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SURVEY ON SIGN LANGUAGE TRANSLATOR

Minnuja Shelly[1], Krishnapriya Sadhasivan[2], Risala K.M[3], Shasna P.A[4], Sunhath K.A[5]

Assistant Professor, Department of Computer Science And Engineering, Universal Engineering College, Vallivattom, Thrissur, India.[1]

B.Tech Student, Department of Computer Science And Engineering, Universal Engineering College, Vallivattom , Thrissur, India.[2,3,4,5]

Abstract: **C**ommunication is an important aspect of every single individual. We are able to express our ideas and thoughts through communication. But this is not the case with differently abled person i.e. person who cant speak or/and hear. For such differently abled people, a mechanism has to be developed to tackle this communication gap. In this survey, different mechanism and procedures to develop a sign language translator are discussed.

Keywords: Sign language, feature extraction ,translator

I. INTRODUCTION

Main aim of this survey is to bridge the communication gap between the disabled and the normal people. Common man does not understand the sign language depicted by the differently abled persons. As a result the need of an translator has become essential in this competitive world. The need of an third person can be easily replaced by any of these mechanisms through various devices ,including hand held devices such as smartphones. These translator devices can be carried along with disabled person to any part of the world and is also easily accessible with the help of internet support. Through the development in technologies even more user friendly and budget friendly translators are gaining higher amount of interest.

II. THEORY

A. Sign language

Sign languages are languages that use the visual modality to convey meaning . Sign languages are expressed through articulations in combination with non-manual elements. Sign languages are full-fledged natural languages with their own grammar and lexicon. Sign languages are not universal and are usually not mutually intelligible with each other, although there are similarities among different sign languages.

B. Feature Extraction

Feature extraction is a part of the dimensionality reduction process, in which, an initial set of raw data id divided and reduced to more manageable groups. So when you want to process it will be easier. The most important characteristics of these large data sets is that they have a large number of variables. These variables require a lot of computing resources to process them. So feature extraction helps to get the best feature from those big data sets by select and combine variables into features, thus, effectively reducing the amount of data. These features are easy to process, but still able to describe the actual data set with the accuracy and originality.

C. Translator

A translator is a person whose job is translating writing or speech from one language to another. Here ,in this context translator refers to anyone who translates sign languages to more understandable languages such as a specific native languages. Human translators can be easily replaced with device based translators using the improving technologies.

III. RELATED WORK

Here we introduce each papers based on the technologies used in the Sign Language Translator.

This paper[1] proposes, a System to make communication through the internet easier for the deaf and mute community. Thus, the sensor-based approach might not be very feasible due to its complexity and difficulty to use it. Compared to this, a video-based approach might prove to be more effective and easier to use. The project uses static hand gesture recognition as the input mode. In the approach, camera capture is used to capture a sequence of images,

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that is, the signs made by the user. The image is then compared with the dataset pre-built and the sign is identified and the output is given accordingly. The feature extraction is done by knowing the position of the hand and its orientation. There are skin segmentation algorithms that are used widely in Computer Vision applications. In the project, there are different methods and algorithms used to extract the details of the hand such as: the area of the palm, which is obtained by finding the largest circle that can fit in it,detecting the convex hull and The number of open fingers, which is measured by finding concontour

The authors of this paper[2] ,presents a mobile VISION-BASED SIGN LANGUAGE TRANSLATION DEVICE for automatic translation of Indian sign language into speech in English to assist the hearing and/or speech impaired people to communicate with hearing people. It can act as a translator between a common man ,who does not understand sign language and a disabled person. The proposed system is an interactive application program developed using LABVIEW software and incorporated into a mobile phone. The sign language gesture images are acquired using the inbuilt camera of the mobile phone; vision analysis functions are performed in the operating system and provide speech output through the inbuilt audio device thereby minimizing hardware requirements and expense. The experienced lag time between the sign language and the translation is little because of parallel processing. This allows for almost instantaneous recognition from finger and hand movements to translation. This is able to recognize one handed sign representations of alphabets (A-Z) and numbers (0-9).The results are found to be highly consistent, reproducible, with fairly high precision and accuracy.All paragraphs must be indented.

The paper[3]points to the difficulties faced by speaking impaired persons.It is hard for such individuals to express what they want to say since sign language is not understandable by everyone. The paper is to develop a Data Acquisition and Control (DAC) system that translates the sign language into text that can be read by anyone. This system is called Sign Language Translator and Gesture Recognition. A smart glove is developed that captures the gesture of the hand and interprets these gestures into readable text. This text can be sent wirelessly to a smart phone or shown in an embedded LCD display. It is evident from the experimental results that gestures can be captured by set of inexpensive sensors, which measure the positions and the orientation of the fingers. The current version of the system is able to interpret 20 out of 26 letters with a recognition accuracy of 96%.

The paper[4]proposes an android application that converts sign language to natural language and enable deaf and dumb community to talk over mobile phones. Developing Sign Recognition methods for mobile applications has challenges like need for light weight method with less CPU and memory utilization. The application captures image using device camera process it and determines the corresponding gesture. An initial phase of comparison using histogram matching is done to identify those gestures that are close to test sample and further only those samples are subjected to Oriented Fast and Rotated BRIEF(Binary Robust Independent Element Features) based comparison hence reducing the CPU time. The user of the application can also add new gestures into the dataset. The application allows easy communication of deaf and dumb with society. Though there are many computer based applications for sign language recognition, development in android platform is adequately less.

The paper[5], present a gesture recognition glove based on charge-transfer touch sensors for the translation of the American Sign Language. The device is portable and can be implemented with low-cost hardware. The prototype recognize gestures for the numbers 0 to 9 and the 26 English alphabets, A to Z. The glove experimentally achieved, based on 1080 trials, an overall detection accuracies of over 92 %, which is comparable with current high-end counterparts. The proposed device is expected to bridge the communication gap between the hearing and speech impaired and members of the general public.

The paper[6] proposes a system that can automatically detect static hand signs of alphabets in American Sign Language (ASL). To do this, two combined concepts namely AdaBoost and Haar-like classifiers are being used. In the work, to increase the accuracy of the system, a huge database for training process is used, 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 the 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.

The paper[7] aims to demonstrate a user-friendly approach towards Bangla Sign language to text conversion through customized Region of Interest (ROI) segmentation and Convolutional Neural Network (CNN). 5 sign gestures are trained using custom image dataset and implemented in Raspberry Pi for portability. Using the ROI selection approach, the process shows better outcomes than conventional approaches in terms of accuracy level and real time detection from video streaming through webcam. Furthermore, this method serves to offer an efficient model which ultimately results in easy addition of more signs to the final prototype made using Raspberry Pi.

In this paper[8],A real-time portable sign language translation system for deaf-mutes will be presented. In the proposed system, a wireless hand gesture recognition glove for real-time translation of sign language commonly used in Taiwan is developed. To discriminate between different hand gestures, a flex and inertial sensors are embedded into the glove so that the three most important parameters, i.e., posture of the fingers, orientation of the palm, and motion of the hand,

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in Sign Language can be recognized without ambiguity. The finger flexion, palm orientation, and motion trajectory will be sampled periodically. Once the gesture is recognized as a valid signal, it will be encoded and sent to cell phone via Bluetooth Low Energy (BLE) for vocabulary look up. Finally, the vocabulary will be translated to speech via Google translator so that people can hear and know the meaning of the sign language. With the proposed system, the deaf-mutes can communicate with others easily.

The paper [9] is focused on providing an applicative architecture of hand glove that records the gestures made by a speech and hearing disabled people, converts them into a meaningful text and transmits them to remote areas with help of Bluetooth, GSM-CDMA and Internet modules. It has five flex sensors, three contact sensors and one three axis accelerometer that serve as an input channel, AVR 2560 micro controller is used for gesture processing algorithm, trans-receiver modules for transmitting and receiving data and a graphic user interface that displays all the information sent and received between two users.

The work[10] present SUGO, a depth video-based system for translating sign language to text using a smartphone's front camera. While exploiting depth-only videos offer benefits such as being less privacy-invasive compared to using RGB videos, it introduces new challenges which include dealing with low video resolutions and the sensors' sensitiveness towards user motion. This paper overcome these challenges by diversifying the sign language video dataset to be robust to various usage scenarios via data augmentation and design a set of schemes to emphasize human gestures from the input images for effective sign detection. The inference engine of SUGO is based on a 3-dimensional convolutional neural network (3DCNN) to classify a sequence of video frames as a pre-trained word. Furthermore, the overall operations are designed to be light-weight so that sign language translation takes place in real-time using only the resources available on a smartphone, with no help from cloud servers nor external sensing components. Specifically, to train and test SUGO, sign language data was collected from 20 individuals for 50 Korean Sign Language words, summing up to a dataset of ~5,000 sign gestures and collect additional in-the-wild data to evaluate the performance of SUGO in real-world usage scenarios with different lighting conditions and daily activities. Comprehensively, extensive evaluations show that SUGO can properly classify sign words with an accuracy of up to 91% and also suggest that the system is suitable to enable a fully mobile solution for sign language translation.

The proposed[11] research based mobile-application development is to aid the needs of the differently-abled (deaf and dumb) community. The application inherits the core design of artificial intelligence that eliminates the language barrier faced by the differently – abled people. The base work of this application is to translate the static sign language into text that is understood by all. The application is implemented in Android operating system platform, which has the mode for wider usability of the application. The primary goal of this work is to detect and recognize the hand signs of deaf and dumb people trying to communicate and convert that into understandable text. The detection is a dynamic process since it is based on color and it can be varied in-line to the lighting conditions of the user. On the identification of the sign displayed by hand, it will be recognized by initiating the mobile application preprocessing techniques. The preprocessing technique involves attributes like conversion to HSV, and then to a binary image. As a result, from the processed image, features like the area of detecting region, bounding rectangle, min and max axis are extracted and managed, that would help in recognition of signs. Then, the related sign text will be displayed on the screen, which can be understood by the normal user. The application is also embedded with speech-to-text conversion, where the phrase spoken by the normal user will be displayed on the mobile screen as a text understandable by the differently abled. This, in turn, makes the conversion fluent and efficient between differently-abled and normal people without the use of any specified sensor or recommended hardware model. This application can be implemented in the railway stations so that when the user enters the administer controller of this application will be available.

[12] Deaf and speech impaired have limitations in terms of communication. Researchers are keen to develop a technology translator is able to translate sign language into written language. Growing technology is still limited to the PC-based translator. Researchers are interested in developing the mobile translator shaped because of its simplicity that can be brought in mobile. The research is making an Android-based application that can directly interpret sign language submitted by deaf speech into written language. Translation process begins from the hand detection using Opencv and translation of hand signals with the K-NN classification. Tutorial features added in this application with the aim to train intensively to users in the use of sign language.

[13]Nowadays, web technologies are a very efficient way to ensure communication between a large and heterogeneous audience. Furthermore, web information is mainly based on textual and multimedia content and consequently, some people with special needs, such as deaf and hard of hearing people, have difficulties to access to information or to communicate with hearing people. This problem is due to the lack of services that facilitate sign language learning for hearing people or text translation into sign language for persons with hearing impairment. In this context, the paper [1 presents a new approach based on web services, X3D and android operating system to build a mobile translation system from text into sign language using virtual signing agent. The main feature of this work is that it can be used to learn sign language and to provide sign language translation of written text for people with hearing impairment.

The paper [14]helps the deaf and dumb person to communicate with the rest of the world using sign language. Communication plays an important role for human beings. Speech-to-sign technology and VRS enables audible

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language translation on smart phones with signing and application has characters feature in mobile without dialing number uses a technology that translates spoken and written words into sign language with video. Interaction between normal people with blind person is very difficult because of communication problems. There are many applications available in the market to help the blind people to interact with the world. Voice-based email and chatting systems are available to communicate with each other by blinds. This helps to interact with persons by blind people. This work includes a voice based, text based and video based interaction approach. Video chat technology continues to improve and one day may be the preferred means of mobile communication among the deaf. Technologies not mashed up to solve the problem of mobile sign language translation in daily life activities. Video interpreter is responsible for helping deaf or hearing impaired individuals understand what is being said in a variety of situations. The main feature of this work is that it can be used to learn sign language and to provide sign language translation of video for people with hearing impairment.

In this paper [15], an accurate implementation of American Sign Language Translator is presented. It is a portable electronic hand glove to be used by any deaf/mute person to communicate effectively with the others who don't understand sign language. It provides the visual and audible output on an LCD and through a speaker respectively. This glove consists of five flex sensors that senses the variation in different signs, an accelerometer to distinguish between the static and dynamic signs, a contact sensor, Arduino Mega 2560 for processing of the data, VoiceBox shield, LCD and Speaker for the outputs. There exists a communication gap between the normal and the disabled people. A simpler, easier, useful and efficient solution to fill this void is presented in this paper.

The main aim of the research[16] is to build a mobile application using augmented reality (AR) translation system which will also provide the human gesture understanding and motion capture by snapping the real world using a smartphone's camera that requires the user to simply tap on the word of interest once in order to produce a translation, presented as an AR overlay. The translation orderly replaces the original text in the live camera stream, matching the background and leading-edge colours estimated from the source images. With this purpose, the research developed an efficient application for accurately detecting disorientation of the text in a live camera stream that is robust to perspective distortion, and we combine it with Optical Character Recognition (OCR). And also use Android Studio as the best platforms for augmented reality development that offers an impressive set of functions, with Software Development Kit (SDK), can recognize 2D and 3D objects and others. The AR mobile application will provide learners with supplementary information and also assist the interpreter in their teaching process for deaf people.

The paper[17] like to present a Convolutional Neural Network (CNN) model for predicting American Sign Language. There are 4800 images were captured to train and validate the proposed model. 95% recognition accuracy was attained in experiment, which shows robust performance in recognition 24 static American Sign Language pattern. The successful development of this model can be served as the basis to develop a more complicated sign language translator.

The research[18] proposes a semantic translation system for dynamic hand gestures using deep learning and ontology. We used the proposed MSLO (Multi Sign Language Ontology) in the semantic translation step. Also, any user can retrain the system to be a personal one. A Three-dimensional Convolutional Neural Networks followed by Convolutional long short-term memory to improve the recognition accuracy in Dynamic sign language recognition is used. The proposed system is applied on three dynamic gesture datasets from color videos. The recognition accuracy average was 97.4%. All the training and testing processes was done using the Graphics Processing Unit with the support of Google Colab. Using "Google Colab" in the training process decreases the average run time by about 87.9%. In addition to adding semantic in dynamic sign language translation, the proposed system achieves good results compared to some dynamic sign language recognition systems.

The work[19] addresses the issue of ” sign language recognition and sign language translation”. The dataset used here is American Sign Language(ASL) Alphabets, which contain 26 letters and 3 special characters that are space, delete and nothing. These special characters help in realtime recognition. Convolutional Neural Network(CNN) was chosen for the ASL recognition and Translation. Since the dataset is images, Image augmentation, color conversion, size reduction are implemented. The model could predict the letter and display in text and convert to audio with the help of python library called ’gTTs’(Google Text to Speech). The CNN model with Image Augmentation have achieved an accuracy of 94% with 10 epochs. In terms of accuracy the model is compared with all other ASL translation techniques, where most of them are using glove and sensors. However the model is overfit, and future work should address this while improving

The paper[20] considers peculiarities of the Russian sign language grammatical system which should be taken into account when developing a computer sign language translator. We draw a conclusion that the Russian sign language has its own grammatical system which includes word formation, morphology, and syntax, and may be described in terms and categories of the Russian language. The stage of the Russian text analysis, including morphological, syntactic, and semantic analysis, is characterized in detail.

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