Sign Language Mediator

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Abstract - Deaf and dumb people's communicate their thoughts using sign language, which is a visual language. Unlike vocal communication, sign language makes use of body language and physical communication to fluidly express a person's thoughts. It can be used by someone who has trouble communicating or by a person who can hear but can not speak and also, by normal people to communicate with hearing disabled people. For deaf individuals, sign language is a very important factor for their growth. Our project aims to bridge the gap between these Deaf people and normal people with the advent of new technologies of web applications, Machine Learning, and Natural Language Processing. The main purpose of this project is to build an interface that accepts Audio/Voice as input and converts them to corresponding Sign Language for Deaf people. It is accomplished by incorporating hand forms, orientation, and movement of the hands, limbs, or body at the same time. The user interface is divided into two steps, first converting Audio to Text using speech to text API (webkitSpeechRecognition api) and secondly, represent the text using Parse Trees and applying the semantics of Natural Language Processing (NLTK specifically) for the lexical analysis of Sign Language Grammar. The work builds upon the rules of ISL(Indian Sign Language) and follows the ISL rules of Grammar

I. INTRODUCTION

A sign language (SL) is a three-dimensional natural visual-spatial language that uses handshapes, orientation, and movement of the hands, limbs, upper body, and facial expressions to communicate linguistic utterances instead of sound to convey meaning.The language was created as a result of India's deaf, dumb, and hard of hearing population. Because there are distinct groups of deaf and dumb individuals all throughout the world, the languages of these civilizations will differ. There are several languages on the globe, such as English, French, and Urdu, among others. Hearing impaired persons utilise a variety of sign languages and phrases all over the world. In the United States, American Sign Language (ASL) is used; in the United Kingdom, British Sign Language (BSL) is used; and in India, Indian Sign Language (ISL) is used to interact with one another. Many sign languages, such as ASL and BSL, have interactive systems already built. Hearing impairment affects roughly 5.07 million persons in India. More than a third of those surveyed are under the age of 20, with the remaining half falling between the ages of 20 and 60. Because they communicate with others using sign language, these persons are generally unable to talk properly. Many sign languages, such as ASL and BSL, have interactive systems already built. Hearing impairment affects roughly 5.07 million persons in India. More than a third of those surveyed are under the age of 20, with the remaining half falling between the ages of 20 and 60. Because they communicate with others using sign language, these persons

are generally unable to talk properly. Because sign languages lack a well-defined structure and grammar, they are either unaccepted or only marginally accepted outside of the narrow world of these differently-abled persons. According to research on American Sign Language, sign language is a full-fledged language with its own grammar, syntax, and other linguistic properties. There are various efforts, such as Indian Sign Language, to show that the same is true for different sign languages. In 1978, researchers discovered that ISL is a fully functional natural language with its own grammar and syntax. Hearing-impaired people have a difficult time communicating in public locations like railway stations, bus stops, banks, and hospitals since a normal person may not understand the deaf person's sign language. Also, because a normal person may not know sign language, he or she will be unable to communicate with a deaf person. To facilitate communication between deaf and non-deaf cultures, language translation is required

II. LITERATURE REVIEW

The base architecture of our project is based on paper [1] the project aims to develop a communication system for the deaf people. It converts the audio message into sign language . This system takes voice as input, transforms it to text, and then displays the appropriate Indian signing graphics or GIFs that have been pre-programmed.

POS tagger is an important tool, which assigns parts of speech tags for every word of the sentence. Because of the ambiguity in the language, designing effective POS taggers is difficult. The paper [2] discusses the survey of different types of POS taggers designed by the researchers and organizations. Each tagger will have their own set of tags. Tagging in NLP is analogous to tokenization in computer languages. Choosing the right tag for the context may be a challenge for POS taggers.

The interpretation system discussed in Paper [3] consists of a parser that converts the input English sentence to syntax grammar representation, which is then used to arrange the words of the English sentence using Indian signing grammar rules. The system uses Hammocks notation and SiGML tags for animation

Paper [4] helps us to implement the concept of lemmatization .Stemming lowers all words with the same stem to a similar form, whereas lemmatization focuses on removal of modified endings and restores the bottom or dictionary sort of a word. A baseline grading system was used to make comparisons between these two methodologies. A search engine was created, and the algorithms were put to the test in order to enable a test collection. Stemming and lemmatization exceed the baseline

approach in both mean average precisions and histograms. In terms of language modelling techniques, lemmatization outperformed stemming in terms of precision, though the differences are minor.

III. GAP ANALYSIS

We have researched about the current existing systems and found out that some of the systems just implement plain Audio to text conversion, tokenizing the words , removing stop words and finally displaying the GIFs for these words from the local database. What lacks in these implementations is the need of Restructuring the grammar which is different for Indian Sign Language. Our System ensures that this part is integrated into existing projects making it more flexible and meaning-full.

IV. PROPOSED SYSTEM

The proposed translational system takes audio input and converts it into text. NLP text preprocessing techniques are used to clean and ready the text for sentence reordering according to the conventions of Indian Sign Language(ISL). Finally searching for Short Videos corresponding to the words in the rearranged sentence and showing it to the end user.

Modules in System Architecture[Fig. 1.]:
1. Audio to text Converter
2. Text Tokenizing and Parts of Speech Tagging
3. Removal of Stopwords
4. Tense Determination
5. Lemmatization
6. Sentence reordering using ISL Grammar Rules
7. Display the Animation

A Audio to text Converter The external or in-built microphone on any Personal Digital Assistant (PDA) is used to give input for the module. The module uses webkitSpeechRecognition API for audio to text. The audio input is converted into English text. The module has been developed in python script. The speech is recognized by the module and punctuation is added accordingly to the input text.

B Text Tokenization and Parts of Speech Tagging The process of breaking down a character set and a document unit into bits, or tokens, while omitting characters such as punctuation is called tokenization. The text tokenization algorithm used in this project is Punkt Sentence Tokenizer. This tokenizer uses an unsupervised approach to construct an abbreviation model that splits a text into a list of sentences, words, collocations, and words that start sentences. Before it can be utilised, it must be trained on a large amount of plaintext in the target language.

Input: Friends, Romans, Countrymen, lend me your ears;
Output: [Friends, Romans, Countrymen, lend, me, your, ears]

The method of identifying the parts of speech of each word in a phrase is known as POS tagging. The output is a dictionary with the specified word as the key and the POS as the value. In this application, POS tagging is implemented using an average structured perceptron method. Input: [Friends, Romans, Countrymen, lend, me, your, ears]
Output: {Friends:NN, Romans:NN, Countrymen:NN, lend:VB, me:PRP$, your:PRP$, ears:NN}

C. Removal of Stopwords

According to the rules of ISL, we never use am/is/are/was/were/ (linking verbs) or Do not use articles. (a, an, some, the). Such words are called Stop Words. These words are very common in source language but do not give any meaning and are not a part of the dictionary of the target language and thus should be eliminated. In this phase of the module, we eliminate stop words out of reordered tokens.

D. Tense Determination

Tense Determination is a necessary process because the tense of the reordered sentence should be the same as that of the original sentence. Tense can be determined by classifying the type of verb the sentence has. The count of past, present, future, and present participle is calculated and then the maximum among the four is retrieved. This retrieved tense will be the tense of the sentence.

E. Lemmatization

Lemmatization is a technique of finding the root word or lemma of a given word. This root word is present in the dictionary of a particular language. Stemming is similar to Lemmatization but the lemma or root word found may or may not be present in the dictionary of desired language. Stemming and lemmatization can also differ in that stemming usually collapses derivationally related terms, while lemmatization usually only collapses a lemma's different inflectional forms.

F. Sentence reordering using ISL Grammar Rules

When both languages have differing grammar rules, translating one spoken language to another is a difficult undertaking. Especially when the source language is spoken and the target language is sign language, the complexity is multiplied by a factor of ten. For translating English text to Indian sign language, a comparison of the grammar of both languages is a necessary[Fig. 2.].Examples of sentence reordering[Fig. 3]

Verb Pattern	Rule	English Grammar	ISL Grammar
Verb + object	VP NP	Go school	School go
Subject + verb	NP V	Birds fly	Birds fly
Subject + verb + subject complement	NP V NP	His brother became a soldier	His brother a soldier became
Subject + verb + indirect object + direct object	NP V NP NP	I lent her my pen	I her my pen lent
Subject + verb	Subject + verb	Show me your hands	Me your hands show
Subject + verb + direct object + preposition + prepositional object	NP V NP NP	She made coffee for all of us	She coffee for all of us made
Subject + verb + indirect object + direct object	V NP PP	Show me your hands	Your hands to me show
Subject + verb + direct object + prepositional object	NP V NP	We are waiting for suresh	We for suresh are waiting

. 5. ISL Grammar Rules

G.   Display the Animation

The words from the reordered sentence are considered as a single entity and the video for each word is searched in the database and the same is returned. These returned videos are stored into a video buffer in the sequence matching that of the recorded sentence.

V.   CONCLUSION

A platform which converts English text into Indian Sign Language is proposed in this paper. The goal of this project is to provide a way to communicate with deaf people. The major components of this project include text processing(POS tagging, lemmatization), Grammar reordering using ISL grammar rules and Animation. A limitation of this project is the limited words present in the ISL dictionary(approximately 6000 words). As the dictionary size may increase the scope of this project may increase at a faster pace..

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