and dumb people use different types of gesture for communicate with each other [1]. Each gesture or movement of hand and facial or body movement has different meaning [2]. Different sign language of particular place depends upon spoken language & their culture [1]. Aim of developing hand gesture recognition system is to establish a system for deaf and dumb people hence recognize the hand gesture automatically [4] [5]. There are two types of hand gesture one is static and another one is dynamic. There is difference between static and dynamic, static requires less computational complexity & Dynamic requires more computational complexity. Some of the researcher concentrates on the image acquisition, hand gesture recognition and classification of gestures sign language. Arabic sign language recognition [6], American Sign Language recognition [7], Spanish sign language recognition [8], and Tamil sign language recognition [9] contributed

more on this area. A sign language is a small collection of all possible forms of gesture communication. Sign languages are most of them symbolic natures like hand movements. Hand gesture includes sign language involves manuals and non manual signal.

3. SIGN LANGUAGE RECOGNITION

Devanagari is a compound of deva and nagari, Devanagari is written from left to right. The main advantage of Devanagari, all alphabets are symmetrical round shape and horizontal line on the top of words or letter. The nagari script is used in seventh century. The Devanagari language or script used over 120 languages. Devanagari language consists of fourteen vowels & 35 consonants. Sign language recognition and identification is an integral part & identifying in deaf culture. The normal people never try to learn sign language for communication with deaf peoples for that reason day by day communication gap between deaf and normal people. The important aim of this proposed work is to develop a Devanagari sign language recognition for normal and visually impaired people. The Devanagari alphabets are captured by image acquisition and each alphabets indicated by a particular number. In the training the database trained by each alphabet with number and then these number stores a voice of those particular alphabets.

4. PRESENT WORK

For the current work we have used around 50 images of each (alphabets of Devanagari) Devanagari alphabets. In the separate folder we collect all images of maximum alphabets. We have collected more databases for better result. We have designed a system in those vowels and consonants images of each alphabet stores voice and written form image in the number format. It means the voice and image is store in that number value. In Matlab tool audio recorder function is used for recording function; audio recorder creates an 8000 Hz, 8-bit, 1–channel audio recorder object. y is a handle to the object. The audio recorder object supports strategies and properties which will use to record audio data. A Video is captured for one word testing, and then result is more for maximum storage of database.

This System is useful for the visually impaired people. The key module of this present work is shown in table.

Table 1- Devanagari Alphabets with Notification

Sr. No.	Images	Devanagari Notation
1.		अ
2.		ब
3.		क
4.		स
5.		ड
6		ज

5. SIGN ACQUIRING METHODS

5.1 Leap Motion Controller

Leap Motion controller may be a small USB computer peripheral that is meant to be placed on a desktop. It will even be mounted onto a virtual reality receiver section, using two monochromatic IR cameras and three infrared LEDs mounted on for better performance. The device observes a roughly hemispherical space, to a distance of about one meter. The LEDs generate pattern less IR light [10] and also the cameras generate nearly two hundred frames per second of reflected data.[11] This is then sent through a USB cable to the pc or laptop computer for image acquisition method , wherever it's analyzed by the Leap Motion package using complex maths in an extremely means has not been disclosed by the company. In some way synthesizing 3D position Image data by comparing the 2D frames generated by the two cameras.[12] In a 2013 study, the overall average accuracy of the controller shown to be 0.7 millimeters.[3]

The smaller observation space and better resolution of the device differentiates the product from the kinect that is a lot of appropriate for whole-body following in a very area the

dimensions of a front room. P. Karthick et. Al [13] used to convert sign language to text. In this proposed system. The combination of DTW and LS algorithms for convention of hand gesture to text. Neural network is used for training purpose in this project. Leigh Ellen potter at. Al [14] used leap motion controller for recognition of Australian sign language. In that the store hand movement and converts to commands into the computer. Artificial neural_network is used for training all alphabets. The disadvantage of that system was low accuracy and less result found.

5.2 Gloves

This method uses different sensor to detect a particular hand gesture. Hand Gesture signal is in the form of analog for analog to digital conversion ADC converter is used. Gloves are consist of flux sensor & accelerometer in this paper.[15]

6. METHODS

6.1 Image acquisition

In this method, we will capture the image through the imaging device such as web cam and all images will be stored into the database for the purpose of matching the image. The images will be capturing through basic mode of mat lab for image acquisition and each input is stored by a particular number into folder then this number also stored a voice of the alphabets. The image is captured using 8 mega pixel web-cam or we can capture a image by laptop. Image capturing can be done by different color space methods basis such as RGB, Gray & HSV. By this web cam we can convert into HSV and gray images.

6.2 Region & Feature Extraction

Feature extraction is done by using convex hull method, for each and every object there are many features, interesting points on the object or image that can be extracted to provide a feature description of the object. Convex hull feature extraction provides a set of features of an object.

7. PROPOSED HAND GESTURE RECOGNITION SYSTEM

A. Image capturing
B. Image preprocessing
  -Skin detection
  -Noise removal using filters
C. Feature Extraction
These Stages are explained below:

7.1 Image Capturing

First image capturing is the main step in this system, the image is captured using 8 Mega pixel web cam. Image capturing can be done by different color space methods such as RGB, Gray and HSV. Our system uses the RGB color space model to capture the image. 8 mega pixel web cam is used, shows the camera model used in the system.

7.2 Image Preprocessing

Preprocessing consists of image acquisition, Gaussian filtering methods; filtering techniques are used to remove noises from images, So that we can get a smooth convex hull. The preprocessing operation is done on the collected database.

7.3 Noise removing

Filtering of Grey image is completed using Gaussian Filter for conserving edges and image smoothening from database

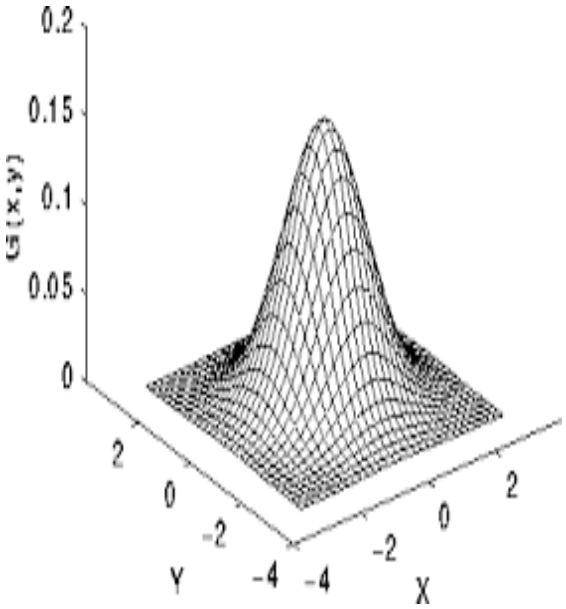

Fig 1 : Gaussian Filter

7.4 Feature Extraction

For this purpose we have collected images of each alphabet store in a separate folder. We can use any background for database images. Because of any background the some distortion is occurring but that can be removed by using Gaussian filter. We have applied our previously various techniques to extract features. ANFIS classifier is trained with the designed feature set to more accurate result or experimental result. Convex hull feature extraction provides a set of features of an object. In this proposed work we add a filter to remove background distortion. In Previously research work already use ANFIS system to trained the system but for one alphabet in that accuracy is more around 90%, we tried for 5-6 alphabet in their less accuracy for voice & sign recognition.

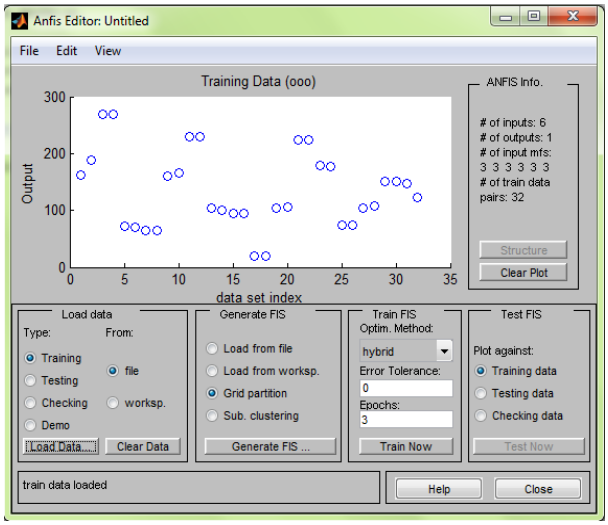

Fig-2: (a) ANFIS Training Data

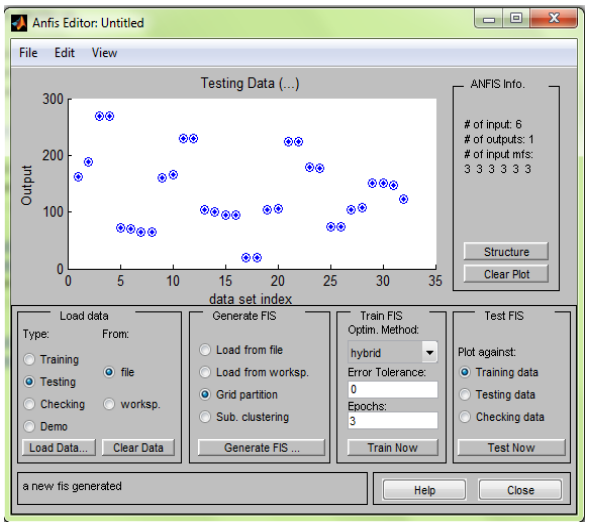

Fig-3:(b) Testing Data

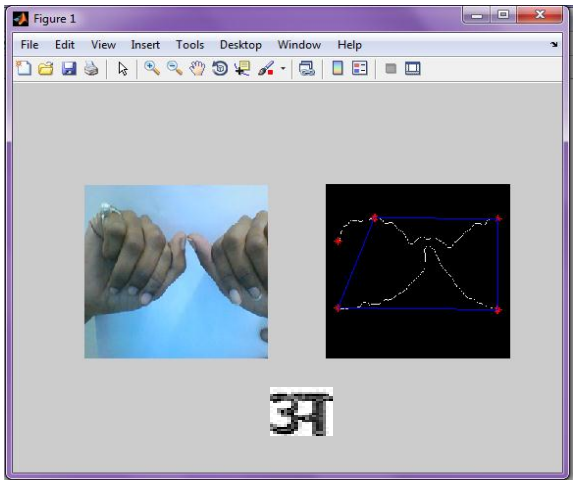

Fig 3: (a) Feature Extraction by Convex hull

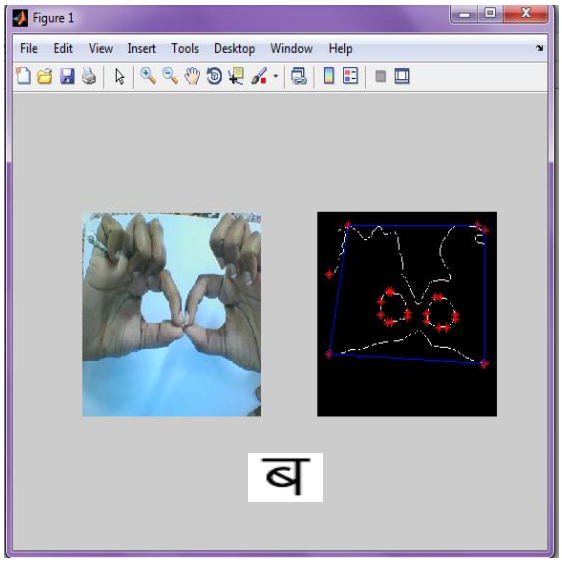

Fig 3: (b) Feature Extraction by Convex hull

8. EXPERIMENTAL SETUP

The database contains the maximum number of images of training data. The 8 mega pixel camera can be used; the hand gesture should be taken in plane background or any background. The lighting condition should be sufficient light on input hand gesture. The distance of hand gesture from camera should be at any distance.

9. EXPERIMENTAL RESULT

The performance of this proposed methodology for Devanagari sign language recognition using convex hull is evaluated for 14 hand gesture. For this experiment about 25 samples of each alphabet are stored in the database. The captured sample is matched with stored sample & when the match is replaced with a particular separate number to each alphabet and also the number voice is stored & then converted into voice. According to experimental results the obtained accuracy for various alphabets on an average is 91.1%

10. CONCLUSIONS

This paper consists of slightly closer to building sign language recognition system that well performs under natural background or white background. The proposed method gives output in voice and Devanagari alphabets forms that helps to reduce generation gap between deaf & deaf & dumb people. The simulation result shows the sign recognition rate of the system is over 93.3%. In future, this work will be extended to all the letters and moving sign capturing in Devanagari signs

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