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A Communication System for Deaf and Dumb People

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Abstract: ***One of the important problems that our society faces is that people with disabilities are finding it hard to cope up with the fast growing technology. The access to communication technologies has become essential for the handicapped people. Generally deaf and dumb people use sign language for communication but they find difficulty in communicating with others who don't understand sign language. Sign language is an expressive and natural way for communication between normal and dumb people (information majorly conveyed through the hand gesture). So, we need a translator to understand what they speak and communicate with us. The sign language translation system translates the normal sign language to speech and hence makes the communication between normal person and dumb people easier. So, the whole idea is to build a communication system that enables communications between speech-hearing impaired and a normal person.***

Keywords: Image Processing, Human Computer Interface (HCI).

1. Introduction

Humans know each other by conveying their ideas, thoughts, and experiences to the people around them. There are numerous ways to achieve this and the best one among the rest is the gift of "Speech". Through speech everyone can very convincingly transfer their thoughts and understand each other. It will be injustice if we ignore those who are deprived of this invaluable gift; the deaf and dumb people. The only means of communication available to the deaf and dumb people is the use of "Sign Language**"**. Using sign language they are limited to their own world. This limitation prevents them from interacting with the outer world to share their feelings, creative ideas and Potentials. Very few people who are not themselves deaf and dumb ever learn to Sign language. These limitation increases the isolation of deaf and dumb people from the common society. Technology is one way to remove this hindrance and benefit these people [1] [2].

Hand gesture recognition provides an intelligent and natural way of human computer interaction (HCI). Human computer Interaction (HCI) is a branch of artificial intelligence, it is a scientific discipline that is concerned with the development of algorithms that take as input empirical data from sensors or databases, and yield patterns or predictions thought to be features of the underlying mechanism that generated the data. A major focus of HCI research is the design of algorithms that recognize complex patterns and make intelligent decisions based on input data. As the integration of digital cameras within personal computing devices becomes a major trend, a real opportunity exists to develop more natural Human-Computer Interfaces that rely on user gestures.Hand gesture recognition is an area in computer science and language technology that aims in defining human gestures via mathematical algorithms. With gesture recognition it is possible for humans to interact naturally with machines without the aid of any mechanical devices. Hand gesture is one of the most expressive and most frequently used among a variety of gestures. Applications of hand gesture recognition are varied from sign language to virtual reality [1].

Thus, we propose a new technique called artificial speaking mouth for dumb people which will be very useful to them for conveying their views to others. Mute people can use fingers to perform hand gesture and it will be converted into speech so that normal people can understand their expression.

2. Literature Survey

The communication between a dumb and hearing person poses to be an important disadvantage compared to communication between blind and ancient visual people. This creates an extremely little house for them with communication being associate degree elementary aspect of human life [1]. The blind people can speak freely by implies that of ancient language whereas the dumb have their own manual-visual language referred to as sign language. Sign language is also a non-verbal form of intercourse that's found among deaf communities at intervals the planet. The sign languages haven't got a typical origin and hence hard to interpret. A Dumb communication interpreter is also a tool that interprets the hand gestures to sensibility speech. A gesture in associate degree extremely language is also a certain movement of the hands with a particular kind created out of them [1] [2].

A gesture in a sign language is a particular movement of the hands with a specific shape made out of them. A sign language usually provides sign for whole words. It can also provide sign for letters to perform words that don't have corresponding sign in that sign language. In this device Flex Sensor plays the major role, Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor [1]. This digital glove aims to lower this barrier in communication**.** It is electronic device that can translate Sign language into speech in order to make the communication take place between the mute communities with the general public possible [2] [5]. A hand gesture recognition system is also used to recognize real time gesture in unconstrained environments. The system consists of three modules: real time hand tracking, training gesture and gesture recognition using pseudo two dimension hidden Markov models. In this they have used a Kalman filter and hand blobs analysis for hand tracking to obtain motion descriptors and hand region [3].

The recently developed depth sensors, e.g., the Kinect sensor, have provided new opportunities for human-computer interaction (HCI). Although great progress has been made by leveraging the Kinect sensor, e.g., in human body tracking, face recognition and human action recognition, robust hand gesture recognition remains an open problem. Compared to the entire human body, the hand is a smaller object with more complex articulations and more easily affected by segmentation errors. It is thus a very challenging problem to recognize hand gestures. This paper focuses on building a robust part-based hand gesture recognition system using Kinect sensor [6].

3. Proposed Methodology

This paper describes the system that overcomes the problem faced by the speech and hearing impaired. The objectives of the research are as follow:

1) To design and develop a system which lowers the communication gap between speech-hearing impaired and normal world.
2) To build a communication system that enables communications between deaf-dumb person and a normal person.
3) The main approaches for analyzing and classifying hand gestures for HCI include Glove based techniques and Vision based techniques. The proposed system fig.1 consists of mainly four processes i.e. Image aquisition, Image preprocessing, Feature extraction and Image classification.

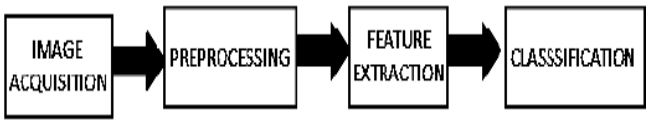


Figure 1: Proposed System

A. Image Acquisition

Image acquisition is the process to capture the hand gesture images which represents different signs. The resolution of various image capturing devices may not be the same. This results in different resolution of the captured images. For accurate comparison of the features and to reduce the computational effort needed for processing. All the images should be scaled to a uniform size. Thus the images for training and testing are captured in a white background with webcamera and database is created. This database consists of 26 hand gesture. The system works offline recognition i.e. we give test image as input to the system and system tells us which sign is recognized [3].

B. Preprocessing

A Preprocessing is very much required task to be done in hand gesture recognition system. Preprocessing is applied to images before we can extract features from hand images.

The main goal of image segmentation is domain independent partitioning of an image into a set of disjoint regions that are visually different, homogeneous and meaningful with respect to some characteristics or computed property such as grey level, texture or colour to enable easy image analysis.

Image segmentation is a useful tool in many realms including industry, health care, astronomy, and various other fields. Segmentation in concept is a very simple idea. Simply looking at an image, one can tell what regions are contained in a picture. Is it a building, a person, a cell, or just simply background? Visually it is very easy to determine what a region of interest is and what is not. Doing so with a computer algorithm on the other hand is not so easy. The image segmentation results are a set of regions that cover the entire image together and a set of contours extracted from the image. All of the pixels in a region are similar with respect to some characteristics such as color, intensity, or texture. Adjacent regions are considerably different with respect to the same individuality.

Segmentation is the classification of the input colored image into skin and non-skin pixels based on skin color information. A wide range of applications that require the segmentation process as a preprocessing operation such as computer vision, face/ hand detection and recognition, medical image analysis, and pattern recognition. Color information is one of the simple cues used for detecting skin color, and the use of proper color space to represent color information of an image is a crucial decision [2] [3].

The selection of appropriate segmentation method depends on the application and system environments. The performance of any segmentation algorithm is quantified using some benchmarking such as recall and precision coefficients, or by calculating the percentage of correct and false detection rates according to the complexion of the technique used.

C. Feature Extraction

Good segmentation process leads to perfect features extraction process and the later play an important role in a successful recognition process. There are many interesting points on every object which can be extracted to provide a "feature" description of the object. Features vector of the segmented image can be extracted in different ways according to particular application. Under different scene conditions, the performance of different feature detectors will be significantly different. The nature of the background, existence of other objects (occlusion), and illumination must be considered to determine what kind of features can be efficiently and reliably detected [2] [4].

Feature extraction is a method of reducing data dimensionality by encoding related information in a compressed representation and removing less discriminative data. Feature extraction is vital to gesture recognition performance. The selection of which features to deal with and the extraction method are probably the most significant design decisions in hand motion and gesture recognition development.

D. Classification

Classification between the objects is easy task for humans but it has proved to be a complexproblem for machines. The raise of high-capacity computers, the availability of high quality and lowpriced video cameras, and the increasing need for automatic video analysis has generated an interest

in object classification algorithms. A simple classification system consists of a camera fixed high above the interested zone, where images are captured and consequently processed. Classification includes image sensors, image preprocessing, object detection, object segmentation, feature extraction and object classification. Classification system consists of database that contains predefined patterns that compares with detected object to classify in to proper category. Image classification is an important and challenging task in various application domains, including biomedical imaging, biometry, videosurveillance, vehicle navigation, industrial visual inspection, robot navigation, and remote sensing [2].

Image classification is perhaps the most important part of digital image analysis. Classification of remotely sensed data is used to assign corresponding levels with respect to groups with homogeneous characteristics, with the aim of discriminating multiple objects from each other within the image. The level is called class. Classification will be executed on the base of spectral or spectrally defined features, such as density, texture etc. in the feature space.

4. Result and Discussion

The proposed procedure was implemented and tested with set of images. The set of 26 images of single person is used for training database; the sample database is shown in fig.2. Preprocessing results of the same hand gesture shows in fig.3. These preprocessed gesture taken as input for feature extraction and classification stage. The graphs generated in the preprocessing statge are shown in fig.4. Once the gesture is recognised; the equivalent gesture audio file is played at the output shown in fig.5.

Figure 2: Sample in Database generated of 26 alphabets

Figure 3: Output of preprocessing stage

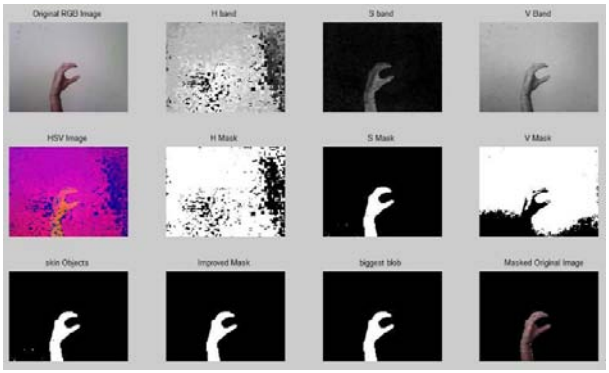


Figure 4: Different graphs generated in preprocessing stage

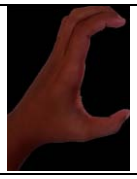
Image to Sound Conversion			
Input Image	Detected Image	Identified Gesture	Identified Gesture Audio File Output
		C	

Figure 5: Output of Hand Gesture Recognition system

5. Conclusion

Sign language is a useful tool to ease the communication between the deaf person and normal person. The system aims to lower the communication gap between deaf people and normal world, since it facilitates two way communications. The projected methodology interprets language into speech. The system overcomes the necessary time difficulties of speech-hearing impaired and improves their manner. This system converts the language in associate passing voice that's well explicable by deaf people. With this project the deaf-mute people can use the gloves to perform sign language and it will be converted into speech.

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