A Review Paper on Sign Language Recognition Approaches

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Abstract: Sign language is the way of communication among the Deaf-Dumb and physically impaired people by performing specific gesture. Deaf and Dumb people face struggle in expressing their feeling to other people. This creates communication gap between normal human beings and deaf and dumb people. Sign language recognition getting more and more attention of research due to widespread applicability. This paper based on Sign language Recognition approaches that aims to provide communication way for Deaf and Dumb Community over Society. There are main two approaches for sign language recognition is Sensor based and Image based is discussed in this paper.

Keywords: Sign language recognition, Image based recognition, Sensor based recognition.

I. INTRODUCTION

Sign language is the form of communication among the deaf and dumb people. Deaf-Dumb people uses sign language to represent themselves in society and all over world. All over world, deaf and dumb people face challenges in expressing their feelings to other people. There are many challenges has face by deaf and dumb people in public places in expressing themselves to normal people. Some of the main challenges experienced by deaf and dumb people while communicating with normal people were social interaction, education, mental health and their safety concern. As deaf and dumb person uses sign language for communication so, the normal person to whom this communication needs to know the sign language and its meaning. Sign language recognition approaches having two types. Sign languages recognition is divided into sensor based and image based recognition.

II. A REVIEW ON APPROACHES OF SIGN LANGUAGE RECOGNITION

People communicate with their environment using hands interfacing and manipulate various tasks in everyday life. Researcher has been considerably more attention and interest towards developing techniques for studying and manipulation to do various tasks by performing gesture.
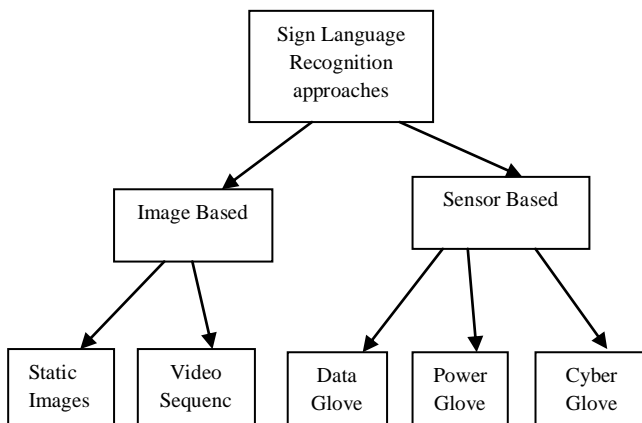

Fig.1. Main classification of sign language recognition

The development of popular glove based hand gesture recognition started about three decade ago and continuously enhancing number of researcher. Hand motion data information evaluation is used in

The main classes of sign language recognition are:
- Alphabet recognition
- Word recognition
- Continuous signer recognition

A. Sensor based sign language recognition

Sensor based recognition methods process data acquired from glove equipped with sensors. Data glove, power glove and cyber glove have commonly been used for sign language recognition. These gloves provide information on the position, rotation, movement, orientation of the hand, and more importantly, finger bending. A large number of features can be extracted from the data acquired from the gloves. These features can be used with a proper classifier to recognize the performed sign. There are two main types of data glove are:

1) Active data glove- consisted variety of sensors on the glove to measure bending of fingers or acceleration of hand and connected to the host device using wired or wireless technology.

2) Passive data glove- consisted only of markers or colors for finger detection by an external device such as a camera. The glove did not have any sensors on board.

Fig.2 Different types of Glove

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➢ Sayre Glove- Sayre Glove First introduced in 1977 by Massachusetts Institute of technology. In this flexible tubes are used with a light source at one end and a photocell at the other, which were mounted along each finger of the glove. As tube was bending, the amount of light passing between its source and photocell changes. Thus, voltage from each photocell correlated with finger bending.

➢ Data Glove- Data glove commercialized in United States in 1987. The original version of data glove first developed by Zimmerman in 1982. Data glove used a flexible plastic tubes mounted on cloth. Light sources and sensors measure joint angles. Data glove with fiber optics version was developed 1987 by visual programming language research, Inc. these data glove equipped with 5 to 15 sensors that measures finger bending. Abduction and adduction sensors are used to measure angles between adjacent fingers.

➢ Power Glove- Power glove was commercialized by Mattel Intellivision in 1989. It is used as control device for the Nintendo video game and became popular among video games players. In power glove resistive ink spread over flexible plastic bends that followed movements of each finger to measure the overall flexion of fingers.

➢ Cyber Glove- Cyber glove developed by James Kramer at Stanford University. Cyber Glove has been developed to acquire many data inputs from different flexing of joints motion from other hand areas. The 18-sensor cyber glove features two flexion sensors on each finger, four abduction sensors, and sensors measuring thumb crossover, palm arch, wrist flexion, wrist adduction and wrist abduction. Different version of this glove that contains 22-sensors has three flexion sensors on each finger, four abduction sensors, a palm-arch, and sensors to measure wrist flexion and abduction. The Cyber Glove used in many applications like digital prototype evaluation, virtual reality bio mechanics, and animation.

B. Image based sign language recognition
Researcher has more interest and they take more efforts to provide natural human-computer interaction in recent years. Main objective to develop a system to provide interacting with computers to control various systems. A mainly important approach is that provide user interfaces, where the computer processing provide perceptive capabilities that allow it to recognize both implicit and explicit information about the performer and its environment. Image based approach has the potential of carrying information in a non-intrusive pattern. Image based sign language recognition approach have a low cost therefore it facilitate a very attractive recognition model for perceptive user interfaces. In Image based approach cameras are used to recognize hand gestures or other type of gesture that started very early along with the invention of the first wearable data gloves. There were many challenges at that time in interpreting camera based gestures. The system is coupled with very low computing power. Cameras used for recognition offered very poor resolution with color inconsistency problem. The theoretical research that lead to identifying skin color segmentation having problem of accuracy of segmentation and were not recognized over wide range of skin color for its better performance that we see today. Although these challenges, the first computer vision based gesture recognition system was reported in 1980s.
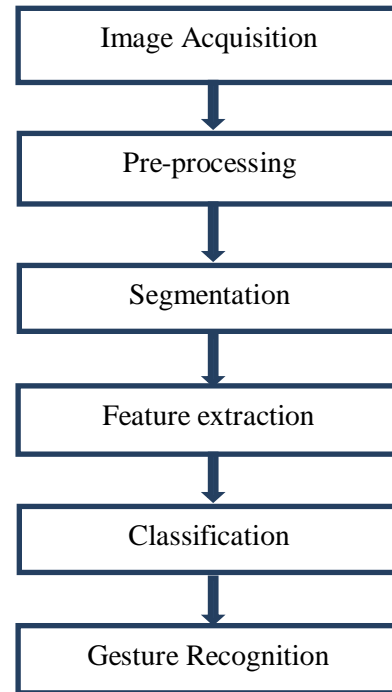

Fig.3 Flow diagram of image based gesture recognition

Image-based approach categorized into three types is: alphabet, isolated word, and continuous recognition. An image-based recognition system mainly consists of five stages for image processing are image acquisition, pre-processing, segmentation, feature extraction, and its classification. Recent work focused on a limited and very less vocabulary mainly used for basic human-computer interaction. The input to the image-based systems is a set of static images or dynamic images. The dynamic sign images consist of video sequences or image sequences. Usually, the users perform the static or dynamic signs are asked to briefly pause between signs for convenience to separate these signs. The main advantage of image-based sign language recognition is user acceptance as the signer does not require wearing a cumbersome glove system. Image-based recognition approach exhibit a number of problems. Lighting invariance conditions, image background and hand segmentation, variety of gestures and various types of noise introduced. The segmentation of hands and face is computationally more expensive. During accommodation of accurate segmentation occur problem due to variation in illumination. In recent years the recognition advances in computing Processing and various algorithms have made it possible to perform this segmentation in real time. However, the widespread commercial deployment of image-based sign language systems is still limited.

III. CONCLUSIONS

In this paper, a review of different techniques and methods used to implement sign language recognition system is briefly elaborated. Different techniques are implemented for the sensor based system and each technique has got its own advantage and trade off in terms its application, performance and recognition rate.

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