

# Framing Sentences from Sign Language symbols using NLP

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**Abstract:** Normal person cannot understand the conversation of deaf or dumb people. Deaf/dumb people defect in sentence formation and grammatical correction. Previously the sign language is converted to the text, but only in word format using image processing methods. Natural Language Processing (NLP) is a powerful tool for translation in the human language. This work is responsible for the formation of meaningful sentences from sign language symbols, which can be read out by a normal person. For this the combination of Image processing and Natural language processing techniques are used. Vital target of this project is to help deaf/dumb and normal people to ease their day to day life.

**Keywords:** NLP, deaf/dumb, sign language, sign language symbols, Image processing.

## Introduction

Natural language is use by normal people, to communicate/interact with each other, while tactile sign language is used by deaf and dumb people to interact [4]. Now a days, people with disabilities, experience difficulties to stand in the race because of ferocious competition in every field. The effort is to develop an application which will help deaf and dumb people to interact with a normal person [2]. According to a survey, India composes of nearly 2.4 million deaf and dumb populations which approximately make up 20% of the world's total deaf and dumb population. For hassle-free interaction between the normal person and deaf /dumb person, there is a need of an interpreter (Person who has the knowledge of sign language, as well as normal language) .

The interaction of deaf/dumb people is developed depending on the movements of hands. Using a collection of hand gestures and symbols, tactile sign language is an effective means of communication for them [13]. Though it is true, the hearing-impaired have to challenge interaction barriers in a mostly hearing-capable society. This research work will concentrate on sentence formation for deaf interaction.

Natural language is a skill use for understanding human language [10]. It is a part of linguistics and Artificial Intelligence. NLP (Natural language processing) is a step for developing a system that can convert the text (words) in human language. POS tagging is the method of NLP which was first introduce in 1960. It is an important method for language processing. For many NLP applications it is the simplest and most stable step. Part Of Speech tagging is the initial step for machine translation, retrieval of information and etc [15]. Second important method in NLP is parsing. Parsing is the method which is followed by the compiler.

The objective of this work is to construct a sentence from the words outputted by the video of deaf/dumb. The process of construction of sentence is done by Natural Language Processing engine. Natural language processing is mainly done using two methods which are POS tagging and Parsing [5]. In preprocessing step a video of deaf person is captured while interacting. On this video some image processing steps such as segmentation, tracking, feature extraction and classification are carried out and enacted words are identified [16].

## Steps for sentence formation

The process of sentence formation for deaf interaction consists of following steps:

1. Preprocessing of videos
2. POS tagging

3. Grammar designing
4. Parsing

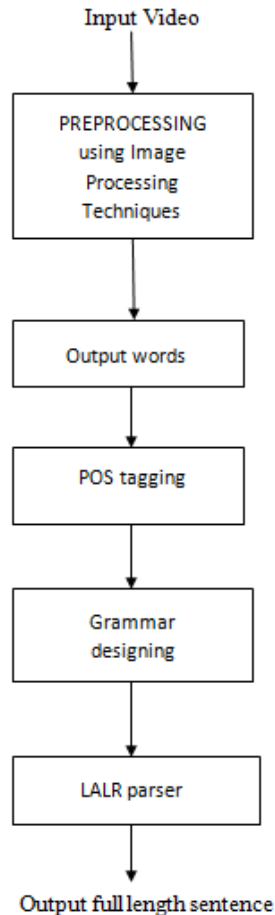


Fig.1.Steps for Sentence formation for sign language symbol

### Preprocessing of videos

Video of deaf/dumb is taken with the help of camera. This video is then preprocessed using Image processing techniques [11, 20]. Preprocessing steps are listed below:

- Framing
- Segmentation and Tracking
- Feature extraction
- Classification and Recognition

The video is divided into frames on the basis of size and timing of video. While taking the video only hand movements are considered. For capturing the videos 2D camera is used [9]. Frame extraction is done by maximum curvature point [3]. Segmentation and Tracking is done using Hue Saturation value method and Camshift method respectively. It gives satisfactory result in complex background with different light conditions [2, 8, 17, 19]. For feature extraction P2DHMM i.e.

pseudo 2-dimensional Hidden Markov Model is used [7]. Classification and Recognition is done using Harr like classifier [6]. Recognition is done using database.

### POS tagging

Words obtain from preprocessing step are passed to NLP engine where each word gives some description and this process is called tagging [1]. Basically the process of tagging is divided into two stages which are tokenization and tagging. The descriptor for the description is called tagger. The tag indicates one of the parts-of-speech like interjection, verb, adjective, adverb, noun, conjunction, preposition and pronoun. Input i.e. Raw Text is tokenized and a text is used for finding the corresponding part of speech (POS) of each token in the sentence. Working of POS tagger is explained with the help of following example:

Consider words such as “I” and “Love”. In these two words “I” is tagged as “N” where meaning of N is noun. Word “Love” tagged as “V” where V means verb. POS tagging techniques are divided into two parts viz. Supervised and Unsupervised techniques. Supervised learning technique uses pre-tagged text, which is use in case of training to learn information about the frequencies. Unsupervised learning use methods which automatically tag the words [18].

### Designing of grammar

Grammar specifies the set of rules to define legal sentences in particular language. These rules work together for constructing the valid sentences. Simple and easiest form of grammar is context free grammar [13]. It is easy to deal and write the context free grammar for people. Most of the time grammar is compromised by writing rules in context free style. These rules are then augmented to deal with some kind of complications. For grammar construction variety of approaches are used. It is useful to examine the use in following ways:

1. Conceptual tool- It is used for finding complexity of natural language by capturing and reporting.
2. Formal notation – It is used to trace syntactical and semantical feature of language which is used by parser.

First category is concerned with structure of language while second is concerned with implementation and description of the specified grammar. The relationship between the conceptual design and notation is similar to the program and the programming language. In the design of grammar, parser act as interpreter or compiler which is used for recognizing the language. Representation of Grammar design is as follows:

$$G = \{V, \Sigma, P, S\}$$

Where,

V=Set of non terminal

$\Sigma$ = Set of terminal

P= Set of production

S= Start symbol

### Parsing

In the current work bottom up Left to Right (LR) parser is used. It is versatile, shift reduce, efficient and useful technique for parsing large class of context free languages. LR parser is recursive program which can be proven with the help of direct computation [12]. LALR parser is simplified version of Left to Right (LR) parser it is uses to separate and analyzes the text according to their production rules specified by formal grammar. The inputs to the parser are pronoun, verb, conjunction, adjectives etc. Tactile sign language does not consists words like is, am, are and article. So to construct meaningful sentence parse tree is used which insert word and articles to the appropriate places.

### Conclusion

The major objective of this work is to give significance of sign language as an interpretation language and focus on methods/techniques available for Sentence formation using Natural Language processing Engine. For sentence formation methods of NLP are used which POS tagging and LALR are parsing. Framing of sentences from the sign language symbols work effectively so that it use for narrowing the gap between deaf/dumb and normal people. So that deaf/dumb people also stand in the race with normal people.

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