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Gesture Recognition for Physically Challenged

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Abstract

Objectives: The sign language is very important for hearing impiared people. Finding an educated translator for the sign language every time and everywhere is difficult task. The human-computer interaction system is helpful for dumb people to overcome the difficulty, besides it and can be installed anywhere. This paper proposes the method or algorithm for an application which would help in recognizing the different signs and convert those sign gestures into voice. **Methods:** Different sets of hand gestures were captured using web camera and then stored in a directory. The correct signs by the user is identified by using feature extraction techniques and neural network algorithm. **Findings:** The sign languages for different numbers in words are trained and tested. The test image is aligned correctly with training images which is based on correlation and convert the matched image into text and then text into voice. **Applications:** By using this system, hearing impaired people can easily interact without depending on translators.

Keywords: Deaf and Mute, Human-Computer Interaction, Hand Gestures, Neural Network, Sign Language

1. Introduction

There are nine billion dumb people in the world. The communication between dumb people and normal people is always a challenging task. One of the key technologies to afford reality is usual interaction between human and objects or living-things in the implicit world created in a computer. Disabled persons are an important part of our society. With the advent of science and technology, efforts are being made to develop certain systems that make them feel and act normally. Especially hearing impaired people interact through hand gestures or signs. It is difficult to find a well experienced translator for the sign language conversion every time and everywhere.

Human-computer interaction system can be installed and can be used anywhere possible. Gestures are basically the physical action form performed by a person to convey some meaningful information. Hand gesture is a technique of non-verbal communication for human beings for its freer expressions. In fact gesturing is so deeply rooted in our communication that people often continue gesturing when speaking on the telephone. There are diverse signs which express complex meanings and recognizing them is a challenging task for people who have no indulgent for that language. Hand gestures can be classified into two categories. Static hand gestures which depend only on the information about the flexure angles of the fingers and dynamic hand gestures which depends not only on the fingers flex angles but also on the hand trajectories and orientation.

The existing systems concentrated on posture recognition and static gesture recognition. It uses more additional devices such as data gloves, micro controller, colored marker and these devices are in high cost. The development of a model, which translates their hand gestures into text and voice, is an ideal way to facilitate them to communicate with normal people. Different sets of widespread hand gestures were captured by using web camera and those images are used to train the neural network for classification purpose and convert the sign into voice.

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The sole objective of this software system is to convert the hand gestures of Sign Language into text and voice. Dumb people can easily communicate with normal people without any problem using this model. This model will help normal people to understand the language of dumb people. The goal of the system is to use it in public places like airports, railway stations and counters of banks, hotels etc.

The main issue in gesture interaction is how to make the efficient communication and how gestures are understood by computers.

[1]Proposes the method or algorithm for an application which would help in recognizing the diverse signs which is called Indian Sign Language. The images that are the palm side of either right or left hand are loaded at runtime. The method has been developed with respect to single person. The real time images will be captured initially and then stored in database and on recently captured image and feature extraction will take place to recognize which sign has been articulated by the user through SIFT (scale invariance Fourier transform) algorithm. The result will be produced in accordance through matched key points from the input image to the image stored for a specific letter in the directory or the database.

[2]Introduces A wired glove for the human–computer interaction. These input device is wear like a glove. There are lots of sensor technologies that are available to capture physical data. They used magnetic tracking device to capture the motion of the finger. That is attached to the wired glove[3,4]. These movements are completely identified by the software, with respect to the glove movement. Gestures can then be converted into useful information, to recognize Sign Language or other symbolic functions. Traditionally, wired gloves have been available at a huge cost, with the finger bend sensors and the tracking device have to be bought separately.

[5]Uses hand gesture recognition method for Indian sign language. A set of 32 signs, each representing the binary up and down posture of the five fingers is defined. In this method, 32 combinations of binary number sign are obtained using right hand palm image, which are loaded at runtime. An image captured at run time is scanned to recognize finger tip positions of the five fingers. Measuring the height according to a reference point at the bottom of the palm close to the wrist, the tilt of fingers is identified and compared with the database.

[6]Developed a system prototype to systematically recognize sign language to help hearing or speech impaired people to converse more efficiently with the normal people. The Sign to Voice system prototype, was built up using Neural Network Feed Forward algorithm[7,8] to convert the sign into voice. Different sets of worldwide hand gestures were detained from video camera and employed to train the neural network.

[9]Developed a mems accelerometer based robot for automatic irrigation. They used pic microcontroller and the hand movements are detected by using mems and then transmitted to receiver. Based on the hand movement, the robot did irrigation[10] captures gestures using Tracking-Learning-Detection (TLD) for camera based multi-touch method. From the captured images, information about the finger movements are extracted.

2. Proposed Work

This section provides the detailed description of the proposed gesture recognition system. The system design is shown in Figure 1. The dataset is collected using webcam at runtime.

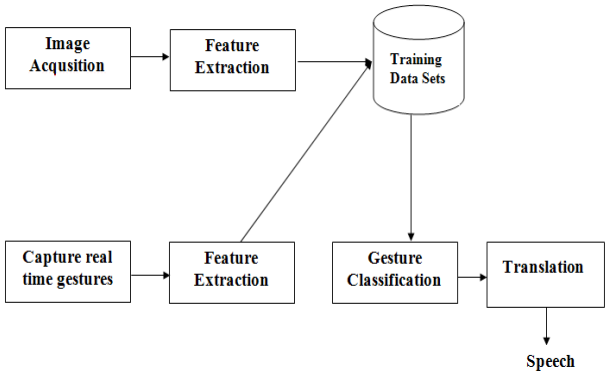

Figure 1. Overall system design.

3.1 Dataset

There are fifty different gestures which are taken with the help of webcam and stored in database for training. And the test data will be taken at runtime.

3.2 Image Acquisition

Image Acquisition is the first step in image processing because without get the images we cannot perform any operation. The Toolbox make easy to acquire images

and video from cameras and frame grabbers directly into MATLAB. In this work, the webcam is used to capture a video as input. Dynamic hand gesture is captured using the workspace and convert the video into frames for further processing. After the frame splitting, the frames are stored in working directory.

3.3 Feature Extraction

Feature extraction is the method of changing the input data into the set of features. It extracts relevant information from the input data. To perform the desired task, it reduces the input image size representation and simplifying the amount of resources required to describe a large set. In this work, feature extraction involves two major steps. The first step is image segmentation and the second one is edge detection.

Image Segmentation is the method of separating a digital image into segments(subparts). Image segmentation is generally used to locate objects and boundaries (lines, curves, etc.) in images. In order to get those important parts, background subtraction to be done. we have to detect objects

Edge Detection is used to identify points in a gesture image. The points are easily detected by the sharp changes in the image. And these points are termed as edge. After this step the edge pixels are highlighted. For that we use the sobel edge detection technique. Then we have to convert an image to a binary image, based on threshold. It removes pixel value below the standard value. Finally to equalize all the extracted pixel and to improve the local contrast of an image and bringing out more detail we perform the adaptive histogram equalization.

3.4 Gesture Classification

After completion of previous step process, the application will then convert the gesture into its recognized character which might be helpful to be understood sign language. In gesture recognition, take the image at runtime and perform feature extraction. And maintain the trained data sets. The trained data sets contains output of feature extraction and also the real hand gestures of the person. In this module, compare the run time feature extracted images with trained feature extracted images by correlation function. If the two images are same, recognizes the gesture into word.

Neural network algorithm is used to recognize the gesture correctly. Here, we have to give the test image at run time and compare the test image with all training images using neural network algorithm iteratively. At every iteration, compare the image with training image and select the most accurate image. i.e. less error value. Figure 2 shows the architecture of neural network, which consists of input, hidden and output layer.

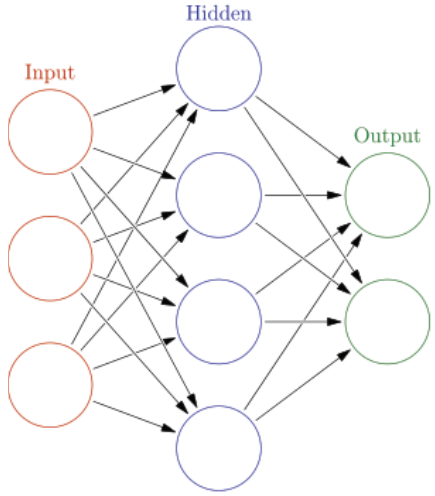

Figure 2. Neural Network Architecture

3.5 Translation

Text-to-voice system, help normal people to communicate more effectively with mute or hearing impaired people. Using required function, we convert the word into speech. First, it converts raw text containing symbols like numbers and abbreviations into the equivalent of written-out words. Then converts the symbolic linguistic representation into sound.

4. Results and Discussion

This section discusses about the intermediate results of the each component of the system and provides the performance evaluation of the implemented methodologies.

4.1 Experimental Setup

The dataset contains set of images which is acquired using web camera. Some training images of gesture dataset shown in Figure 3.

Figure 3. Training dataset.

4.1.1 Performance Analysis

Correlation r is used to measure the performance as in equation (1). If the correlation is nearer to 1 and the gesture is correctly classified. If the correlation is greater than 1, the gesture is not correctly classified. Table 1 shown the result for both correct and incorrect classification.

$$r = \frac{\sum_m \sum_n (A_{mn} - \overline{A})(B_{mn} - \overline{B})}{\sqrt{(\sum_m \sum_n (A_{mn} - \overline{A})^2)(\sum_m \sum_n (B_{mn} - \overline{B})^2)}} \quad (1)$$

$\overline{A}$ Where = mean (A) and $\overline{B}$ =mean (B).

Table 1. Performance Analysis

Training Data Set	Reference Image	Correlation Weight	Output
Imageone	Imageone	0.2458	Correctly Classified
imagetwo	imagetwo	0.2234	Correctly Classified
imageone	Imagetwo	1.2271	Incorrectly Classified
Imagetwo	imageone	1.0011	Incorrectly Classified

5. Conclusion and Future Work

With our method the frames are extracted from video. From the frames the hand gestures could be identified by using background subtraction techniques. The segmentation of the hand movements plays a vital role in such process. Sign languages, as spoken languages, have certain rules of grammar. These rules must be taken into account while transforming a sign language into a spoken language. In the end, adding a speech engine to speak the transformed text would help enhance ease of use. We are conducting further to develop a method for handling a large vocabulary. The detection capability of the system could be expanded to body gestures as well. The same technique could be used in a portable device.

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7. References

1. Murakami K, Taguchi H. Gesture recognition using recurrent neural networks. International Conference on Computer Vision. 2013 Feb; 15(1):237–42.
2. Ahdan NAB. Gesture recognition based on hand postures and trajectories using dataglove. IEEE transaction on computer vision. 2012; 13(1):1–6.
3. Chatur T. Hand gesture recognition for Indian sign language. International Journal of Computer Science and Management Studies. 2013 Dec; 1(7):13–20.
4. Goyal1 S, Sharma I. Sign Language Recognition System For Deaf And Dumb People. International Journal of Engineering Research and Technology. 2013 Apr; 2(1):6.
5. Foong OM. Hand gesture recognition - sign to voice. International Journal of Computer Science and Engineering. 2011 Dec; 10(1):32.
6. Chavan P. A reliable hand gesture recognition system using multiple schemes. IJREISS. 2012 Nov; 2(11):299–313.
7. Neha V, Tavari A, Deorankar V. A Review of Literature on Hand Gesture Recognition for Indian Sign Language. International Journal of Advance Research in Computer Science and Management Studies. 2013 Dec; 1(7):13–20.

8. Pathan YM, Waghmare SR, Patil PK. Sign Language Recognition for Deaf and Dumb People, International Journal Of Engineering And Computer Science. 2015 Mar; 4(3):10872–74.
9. Kumar KA, Thamizharasi K. Gesture Controlled Robot using MEMS Accelerometer for Eradication of Weeds. Indian Journal of Science and Technology. 2015 Mar; 8(5):460–65.
10. Sankaradass Khan ZF, Suresh G. Tracking and Recognizing Gestures using TLD for Camera based Multi-touch. Indian Journal of Science and Technology. 2015 Nov; 8(29):1–6.