Original Article

Effective Communication Between Differently Abled And Normal People Using Speech To Sign Translation System

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Abstract

There are very less way of communicating between a differently abled person i.e. deaf and dumb also called as hearing impaired and normal people. Communications from deaf and dumb to normal people are done in many ways but from normal people to hearing impaired people have not been much. What we say cannot be understood by the deaf and dumb people so a system should be made so that a deaf and dumb person can understand the voice of normal people. The voice will be converted to sign language so that deaf and dumb people can easily understand. Machine learning techniques will be used to implement this with the help of Google API for voice recognition and then the Natural Language Processing is used. The voice will be broken into sentences or words and then the context of natural language processing will come into picture. The text will be compared with the gifs generated, if found the gifs will be shown as output or else letter by letter mapping will be done so the hearing impaired people can understand the voice through sign language. This is very important for the hearing impaired people. This helps hearing impaired people a lot because they can easily understand what the normal people are telling and for their daily life it will be very helpful. The system is tested with the number of data samples. As data samples increases, the accuracy of the model is said to have gone up as well.

Keywords: Sign language, Machine Learning, Natural Language Processing, Animations.

1. Introduction

Sign Language also called as signed language are the languages which are mainly used by deaf and dumb people also known by hearing impaired people. It can be easily presented through combination of hand shapes, movements of hands, arms and also of body with the facial expression change. It is mostly used by the people who have a problem of hearing and speaking called as differently abled people or hearing impaired in another word. They use sign language to communicate with everyone so people who communicate daily with the hearing impaired people need to learn sign language for now. The very basic need of deaf and dumb people i.e. hearing impaired people is to learn the sign language for their social need also.

With all the technologies rising and access to all the technologies there is still something that's missing and that is we need to find for communication ways between normal and deaf and dumb people. If some person has to communicate with the hearing impaired people the way it's done till now is either the normal person has to learn the sign language what the differently abled person knows or we have to use a translating person who knows the sign language and also understands what we say. As the use of technologies is rising so much there should be a way of communication. So this paper has a small description of how it can be done.

After referring to different papers and we couldn't find much about this way of communication we thought of at the first place. We tried converting the normal voice of a person to sign language so the differently abled person can understand what we say through the translation. Many research and works that are going on mainly focuses on translation of sign language to text which is not the full implementation so we tried making a way of communication which will translate the voice of a person to sign language so the differently abled person can easily understand what we are trying to say. This paper deals with how we tried to achieve it. First we record the voice of a person which will be the first module, with the help of Google API we've done that, then the second module includes the voice to text conversion which is done based on Natural Language processing. The third module is the one in which the text will be compared and then shown as the sign language for differently abled person.

2. Related Work

In the paper [1] Authors presents building an automated voice to sign system based on pose estimation but generating more own animations for not available poses can improvise the system. In paper[2] authors discussed on text to sign conversion for Arabic sign language and it can be extended to other languages with more vocabulary.

In the paper [3] the authors have told about the speech to sign language announcements in the field of transportation. They have discussed about the importance of the technology use for the deaf and dumb and how the speech to sign language conversion is very important and necessary for the differently abled people but the limitation of this work is that it only talks about the use of speech to sign language in the domain of transport services highlighting mainly the railway transport services. It will be very easy for the deaf and dumb people but it shouldn't just limit to one of the domains. In this paper, authors describe how it is useful to the deaf and dumb people.

In the paper [4] the authors Amitkumar Shinde and Ramesh Kagalkar describes about the hand gesture recognition system which can help the deaf to communicate easily with normal people without need of a translator. The scope is very small if we compare the sign language used in a whole nation or a regional language then the scope of regional language is very small. Also this paper discusses about the text conversion from sign language and text to sign language. We are trying to implement voice to sign language. In the paper the authors tell about how deaf and dumb people are marginalized in society and are made to feel unimportant and unwanted. They talk about the importance of a system that will help them to communicate with the normal people and they've done using the Marathi language.

In the paper [5] the authors Shwetha S Kulloli and R.H.Goudar discuss about the converting the sing language into text and voice format. Also the authors tells about people can enter the input as a text and then converting that to text and then to sign language image for the deaf and dumb people. Though it's a both way communication but its little tedious job to give the input in written form.

In paper [6] Pranali Loke, Juilee Pranjpe and Sayli Bhabal, the authors introduce about a sign langauge converter system that uses hand gesture recognition for Indian Sign Language. The authors have used android application to capture images of hand gestures. In paper [7] authors explained many techniques to fetch data automatically for a given keyword using natural language processing and shall also work on accuracy for increased input keyword.

In paper [8] authors discussed in the paper about to convert the human sign language used by hearing impaired people to speech with motion capture and human gesture understanding. Microsoft Kinect is used for motion capture a device from Microsoft. In paper [9] the authors Mr. Sangam Mhatre and Mrs. Siuli Das has talked about using gesture is the most natural way in a virtual reality system. They have used Hand talk glove which is normal, cloth driving glove fitted with flex sensors.

In paper [10] the authors Oi Mean Foong, Tang Jung Low and Wai Wan La describes about the providing a system which translates the voice to sign language which uses speech processing and image processing technique. The authors describes about the uses of template based recognition as the main approach for this work.

Most of the papers referred along with above listed papers were related to the communication way of sign language to text. That's basically one way communication which will help the normal people understand what the deaf and dumb people say but what the normal people say cannot be conveyed to the differently abled person. It was all mainly related to hand gesture from sign language to text.

3. Methodology

The method we have used while implementing this work can be divided into three modules. The first module is the voice recognition module. In second module what we do is use Natural Language processing and use the text converted from speech. We can use different methods to convert the text to sign language by converting. And the third module is the sign language output which the hearing impaired people can see.

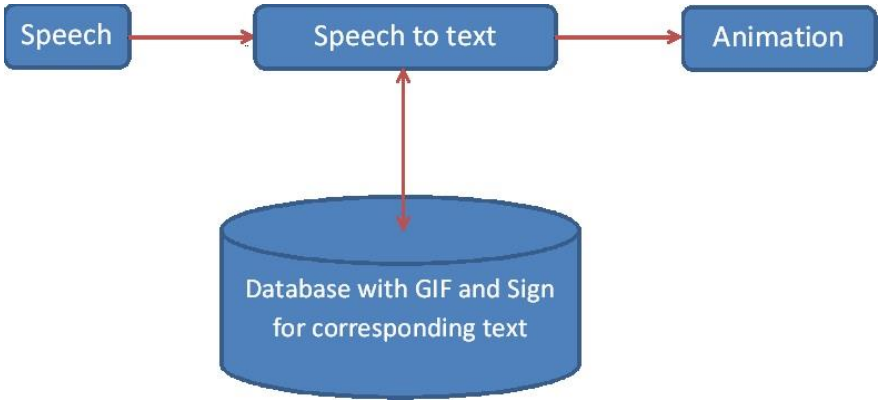

Figure 1: System Architecture

As in the figure. 1, the first part we collect voices from the normal people. With the help of Google API we recognize the voice of a person. After that using the help of Natural Language processing we convert the voice obtained to text. We compare the text with the database. So if the word is present then the gifs output will be shown which will be easy for the hearing impaired people. If the word is not found then letter by letter mapping will be done and then the output will be shown as a animation with letter by letter hand gestures so the hearing impaired people can understand.

In the first component speech recognition, Speech should be changed to an electrical signal from original sound with a help of microphone and then to digital data with the help of analog-to-digital converter. We've used recognize_google() which is a Google Web Speech API which requires internet connection for speech recognition.

For the second module, we've used Natural Language Processing (NLP) which is a field of Artificial Intelligence (AI) and other concepts of Computer science. It mainly focuses on the interaction computers and human language. There are algorithms which can be used for text conversion into speech or vice versa. Hidden Markov Models are one of the measurable models that are utilized to transform voice data into content. The process of conversion of text to speech starts by feeding the input data that is the natural speech to the speech recognition system for recognition of speech after the input data is fed to the matching algorithm, the speech recognition system will train and learn all the input which is fed to it and the final test on the system is done by testing the system to see whether it recognizes different words and produces the expected output. Finally

animation of the sign language can be obtained the last module. After all the mapping is done the last part is the animation. TKinter is used as Graphical User to get the desired result as a look and feel.

4. Results

The system proposed is implemented through Python programming langauge and can be used PyCharm or Spyder as platform to implement the same. The working of system is depicted using the following algorithm

Step 1. Input the voice/speech from normal people
Step 2. Perform speech to text conversion/speech recognition
Step 3: Compare the word sequence with the available GIFs in the database
If corresponding GIF present then show the correct animation
Else create and show animation with letter by letter sign
Step 4: Repeat step 1 to step 3 for different word sequences.

Here are some of the snapshots for how the system works.

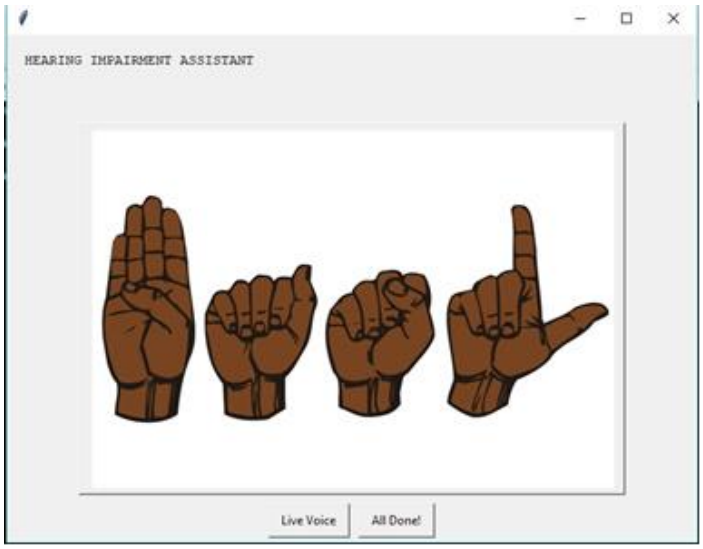

Figure. 2: Snapshot for giving input

As shown in figure.2 we have to option here, the first is the Live Voice option. In this option we can give our input as the voice from a user. The second one all done is the option to close the program. After clicking on the live voice we can see figure. 3 as an output. In this we can give our input which is a voice of a person.

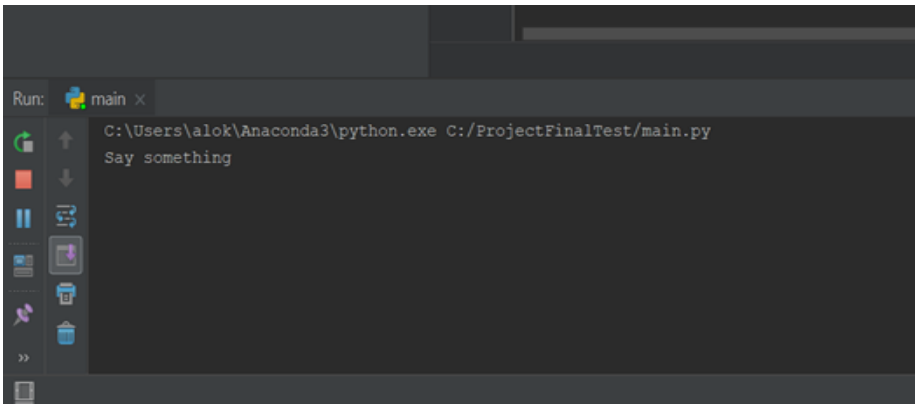

Figure. 3: Snapshot for giving input

After this, what we say as the input i.e. the voice will be converted to text and then it will be compared with the gifs that we have stored in our database. If it gets matched with the databases gifs then the gifs will be shown as the output. figure. 4 show that clearly.

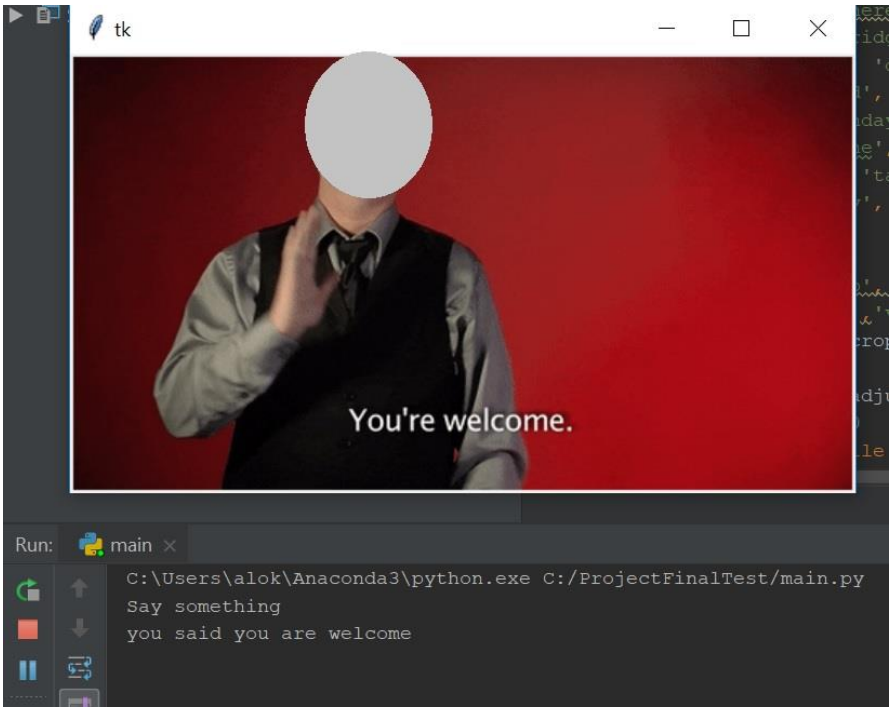

Figure. 4: Snapshot of the gif

Now if the word what we gave input as doesn't match with the gifs then what we tried doing is we broke the word into letters and then compared each and every letter and showed the output. Figure. 5 shows that. We have said a word start, so the letters s, t, a, r and t will be shown.

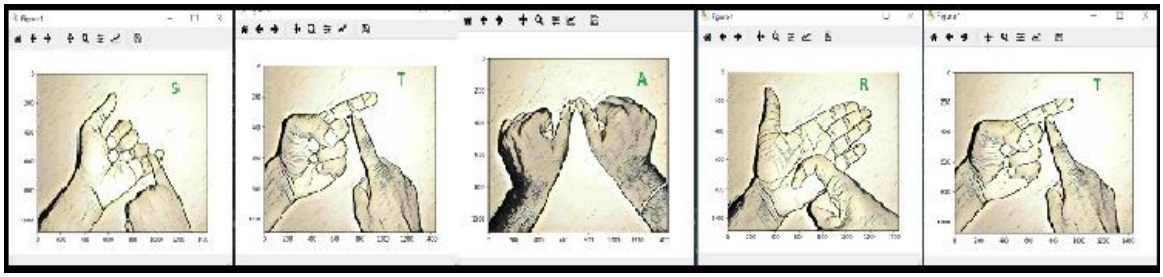

Figure. 5: START word split into letters signs.

The figure. 6 depict the accuracy of the model; the X axis (horizontal) of the model shows the number of data samples which are present. The Y axis (vertical) we can see the accuracy of the model. Here we can observe that, the number of data samples increases, the accuracy of the model is said to have gone up as well, this is because with the vast number of data and the knowledge about things will lead to more accurate data that is being produced.

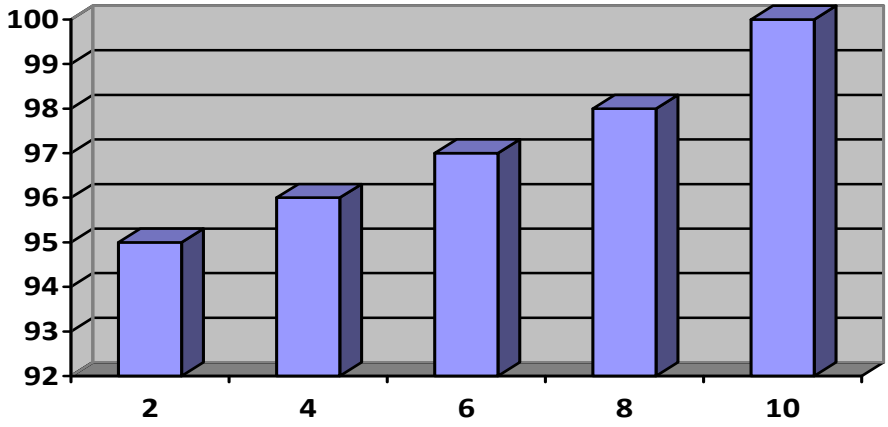

Figure. 6: Accuracy graph for words and N samples

5. Conclusion

We conducted the experiment ourselves to check if we get the results. The results are fairly good enough. Since there is not much works going on this module we could not compare with the other systems. While taking input since we have imported Google API internet connection is must for now. This can be improved for doing without internet connection. While giving input if there is noise around it cannot be recognized so this can be one of the future scope. Another one is we have very less number of datasets for gifs. If we can get large number of datasets then we can certainly improve the system in very efficient way. This system can be implemented in good for the hearing impaired people.

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