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Hand Motion-Recognition in an Intelligent Communication Module

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Abstract— ***our country India consists of very high population. Almost 9 millions of population in this world can be counted as a deaf or dumb people or both. We all know that the most valuable gift from the god given to human is the capability to watch, hear, spoke & to give response as per the situation arises. We all know communication is one of the most important medium through which one may carve up his/her feelings or express the information to others. The key points in communication are ability of listening and speak the word but so many from us are unlucky because they are not gifted by this ability from the god these are deaf & dumb and people. Now a days so many researches are going on to solve difficulties of these people of our society because they had to face very hard to communicate with normal person. It is too hard for mute(deaf & dumb) people to transmit their information to the normal people. As all normal people are not fully trained to understand different sign lingo, the communication between these two types of people becomes too complex. At the time emergency or other days whenever a mute (Deaf & Dumb) people are travelling passing a message (data) becomes too hard. Due to this disability one that has hearing and speaking disability doesn't want to stand and face the race with normal person. Since the communication for the mute people is image (Visibility), not acoustic (Audio). For these mute people Hand motion plays a very part for communication. The data transmission between mute-deaf & normal people is always a very challenging job. Deaf people make use of sign language or gestures to make understand what he/she trying to say but it is impossible to understand by hearing people. The admittance to various communication based technologies plays an essential role for these (mute) handicapped peoples. Developing a small and compressed gadget for these mute people is a difficult task. Deaf-Dumb people find a difficulty in communicating with normal people and hence they always stay apart in their societies. Basically deaf-dumb ones uses various sign language for communication, & they always face lots of difficulty while communicating with normal people because they all not able to understand sign language every time. Hence there is always a hurdle in communication between these two type of peoples. There are so many researches has done in regulate to search a simple and easy way for mute people to communicate with the normal people and articulate themselves to the rest of the real world. So many improvements have been done in sign language but all are based on American gesture (sign) Language. Our research work is purely designed to provide an aid to this deaf-mute by developing and designing a smart communication module which will help to renovate sign language to text & speech communication with other and to help them lead a life in a much better way.***

Our paper represents a static gesture recognition algorithm that will be designed and implemented will be used in the smart communication system to bridge the communication gap between deaf & dumb and normal people. If the algorithm is implemented completely it can be can be also used to capture and analyze emotions of the people in area where high security is desired.

Keywords—Deaf-Dumb, Image processing, Sign language, Gesture, data processing etc

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I. INTRODUCTION

In the course of recent years, enormous measure of advancement has been done in the field of gesture based communication acknowledgment innovation .This has enormously helped in the headway of Human Computer Interaction and Intelligent Computing. The essential point of HCI is to examine and improve the manners by which people cooperate with PC frameworks around them. The software engineers utilize their capacities of perception and create frameworks to make this association basic and advantageous for the clients. HCI requires the association of clients consistently consequently, to make frameworks intelligent, they require certain signals or voice directions as information and a particular yield is produced dependent on the info. Gesture based communication correspondence computer generated reality and apply autonomy enormously depend on motions as information while Voice Command Applications require voice as information. We will focus just on signals as our framework will utilize motions as information. Signals are of two sorts, to be specific static motion and dynamic motion. Static signals are stationary motions that perceive the state of the hand. Dynamic motions are movement motions where the framework recognizes the way that the hand ventures. Our framework will only include dynamic signals to perceive the letters of the English Alphabet. For usage of motion acknowledgment framework, we require a camera, Color markers for following the pattern. The primary goal of this paper is building up a signal acknowledgment framework that will help make correspondence conceivable between the tragically challenged individuals and the ordinary individuals. The American Sign Language (ASL) contains a motion for each letter of the English Language. With this, we can reason that the hard of hearing and unable to speak know about the English language and it is simple for them to comprehend it. At the point when the client will make an example of any letter of the English language, before the webcam, our framework will be fit to recognize the word and demonstrate its yield. This framework will deal with dynamic motions as it were. For this, we will require a camera like the webcam of a workstation to record the live video feed to catch the example that is produced before the webcam.

A Color marker will be utilized to influence this example so our framework to can recognize the specific shading and distinguish the example age in like manner. For the deaf and dumb people the method of communication is sign language, which comprises of hand gestures and face expression for each alphabet, numbers and words.

Figure (1.1): Various Hand Gesture used in sign Language

Figure (1.1) show some gesture used in Indian sign language (ISL). Learning sign language is like learning any other language. The sign used for different gesture may appear similar to each other and it can be differentiated by looking at the angle, space between finger, number of fingers opened, number of closed or semi closed, etc. Every deaf and dumb person is aware of these signs but the normal person does not bother to learn their language. The major challenge these people are facing is communication with the external world. As per the census report of 2011, 6 million people in India are deaf and dumb [1], it is a big number which cannot be ignored. Today these physically challenged people stands at par with the normal people and they have a lot of knowledge, skills and talent to contribute to the society, finding a viable solution to their problem is need of the day. To overcome this communication barrier we propose a smart module which will convert the signs in hand gesture and face expression into text, readable by normal people. The two different approaches are used one using sensor and other using image processing. We will use image processing technique in our work. Detail review of complete system will be done and focus will on improving the dynamic gesture recognition at real time.

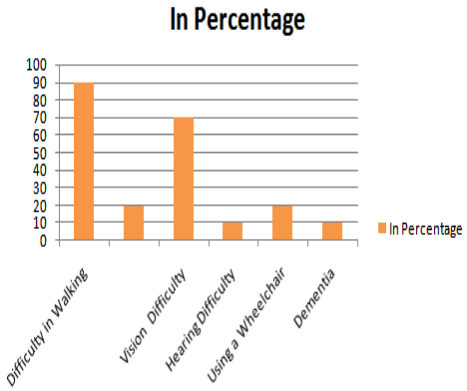

Figure (1.2): Difficulties faced by Handicapped People

As shown in figure (1.2), there are so many difficulties faced by disable people. They can't able to anything by their own. They always needs some assistance from others to complete their or faces lots of challenges in their day to day life. Hence some technology based system should be designed to help them.

II. LITERATURE REVIEW

Numerous researchers worked in the field of motion acknowledgment innovation from 90's. In reference [1], EMG sensors and accelerometers are utilized to catch hand signals. Reference [2] and [3] reviews gloves framework and their applications. It additionally examinations the qualities of the gadgets, give a guide of the advancement of innovation and talk about impediments. In paper [4], Markov's chain based model are used for gesture recognition An epic technique is acquainted with plan limit show in CRF's has been proposed, which decided a versatile edge for recognizing signs in vocabulary and non sign examples In [4] a model which comprised of Eigen esteems and Eigen vector has been implemented .Their framework contained four modules in particular skin color filtering, hand editing ,separating highlight and grouping. They utilized 24 signs in their framework each included 10 tests. They utilized Eigen esteems weighted Euclidean separation and created it dependent on Indian communication via gestures .Their work depends on single casing and utilized put away picture to perceive the gesture. This techniques requires more time to process data(image).In the paper [5],framework depends on static hand signal which comprises of motion caught utilizing web camera preparing, handling edges and pinnacle discovery and acknowledgment picture. Picture is caught with the assistance of web cam and put away in DCR document for example digitations arrangement group In picture handling, picture is changed over from RGB to grayscale yet they found that grayscale was less educational for edge discovery so they supplanted it by vigilant edge calculation. This algorithm is required to identify edges of protests in a picture. In the wake of distinguishing the edges, we need to recognize the tips of fingers. Wavelet family strategy was utilized for this reason. When fingers are recognized next thing is to coordinate the motion with the gestures in the database. The work proposed so far can be categorized in namely two type one using sensors and other using image processing. Using a portable accelerometer (ACC) and surface electromyography (EMG) sensors a framework for automatic Chinese sign language recognition is implemented, data segmentation is performed to divide a continuous sign language sentence into sub word segments, three basic components of sign sub words, namely the hand shape, orientation, and movement, are further modeled and the corresponding component classifiers are learned [6]. [7] uses low cost packaging material, velostat for making piezo resistive sensors that detects a bend in fingers and the data generated is map to a character set by implementing a Minimum Mean Square Error machine learning algorithm. M. Delliraj and S. Vijayga Kumar propose a system with a flex sensor and IMU (Inertial Measurement Unit) to recognize sign symbol, speech synthesis chip for voice output and speech recognizing module for converting voice to sign symbol, interfaced with microcontroller [8]. [9-10] presents the sensor based technique. Propose image processing based technique. A novel method for designing threshold models in a conditional random field (CRF) model is proposed which

performs an adaptive threshold for distinguishing between signs in a vocabulary and non sign patterns; a short-sign detector, a hand appearance-based sign verification method, and a sub sign reasoning method are included to further improve sign language spotting accuracy. It has 87.0% spotting rate and 93.5% recognition rate [13]. A Conditional Random Field (CRF) based ISL recognition for complex background using a novel set of features is proposed [12]. [14] Propose Transition movement models (TMMs) to handle transition parts between two adjacent signs in large-vocabulary continuous sign language recognition, experiments over a large vocabulary of 5113 Chinese signs was conducted with average accuracy of 91.9%. Models using Microsoft kinect system are proposed in which uses the hand tracking feature of the device to perform hand gesture spotting. Computer vision based technique for gesture recognition of alphabets for Bangladeshi and Indian sign language are proposed in [15] respectively. Comparison of Various Gesture Recognition Techniques used in Sign Language for Deaf-Dumb People

Methodology	Analysis
PCA is a image processing system which takes ASL alphabets as an image input & extracts features from the image of the ASL hand pose. The k-NN (k-Nearest Neighbors) classifier is used to distinguish between various gestures and their meanings.	It Process Image very fast . Can process any smaller part of Image. It is costlier as it needs some hardware.
Deaf-Dumb Language Interpreter based on vision sensor which transform the sign language into normal Lingo. Here text is converted voice using T256 SpeechJet.	It can convey text into speech. Capable of Transforming only Ten alphabets.
A hardware system with microcontroller named PIC with vision sensor for body or gesture recognition, able to display the alphabets in a display screen	Will provide a vision data. Not able to provide audio in output.

Table (2.1): Comparison of various Gestures based techniques

III. PROPOSED WORK

Today these physically tested individual's remains at standard with the ordinary individuals and they have a ton of learning, abilities and ability to add to the general public, finding a practical answer for their concern is need of the day. To beat this correspondence boundary we propose a keen module which will change over the signs close by motion and face demeanor into content, clear by typical individuals. The two unique methodologies are utilized one utilizing sensor and other utilizing picture handling. We will utilize picture preparing method in our work. Detail audit of complete framework will be done and spotlight will on improving the dynamic motion acknowledgment at constant.

Figure (3.1): Alphabets in ISL

Image processing based technique comprise of following step:

- Identifying the appropriate image from real time video
- Removal of noise
- Edge detection
- Feature extraction
- Gesture recognition and spotting
- Classification

Significant work is extraction of signals. Motions are static and dynamic. In static, motion does not change for specific snippet of data, for example motion of letters in order is static. In powerful, motions contain numerous casings of various motions when consolidated in a specific grouping gives one snippet of data. Signal acknowledgment suggests extraction of static motions and motion spotting alludes to acknowledgment of dynamic motion.

3.1. BLOCK DIAGRAM:

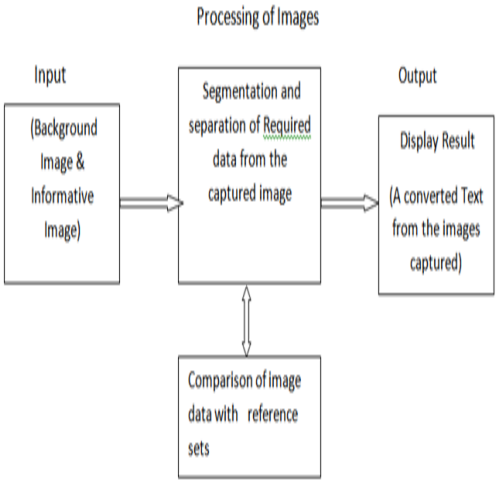

Figure (3.2): Block Diagram of Proposed System

As depicted in fig.(3.2) proposed system will have various functional blocks that combines the function and will give the result as a text data in any display devices .As discussed later an gesture of any hand movement of a Deaf-Dumb people will be captured through any image capturing device.

It can be of digital camera, mobile phone or web camera etc. In our system two images will be considered i.e. Background Image and Informative image.

3.1.1. BACKGROUND IMAGE:

It's an image consist of all background details or data of an image like background color or an picture etc. Fig.(3.3) depicts the background mage used in our proposed system to generate result

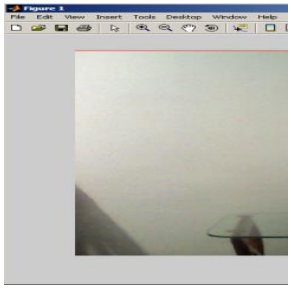

Figure (3.3): Background Image

3.1.2. INFORMATIVE IMAGE:

This is a actual image of an hand movement like an each and every angle, dimension of an every figure or hand of a mute person. Fig.(3.4) depicts informative image used in our proposed system to generate result

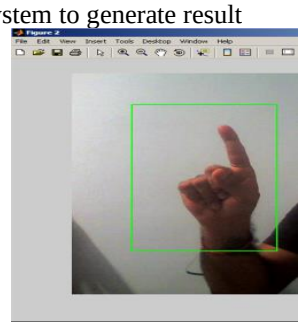

Figure (3.4): Hand Gesture of Signer

3.1.3. PROCESSING OF IMAGE:

To fulfill and decrease the computational exertion required for the preparing, pre-handling of the picture taken from the camera is profoundly imperative. Aside from that, various factors, for example, lights, condition, foundation of the picture, hand and body position and introduction of the endorser, parameters and center the of camera sway the outcome significantly.

3.1.4. SEGMENTATION:

Color Segmentation: Shading in a picture is evident by human eyes as a blend of R(red), G(green) and B(blue), these three hues i.e Red, Green and Blue are known as three essential hues. Different sorts of shading parts can be gotten from R,G,B shading spoken to by either straight or nonlinear changes. The RGB shading segments speak to the approaching light, that is the brilliance estimations of the picture that can be gotten through (Red, Green and Blue channels) i.e RGB channels dependent on the accompanying conditions as depicted in fig.(3.5)

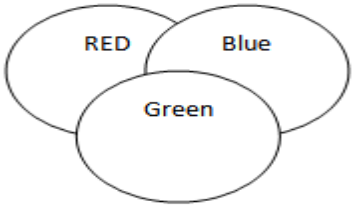

Figure (3.5): RGB Color Schematic

The information image and background images which is given as input will we processed here in this block. Segmentation process of input images is done here. Segmentation is the partition of an info picture in different parts or category, which compare to various items or parts of objects. Every pixel in a picture is assigned to one of a number of these classifications. A genuine partition is generally that one where less than equal pixels is exist in same class has comparatively higher multiplicative value values and discrete structure which is connected to neighboring region pixels which are in deferent classifications have unique qualities. Fig.(3.6) shows the output of segmentation process of image.

3.1.5. COMAPARISON WITH REFERENCE SET:

Here the output image of segmentation process will be compared with predefined set of preference set will match the output with each and every image of preference set. Fig.(3.6) depicts the image preference set used to compare the input given.

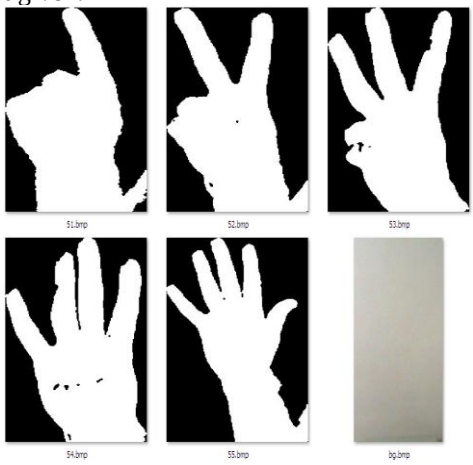

Figure (3.6): Preference Set

As per the image preference set shown in fig.(3.6) the segmented image is compared with the available preference set image and as per the comparison the result will be given to the output block .

3.1.6. OUTPUT BLOCK

This block is consist of various display device used to display the result in the text form which is easily understood by deaf-mute people who are not able to speak or listen the voice of another people. The result will be text data showing by the hand gesture of communicating party.

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IV. EXECUTION FLOW

Execution of our system flow is depicted in the figure (4.1) where in first step an image of hand gesture is captured. The image captures is consist of various data like background color various angles of an image. In this processing the image background should have a clear background color.

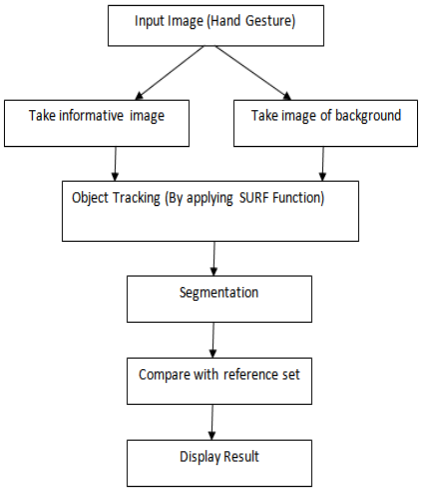

Fig.(4.1). Flow of Execution

In second step we are going to create/develop a image segmentation module where segmentation of image is done into various regions and categories. This segmented image is compared in our 3rd step where we already have various no. of predefined sets of image to compare the segmentated image to obtain the result.Finally the perfectlty matched image information will be converted into text data that can used as a result and that will be displayed in any output device.

V. RESULT AND DISCUSSION

The motivation behind this application is to perceive hand motion. The structure is exceptionally basic and the endorser doesn't have to wear any kind of hand gloves. Despite the fact that this gesture based communication acknowledgment application can be kept running in a customary PC having a web camera, however in a perfect world it requires Android Smart telephone having frontal camera with at any rate 1GHz processor and at any rate 514MB RAM. The format set comprises of all letters in order start to finish. The letters J and Z includes movements and consequently required auxiliary layouts to determinate begin and end limit of the In order to do experiment, generate result and perform analysis the hand gesture image is taken (Hand Gesture Image i.e. Informative Image & Background Image) are consider for simulation using MATLAB 6.0 As shown in fig.(5.1) ,the image is captured from any image capturing device of a mute person(Signer).Only His/her hand gesture has been captured.

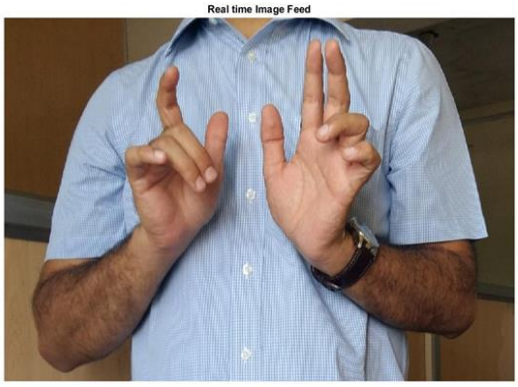

Figure (5.1): Original Image of Mute Person

After that gesture area has been located using SURF function which will track the only object required for image processing. As shown in fig(5.1) & Fig.(5.2).

Figure (5.2): Original Image of Mute Person

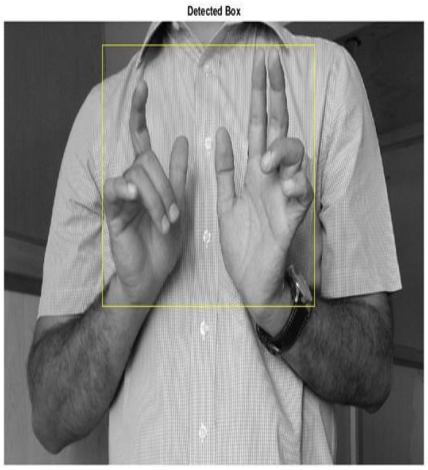

Figure (5.3): Image after Area to be located for Processing

After object tracking the object segmentation process will be done where the image is partitioned into different regions

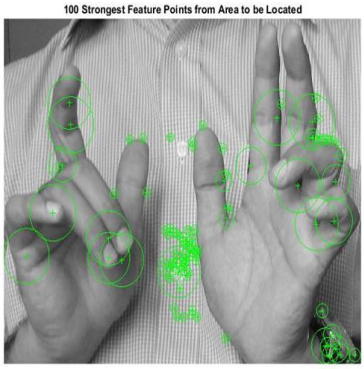

Figure (5.4): Result 3:Strongest Gesture Point to be Located

Figure (5.5): Result : Point located for predefined Matching

After the more gesture spot is obtained using our gesture spotting algorithm all the obtained spots will be matched using our predefined data set which is already stored in our program memory to match the signer gesture image to obtain the result. This matching process is shown in fig.(5.7) below. The lines in yellow color started from red gesture spot which a predefined data set is matched with green gesture spot of segmented image that we had given as a input to our smart communication system.

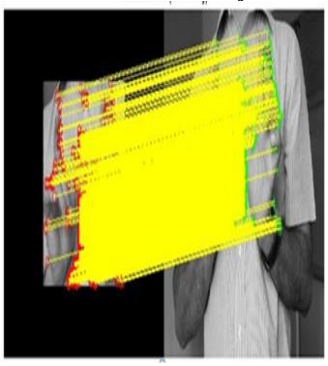

Figure (5.7): Result:3: Matched Gesture Point with Predefined Data Set

Also we had tested our proposed system output by providing different size of hand gestures. For example, a mute person of age between 1-10 years and adult person of age more than 15 years. We are assuming the hand gesture of a child and adult person will be different in size and then the image is provided as a input to the system. The output of the system is shown in the form of graph in fig.(5.8).

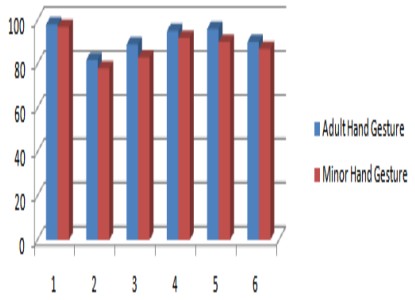

Figure (5.8): Comparison of Two size of Hand Gesture

The accuracy of system output will be more when compared with some related system. We have taken 6 iteration of hand movement of both person (Adult and Child). As shown in fig (5.7) system output has not much effected by the size of hand gesture. Horizontal plane depicts the no. of iteration taken for hand gestures and vertical plane depicts the percentage(%) of accuracy of proposed system.

VI. CONCLUSION

At the end we can conclude that our proposed system is having a very simple and easy step to process and can be used by any mute people. The observation of result after implementation of the system, we conclude that our technique is used for gesture recognition for implementing ISL will work much better than other existing system. It can be used for other sign language as well as it required only gesture image for displaying data. Also it takes very less time to process the data.

VII. FUTURE & SCOPE

In future this system can be used to capture emotional or psychical behaviors of any where a high security is required. Also it can be used to keep a track on criminal activities of any intruders. Although system is beneficial for the society at most but also it requires more memory to store predefined data set and it takes a real time operation so environmental effects may affect the system performance.

REFERENCE:

1. Census 2011. Available from: http://www.censusindia.gov.in/2011census/population_enumeration.html.
2. Yun, L., et al., "A Sign-Component-Based Framework for Chinese Sign Language Recognition Using Accelerometer and sEMG Data", IEEE Transactions on Biomedical Engineering,, 2012. 59(10): pp. 2695-2704
3. Preetham, C., et al., "Hand Talk-Implementation of a Gesture Recognizing Glove", India Educators' Conference (TIIEC), Texas Instruments. 2013.
4. Delliraj, M. and S. Vijayakumar, " Design of Smart e-Tongue for the physically challenged people" , International Conference on Recent Trends in Information Technology (ICRTIT), 2013
5. Begum, S. and M. Hasanuzzaman, " Computer Vision-based Bangladeshi Sign Language Recognition System" , 12th International Conference on Computers and Information Technology ICCIT '09. . 2009.

6. Chao, S., et al., "Discriminative Exemplar Coding for Sign Language Recognition With Kinect", IEEE Transactions on Cybernetics,, 2013. 43(5): pp. 1418-1428.
7. Chikkanna, M. and R.M.R. Guddeti, " Kinect based real-time gesture spotting using HCRF", International Conference on Advances in Computing, Communications and Informatics (ICACCI), 2013.
8. Choudhury, A., A.K. Talukdar, and K.K. Sarma, "A Conditional Random Field Based Indian Sign Language Recognition System under Complex Background ", International Conference on Communication Systems and Network Technologies (CSNT), 2014.
9. Gaolin, F., G. Wen, and Z. Debin, "Large-Vocabulary Continuous Sign Language Recognition Based on Transition-Movement Models" IEEE Transactions on Systems, Man and Cybernetics, Part A: Systems and Humans,, 2007. 37(1): pp. 1-9.
10. Geetha, M., et al. "A vision based dynamic gesture recognition of Indian Sign Language on Kinect based depth images" International Conference on Emerging Trends in Communication, Control, Signal Processing & Computing Applications (C2SPCA), 2013.
11. Hee-Deok, Y., S. Sclaroff, and L. Seong-Whan, "Sign Language Spotting with a Threshold Model Based on Conditional Random Fields", IEEE Transactions on Pattern Analysis and Machine Intelligence,, 2009. 31(7): pp. 1264-1277.
12. Shangeetha, R.K., V. Valliammai, and S. Padmavathi, "Computer vision based approach for Indian Sign Language character recognition", International Conference on Machine Vision and Image Processing (MVIP), 2012.
13. P. Mekala, R. Salmeron, Jeffery Fan, A Davari, J Tan, "Occlusion Detection Using Motion-Position Analysis" IEEE 42nd Southeastern Symposium, on System Theory (SSST"10), pp: 197-201, 2010.
14. Digital Image Processing Using Matlab by Ganzalez, p: 205. 2009
15. Yang quan, "Chinese Sign Language Recognition Based on Video Swquence Appearance Modeling", ICIEA, the 5th IEEE Conference, pp: 1537 – 1542, 2010.
16. Paulraj M. P. Sazali Yaacob, Mohd Shuhanaz bin Zanar Azalan, Rajkumar Palaniappan, "A Phoneme based sign language recognition system using skin color segmentation", Signal Processing and its Applications (CSPA) – pp: 1 – 5, 2010.
17. Byong K. Ko and H. S Yang, "Finger mouse and gesture recognition system as a new human computer interface", pp: 555-561, 1997.
18. Yang quan, "Chinese Sign Language Recognition Based on Video Swquence Appearance Modeling", ICIEA, the 5th IEEE Conference, pp: 1537 – 1542, 2010.
19. J. Davis and M. Shah "Visual Gesture Recognition", IEEE Proc.-Vis. Image Signal Process., Vol. 141, No.2, April 1994.
20. Nasser H. Dardas and Nicolas D. Georganas, Real-Time Hand Gesture Detection and Recognition Using Bag-of-Features and Support Vector Machine Techniques, IEEE Transactions On Instrumentation And Measurement, Vol. 60, No. 11, November 2011.

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