CS 753:
Automatic Speech Recognition

PPT Presentation

Topic Name:

Speech to Indian Sign Language Conversion

By:

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Problem Statement

Design an architecture for differently abled people to convert an audio speech as an input from the user into the Indian sign language

Abstract

- Deaf people always miss out the fun that a normal person does, may it be communication, playing computer games, attending seminars or video conference etc.
- So, Sign language is a natural way of communication for challenged people with speaking and hearing disabilities
- The aim of our project is to develop a communication system for the deaf people.

Abstract

- The scarcity of any sign language corpus caused lesser development of sign language conversion systems.
- This field has been much more focused on American sign language(ASL)
- Our project converts the audio message into the text and and displays the relevant Indian Sign Language Video/GIFs of Avtar.

Methodology

- Speech is taken as input through microphone
- used JavaScript Web speech API for speech recognition
- The text is then pre-processed using NLP (Natural Language Processing)
- Lastly, playing video of avtar that displays sign language for particular word.

Algorithm Design

- English parser for parsing the English text
- Sentences reordering module based on ISL grammar rules
- Eliminator for eliminating stopwords
- Stemming for getting the root words of each word and synonym replacement for words not in dictionary
- Video display

Algorithm Design

1. **Parsing of the Input English Text**

   To carry out rule based conversion of one language to another, grammatical structure of both the source and target language must be known.

   This can be done using Parser

   So, we used Stanford parser which is capable to produce three different outputs, part-of-speech tagged text, CFG (context free grammar) representation of phrase structure and type dependency representation.

Algorithm Design

2. Grammar rules for conversion from English to ISL

Since both spoken language and sign language have different grammar rules. The complexity to translate them is increased many folds

Comparison:

Algorithm Design

2. Grammar rules for conversion from English to ISL

English Grammar	ISL Grammar
English grammar follows the subject-verb-object order.	The structure of sentences of ISL follows the subject-object-verb order
English language uses various forms of verbs and adjectives depending upon the type of the sentence.	ISL does not use any inflections (gerund,suffixes, or other forms), it uses the root form of the word.
Question word in interrogative sentences is at the start in English	In Indian sign language, the question word is always sentence final

Algorithm Design

Therefore ISL grammar rules, require all the verb patterns being shifted after the corresponding noun occurrence. Some Examples of re-orderring:

Verb Pattern	Rule	Input Sentence	Parsed Sentence	Output Sentence
verb+object	VP TO NP	Go to school	(VP (VB Go)(TO to) (NP (NN school)))	School to go
Subject + verb	NP V	Birds fly	(NP (NNS birds)) (VP (VBP fly))	Birds fly
subject + verb + subject complement	NP V NP	His brother became a soldier	(NP (PRP$ his) (NN brother)) (VP (VBD became) (NP (DT a) (NN soldier)))	His brother a soldier became

Algorithm Design

3. Elimination of Stop Words

Since ISL deals with words associated with some meaning, unwanted words are removed these include various parts-of-speech.

For ex:

Alice and Bob are Fighting

Removed stop words->

Alice Bob FIghting

Algorithm Design

4. Lemmatization

Indian sign language uses root words in their sentences. So we convert them to root form

Ex:

Laughing -> Laugh

DATASET

- We came across lots of data majorly showing images of every alphabet of text.
- Some dataset(website https://indiansignlanguage.org/) contains videos of words, which requires manual dataset creation/labelling which is not possible due to time constraint, and also, it is high memory consumption.
- Since, we found a little dataset of around top 150 words which is created using blender animation application.

Deployment Overview

- We used Django framework to deploy our project
- Used HTML, CSS, JS for front-end
- Specifications:

  -we display both ASL as well as ISL avatars

  -input can be given through speech or can be typed

  -processed text and words shown side-by-side

  -those words not present in vocab represented by dividing them into single alphabet

Demo!!

Future Work

Dataset can be created using blender tool to cover more vocabulary

Performance of ISL algorithm can be improved

Continuous Conversion without pause can be developed. And can be used to convert live communication ex: Live news display with side-by-side sign language avtar.

Work Distribution

Ansh: Django deployment and slide

Kiran: Algorithm, code writing and presentation

References used

- https://www.ijeit.com/Vol%209/Issue%2010/IJEIT1412202004_05.pdf
- https://www.cse.scu.edu/~mwang2/projects/NLP_English2IndianSignLanuguage_18w.pdf