International Journal of Engineering and Techniques - Volume 3 Issue 3, May-June 2017

RESEARCH ARTICLE OPEN ACCESS

Survey on Hand Gesture Recognition Using American Sign Language

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Abstract:

Hand Gesture is defined as static movement e.g. making a fist and holding it in certain position is considered as gesture. Complex gesture, fingers can be bent at angles other than zero or ninety degree. It include various forms of pinching, the "okay" sign and many of the gestures used in finger spelling. Dynamic movement such as waving goodbye. Simple gestures are made in 2 ways. First way involves simple or complex gesture and change in position or orientation of the hand such as making a pinching gesture and changing hand position. Second way moving the fingers in some way with no change in position and orientation of hand. e.g.: moving the index and middle finger back and forth to urge someone to move closer. Complex gesture includes finger movement, wrist movement and changes in hand position and orientation. Many signs in American Sign Language are example of gesture. Number of gesture that given recognition system or algorithmic techniques can accurately recognized. 1 to 15 postures and gestures is considered small set, 15 to 25 medium sized and anything over 25 are considered large. Technique for a Human Computer Interface through Hand Gesture is able to recognize 25 Static Gestures from American Sign Language Hand Alphabet. In these there will be using of matlab software is used and there will be different types of images will be captured from the webcam. From there the interactions with system and meaningful information will be easily available.

Keywords — **Hand Gesture Recognition, American Sign Language, Gesture Recognition, Kinect Depth .**

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I. INTRODUCTION

Now days, Sign Language is a form of hand gestures involving visual motions and signs, which are used as system of communication notably by the deaf .Hand Gesture Recognition is very useful in real time applications. It is necessary to make computer knows the meaning of human computer interactions. Gesture means a non verbal communications in which visible part communicate particular message. Motions of body contain information. Gesture provides a way for computers to understand human body language. Deals with the goal of interpreting human gestures via mathematical algorithm. Enables human to interface with the machine and interact naturally without any input device like Mouse, Keyboard.

Various types of gesture recognitions are i.e. Iris Recognition, Face Recognition, Sign Language, Voice Recognition etc.

The main aim of this paper is to design of intelligent human – computer interface by recognizing meaningful expressions.

In these there will be a capturing of image from webcam or camera and the image will be subtracted from the background and the hand region will be extracted from white background and from that the palm location of centroid in hand will be done and then from that it will be shown with green color as centroid of image. Again after that it will be again image will have boundary points or edge will be seen by red line around the image which is extracted. Finally from these image will be available and from that the it will matched with the system database and it will compared with that image , finally the meaningful expressions will be known.

In these various techniques are like how edged detection techniques, wavelet energy signature is used and various techniques are present. In these American sign database will be used and then we will have testing database to be used in the system. When the image will be captured from webcam at that time system will capture the image and from that meaningful information will be known easily.

This paper is organized as follows: The proposed model architecture will be shown in section 2. Section 3 consists of different methods or different techniques which can be used in the system. Conclusion of this study is presented in section 4.

II. RELATED WORK

In [1] , Chong Wang propose in these paper there is comparison between Finger Earth Mover Distance Shaped context distance and path

similarity, super pixel earth movers distance achieves better performance, it is efficient for the real time applications.

In [2] , Jayshree Panare suggested Hand Gesture Recognition System (HGRS) for detection of American Sign Language (ASL) alphabets has become essential tool for specific end users (i.e. hearing and speech impaired) to interact with general users via computer system. ASL has been proved to be a powerful and conventional augmentative communication tool especially for specific users. ASL consists of 26 primary letters, of which 5 are vowels and 21 are consonants. Proposed Real-time static Alphabet American Sign Language Recognizer- (A-ASLR) is designed for the recognition of ASL alphabets into their translated version in text (i.e. A to Z). The architecture of A-ASLR system is fragmented into six consequent phases namely; image capturing, image pre-processing, region extraction, feature extraction, feature matching and pattern recognition. We have used Edge Orientation Histogram (EOH) in A-ASLR system. The system is developed for detection of ASL alphabets based on Vision-based approach. It works without using colored gloves or expensive sensory gloves on hand. Our A-ASLR system achieves the recognition rate of 88.26% within recognition time of 0.5 second in complex background with mixed lightning condition.

In [3] ,Vi N.T.Truong ,suggest , Viola and Jones's study is a milestone in developing an algorithm capable of detecting human faces in real time. The original technique was only used for the face detection, but many researchers have applied it for the detection of many other objects such as eyes, mouths, car's number plates and traffic signs. Amongst them, the hand signs are also detected successfully. This paper proposed a system that can automatically detect static hand signs of alphabets in American Sign Language (ASL). To do that, we adopted the two combined concepts AdaBoost and Haar-like classifiers. In this work, to increase the accuracy of the system, we use a huge database for training process, and it generates impressive results. The translator was implemented and trained using a data set of 28000 samples of hand sign images, 1000 images for each hand sign of Positive training images in different scales, illumination, and the data set of 11100 samples of Negative images. All the Positive images were taken by the Logitech Webcam and the frames size were set on the VGA standard 640×480 resolution. Experiments show that our system can recognize all signs with a precision of 98.7%. Input of this system is live video and output is the text and speech.

In [4] ,Cheok Ming Jin, Due to the relative lack of pervasive sign language usage within our society, deaf and other verbally-challenged people tend to face difficulty in communicating on a daily basis. Our study thus aims to provide research into a sign language translator applied on the smartphone platform, due to its portability and ease of use. In this paper, a novel framework comprising established image processing techniques is proposed to recognise images of several sign language gestures. More specifically, we initially implement Canny edge detection and seeded region growing to segment the hand gesture from its background. Feature points are then extracted with Speeded Up Robust Features (SURF) algorithm, whose features are derived through Bag of Features (BoF). Support Vector Machine (SVM) is subsequently applied to classify our gesture image dataset; where the trained dataset is used to recognize future sign language gesture inputs. The proposed framework has been successfully implemented on smartphone platforms, and experimental results show that it is able to recognize and translate 16 different American Sign Language gestures with an overall accuracy of 97.13%.

In [5] ,Celal Savar ,Sign Language Recognition (SLR) system is a method which allow deaf people to communicate with society. In this study, Real-Time Sign Language recognition system was proposed by using the surface Electromyography (sEMG). To this purpose, sEMG data acquired from subject right forearm for all twenty six American Sign Language gestures. Raw sEMG data was filtered, feature extracted and fed into classification. Support Vector Machine (SVM) with one vs. all approach was used for multi class classification. The experiment result of offline system is reaching a recognition rate of 91.% accuracy and real-time system has a recognition rate of 82.3% accuracy.

The results of the proposed system shows that sEMG signal can be used for Real-Time SLR systems.

III. PROPOSED MODEL

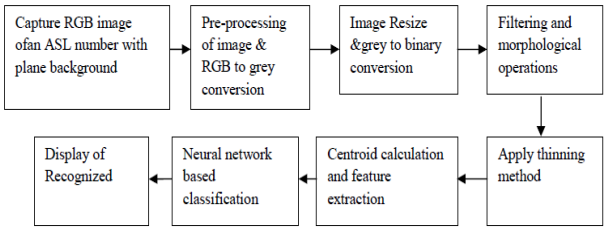

Figure 1 : Proposed Model

The whole system functioning is divided into four main modules namely:

- Image capture and Pre-processing
- Binary image conversion and Morphological operations
- Image thinning and Feature extraction
- Classification

A. *Image capture and Pre-processing :*

The colour image of the sign of an ASL number with a plane black background is captured by a webcam a concentrating on the palm of the hand. The plane background is used for simplicity of processing at the initial stage. The extracted image of ASL gesture from the signer is first pre-processed to enhance the image's quality. For this low pass filtering and median filtering is applied to the input image. Further, the colour image is converted to grey scale image and is resized to 256 x 420 image. Initially, the datasets created by us. The total of 300 images are captured for training, which consists of 30 images for each sign , by a single , along with a separate set of, a total of 376 images of all sign, for testing. The database is made robust such as the images are scale independent and contains rotated samples between +45 and -45 degree in order to make system robust.

B. *Binary image conversion and Morphological operations:*

The resized grey image is converted to a binary image with an appropriate threshold that converts the background to black and foreground i.e. palm to white. Also further filtering and morphological operations are applied to remove noise.

C. *Image thinning and Feature extraction:*

Image thinning is applied to some extent to a binary image in order to get clear separation among the fingers. The extent of thinning is limited so that the image is not totally converted to a skeleton. The morphological from Image Processing toolbox of MATLAB(R2010a) is used for image thinning. The centroid of the hand is obtained and with this centroid as centre, the circle is plotted so that it cuts all the open fingers of the hand. Further, features are extracted. Here the equivalent distance, i.e. the number of black pixels traced by the circle between the two adjacent fingers is used as the feature vector for classification. Here the circle is traced anti-clock wise starting from bottom of image . The number of black pixels are counted back to back and stored in a vector form. The amount of separation between the respective fingers for different signs of an ASL numbers is different, thus giving the different type of vector sequence. This vector obtained itself is a feature vector which is used for further recognition.

D. *Classification:*

Multi-layeredfeed forwardback-propagation Neural Network based classification engine is also there but in these there will be used of Support Vector Machine is used. Initially, it is trained with feature vectors obtained from training set consisting of 30 images of each ASL number obtained from a single user. The feature vector obtained from the actual test image is applied to this trained dataset for classification or recognition of an ASL number. Further, the detected Sign can be displayed in text form.

IV. DIFFERENT TECHNIQUES USED IN HAND GESTURE RECOGNITION

The proposed work is to implement the following steps in Matlab : In Pre-Processing there will be Class Generation, Segmentation, Noise Removal and Morphological Filtering Pre-processing consist image acquisition, segmentation and morphological filtering methods. It is used for segmentation purpose and gray scale images is converted into binary image consisting hand or background .Morphological filtering techniques are used to remove noises from images so that we can get a smooth contour.In Feature Extraction there will be Texture Based Feature, Wavelet Energy Signatures, Runlength Matrices, Local Gabor Binary Pattern Histogram Sequence. In Shape Based Features there will be Edge Detection, Boundary Estimation
In Geometric Features there will be Estimation Of Palm Centre, Fingertip Positions, Mean Brightness, Moment Invariant Features (Rotational and Scale Invariant).

It is used Local contour sequence as our prime feature. Canny edge detection technique is used to detect the border of hand in image.In these Matching , a contour tracking is applied to find the contour and pixel in contour is numbered sequentially. Local contour sequence for any arbitrary pixel is calculated as perpendicular distance from the chord connecting end points of window size *w*. In Performance Evaluation there will be Computation of Accuracy where the accuracy of the techniques will be found easily. In Database there will be two types of database will be used i.e. American Sign Language and Self Generated Database.

Tests	Percentage of dataset	Accuracy
Training set	50%	95.00%
Cross Validation set	25%	92.12%
Test set	25%	91.73%

Figure : Result of offline test

V. Conclusion and Future Work

This paper presents various algorithms for Hand Gesture Recognition. As paper presents, there will be used of distance measure is used and techniques work with accuracy and works smoothly. Even there will be meaningful expressions of the image is given by the computer itself e.g. If two fingers shown then it will give the information that it is sign of victory. In future work, different techniques will improve performance and high accuracy. In recent years a lot of research has been conducted in gesture recognition. The aim of this paper was to develop an offline Gesture recognition system, so work can be done for real time purpose.

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11.

BIOGRAPHY

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