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Survey on Language Translator for Impaired People using NLP Semantics

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Abstract: **Often times normal people are unable to communicate with impaired people ,this gap can be bridged by Sign Language. Sign language is a visual language used by both impaired people as their mother tongue. As far as a both speech-impaired and hearing impaired people is concerned, having access to a sign language is very essential for their social, emotional, linguistic and cultural growth. Our project aims to bridge the gap between these both speech impaired and hearing-impaired people and normal people with the advent of new technologies. This system takes audio as input, converts this audio recording message into text and displays the relevant Indian Sign Language videos which are predefined. By using this system, the communications between impaired people and normal people gets better**

Keywords: **Indian Sign Language, Machine learning, Artificial Intelligence, Deep learning, Natural language processing, Speech Recognition.**

I. INTRODUCTION

It is well known that Sign language is the mother language of impaired people. This includes the combination of hand movements, arms or body and facial expressions. There are a total of 135 types sign languages all over the world. Some of them are American Sign Language (ASL), Indian Sign Language (ISL), British Sign Language (BSL), Australian Sign Language (Auslan) and many more. We are using Indian Sign Language in this project. This system allows the deaf community to enjoy all sort of things that normal people do from daily interaction to accessing the information. This application takes speech as input, converts it into text and then displays the Indian Sign Language images.

- The front end of the system is designed using EasyGui.
- Speech which is taken as input through microphone uses PyAudio package.
- The speech is recognized using Google Speech API.
- The text is then pre-processed using NLP (Natural Language Processing).
- Finally, Dictionary based machine translation is done.

II. LITERATURE SURVEY

[1] Motionlets Matching with Adaptive Kernels for 3D Indian Sign Language Recognition. In this paper, an application for identifying indication of Indian sign language 3D motion captured data is created. Here they build a two- phase algorithm which handles multiple attributes of 3D sign language motion data for machine translation. In phase–I, the unordered 3D sign database is restructured into a 4–class structured motionlet database from the calculated trajectories of motion segmented 3D joints. Each action in a signed frame is motion segmented into joints (both motions and non-motion joints). Phase–II retrieves shapes and orientation of 3D motionlets by applying the measurements of joint relative distance and joint angle. Based on trajectories, finger shape and their orientations are three important kernels are constructed, which will find the likeness between the query signs and the database signs. It was found that that this type of motionlet based adaptive kernel matching algorithm on 500 class 3D sign language data gives better accuracies compared to state–of–the–art action recognition models. It optimizes the database search space by 75% over the existing kernel matching methods. Besides, a sensor-based validation for sign language capture shows that 3D motion capture models have superior classification accuracies compared to Microsoft Kinect and leap motion sensor. Further, the 3D sign language model powers the augmented–reality–based sign language machine translator for building a real time mobile application.

[2]A Wearable system for recognizing American Sign Language in real time using IMU and Surface EMG Sensors. In this paper they have proposed a wearable real-time ASL recognition system. The author says that the signs performed by the both speech impaired and hearing-impaired people into speech are detected by hand gestures using two important modalities i.e.., Inertial measurement unit and surface

electromyography. The author concentrates on recognizing American sign language. The author states that this was the first study of ASL recognition system consolidating IMU sensor and sEMG signals that are compatible to each other. Feature selection is performed to select the best subset of features from a large number of well established features and four popular classification algorithms are investigated for our system design. In this the author uses sign language recognition (SLR) tool to bridge the communication gap between both speech-impaired and hearing-impaired people. The system was estimated with 80 commonly used ASL signs in daily conversation and an average accuracy of 96.16% was achieved with 40 selected features. The significance of sEMG to ASL recognition task is surveyed. This paper is Glove-based SLR system that implements multiple sensors on the glove and capture the physical features of the body. In this paper the author as mentioned that the sensors can be placed either one hand or can be placed on both the hands and he has highlighted telling that placing sensors in both the hands will increase the accuracy. Here the four major muscle group selected by the author to place the sEMG sensors are 1.extensor digitorum, 2.flexor carpi radialis longus, and 3.extensor carpi radialis longus, and 4. extensor carpi ulnaris In this paper the author has used four different experiments to test the system those are inter- subject testing, all cross validation, intra-subject testing and intra-subject cross session testing. By performing this test, the author came to a conclusion that accelerometer is the key element in recognizing signs. As the author tells that this paper using sensors in hand and communicating will not give so much accuracy as vision-based approach. And also people may not feel comfortable wearing wearable devices and then communicating. As the author tells that for continuous sentence recognition other techniques should be considered more preferably machine learning.

[3]Avatar-based Sign Language Interpretation for weather forecast and other TV programs. The author proposed a system that translated the closed captions of weather forecast programs into KSL and presented it with 3D avatar animation. This paper generated 3D sign language animation by translating the closed captions in DTV, for both speech-impaired and hearingimpaired people to see the weather forecast with sign language interpreter. To identify the frequency of each word, they analyzed the last three years' weather forecast scripts from several sources that are available. They also built sign language synonym dictionary using KorLex to improve the translation performance. KorLex was also used for the disambiguation process of word sense. They focused on capturing the motions of a professional sign language interpreter and build the motion database. The motions were applied with motion blending to a 3D avatar. They updated the sign language weather forecast system's dictionaries, translation rules, and motion database, for the real-time open-domain sign language interpretation system. They consider using the proposed real-time sign language interpretation as an additional channel for N-screen services such as "my K"6. Although the system that is proposed is targeted only for the KSL users, they believe that it would be helpful to other similar researches, especially if both the source language and target sign language have a same word order, as in the Korean-KSL relationship. In future work, they will attempt to develop a statistical translation system to improve the translation rate, and build a large-scale Korean-KSL translation corpus.

III. INDIAN SIGN LANGUAGE

In India around 6.8% of its population is Speech and Hearing impaired. In developing country like India, where literacy rate is less, therefore it is difficult for speech and hearing impaired people to interact with surrounding world. In India there are various regional languages as per region and states. Hence there are not any standard signs in Indian sign languages. Indian sign language can be communicated using single and double hand. But in proposed method we considered both single handed gesture and double handed gesture signs for English signs.

IV. PROPOSED SYSTEM

The application is based on converting the audio signals received to text using speech to text API (python modules or google API) and then using the semantics of Natural Language.Processing to breakdown the text into smaller understandable pieces. Data sets of predefined sign language are used which the application can make use of to display the converted audio into the sign language. It is a dictionary-based Machine Translation. Since both speech-impaired and

hearing-impaired people are usually deprived of normal communication with other people, they have to rely on a human interpreter or some visual communication. This is automated, so this project can help eliminate the dependency on the human interpreter. This establishes a two-way communication.

A. Database: We will be using video clips of Indian Sign Language for each and every word. We will manually label each of the video We will like to maintain an filtered input that covers a wide range of words.

B. Elimination of Stop Words: Since ISL deals with words associated with some meaning, unwanted words are removed these include various parts of speech such as TO, POS(possessive ending), MD(Modals), FW(Foreign word), CC(coordinating conjunction).

C. Lemmatization and Synonym replacement: Indian sign language uses root words in their sentences. So we convert them to root form using Porter Stemmer rules. Along with this each word is checked in bilingual dictionary, if word does not exist, it is tagged to its synonym containing the same part of speech.

D. Video Conversion Stage: After the completion of above stages we get the ISL transformed text , the program will then find matches from the dataset available for each of the word. This will be based on the basic string matching algorithm between the processed input text and labels of videos. Finally a display of set of videos as a sequence one after the other can be seen on the screen.

E. Output Generation: The output of this module will be a video clip of ISL translated words. The database will be having video for each and every separate words and the resultant video will be a merged video of such words. For a given english text the system aims at generating its equivalent sign language depiction. Our system generates the output in the following way that is video generation - Output from the ISL conversion phase of input sentence is passed to video generation phase wherein for each of the words in the sentence are looked up in the database for its corresponding video file and then these files are all concatenated to to produce a more structured, informative and easy to understand visual depiction of Indian Sign Language

V. SIGN LANGUAGE DATA SET

We created a data set of hundreds of different signs from the Indian Sign Language data set.Each sign is performed one time by a single signer in varying lighting conditions and speed of signing. For the purpose of consistency, the background in all the videos is the plain.The videos were recorded on an android phone camera on 60fps and at 720p resolution. Each video was broken down by frame to images and trimmed to 300 frames and then augmented to increase the data set for each sign to 2400 images.Each video was recorded in landscape mode. The data set was further divided into training and test data sets, with some as a part of the training and the remaining as the test data set.

VI. SYSTEM ARCHITECTURE

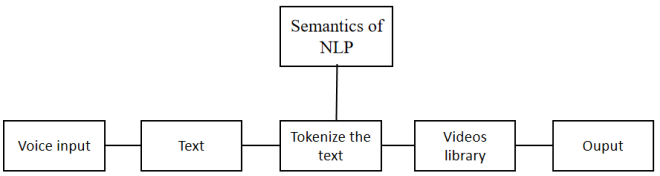

Figure 1:System Architecture

As shown in the figure 1 . The interface works in two phases, first converting Audio to Text using speech to text API (python modules or Google API) and secondly, applying the semantics of Natural Language Processing (NLTK specifically) and then producing the Indian Sign Language video output.
One of the most important roles in the both speech-impaired and hearing-impaired people community is the interpreter of Sign Language. So, Sign Language Interpreter states that it helps both speech-impaired and hearing-impaired people communicate with the society with no limitations and problems. The role of the interpreter is to solve the communication problem.

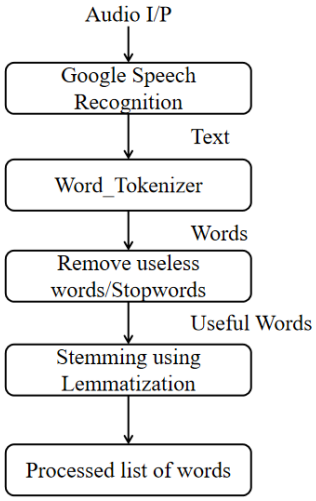

Figure 2: Audio to processed text dataflow

Initially, we take audio as input by utilizing the python PyAudio module.Next, we convert the audio to text using the Google Speech API.

Presently utilizing NLP i.e Natural language processing we breakdown the text into smaller, simpler and understandable text. We have a reliance parser for analyzing the grammatical structure of the sentence and building up the connection between words. Now we have data sets of predefined Indian sign language. We can now display the converted audio into the sign. Finally, we converted audio into Sign language using output as ISL videos.

VII. IMPLEMENTED RESULTS

Output generation for a given English audio or speech is produced by generating its equivalent sign language depiction. The output of this system will be a clip of ISL words. The predefined database will be having video for each and every separate words and the output video will be a merged video of such words.

As we know that Machine can only understand binary language (i.e.0 and 1) then how can it understand our language. So, to make the machine understand human language NLP was introduced. Natural Language Processing is the ability of the machine where it processes the text said and structures it. It understands the meaning of the words said and accordingly produces the output.

Text preprocessing consists of three thingsTokenization, Normalization and Noise removal Natural Language processing which is the mixture of artificial intelligence and computational linguistics. But actually how it works with our project is most important. NLP can do additional functions to our language. We will get our information after giving audio input based on the NLP devices to understand human language using Google Speech Recognition(GSR).

Figure 3: GUI

VIII. CONCLUSION AND FUTURE SCOPE

Sign language translator is very useful in various areas. In schools, colleges, hospitals, universities, airports, courts anywhere anyone can use this system for understanding the sign language to communicate. It makes communication between a normal hearing person and a hard to hearing person easier. The current system operates on a basic set of words and in order to extend the system, many new words can be included in the dictionary in future and specialized terms from different fields can be incorporated too. This project can be made as a mobile application, so that user can install the application into their mobile phones or laptops and can access it easily.

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