International Journal of Current Engineering and Technology
E-ISSN 2277 – 4106, P-ISSN 2347 – 5161

Available at http://inpressco.com/category/ijcet

Research Article

An English Text to Indian Sign Language Converter

Shruti Chikalthankar and Dr. A.S. Ghotkar

Department of Computer Engineering, PICT-Pune, India

Received 10 Nov 2020, Accepted 10 Dec 2020, Available online 01 Feb 2021, **Special Issue-8 (Feb 2021)**

Abstract

This paper describes an approach to bridge the communication gap between hearing impaired or dumb people and normal people. Using Natural Language Processing, the interaction between different languages is now possible. The system takes input as English text and will generate the corresponding HamNoSys notations as a intermediate language. This HamNoSys notations will be given to avatar module to generate corresponding Indian Sign Language (ISL). The system is developed for banking domain.

Keywords: *Natural Language Processing ; HamNoSys; Indian Sign Language; Machine Translation.*

Introduction

In a Country like India with 25 languages, roughly 1% of Indian population are with hearing impairment. Sign language is a visual language which is commonly used by deaf and dumb people as a primary language. It includes facial expressions, hand movements and orientations to create signs. Normal people mostly are unaware of this language and this hinders the communication between hearing impaired people and others. This also impacts the social life of deaf and dumb people. Like different countries have different spoken languages, there are different sign languages for different countries. For example,British Sign Language (BSL) and American Sign Language(ASL) are different, even though the spoken language used by hearing people of Britain and America is same. Also in India, there are different sign languages for different states. For converting spoken language language to sign language, an intermediate language is required which is called as HamNoSys. The Hamburg Notation System for Sign Languages (HamNoSys) is an alphabetic system describing signs on a mostly phonetic level. A HamNoSys notation for a single sign consists of a description of the initial posture describing non-manual features, hand shape, hand orientation and location and the actions changing this posture in sequence or in parallel. For two-handed signs, the initial posture notation is preceded by a symmetry operator that defines how the description of the dominant hand copies to the non-dominant hand unless otherwise specified.

Literature Survey

Authors of paper [1] used probabilistic context free grammar to generate Taiwanese sign language for input Chinese text. Possible phrase structure trees (PST) were generated using Chinese Probabilistic Context Free Grammar (PCFG) which were transformed into Taiwanese sign language (TSL) PST using transferred probabilities. Translated TSL's PST were used to generate TSL sequence and result was obtained through maximum probability. Authors of paper [2] used chi square value between word and lexical co-occurrence to estimate meaning for Korean input and to find relational sign from available limited Korean wordnet. Lower value of chi-square denotes two words related where as higher value denotes no relation between two words. A semantic and syntactic mapping storage technique were used by authors in paper [3]. Fluid Construction Grammar (FCG) was used to encode paired syntactic and semantic structure. This system was build for Hindi to ISL conversion for railways corpus. Authors of paper [4] analyzed the statistical and neural parsing for Urdu. They used probabilistic context free grammar, data oriented parsing and recursive neural network based models using multiple linguistic features. The system was build to process morphologically complex language such as Urdu.

Authors of paper [5] used two sets of POS (Parts of Speech) tagging such as NN,n for noun to build conditional random field. In paper [6] a system were designed for simile recognition using self attention mechanism which relates different positions of a single sequence. Paper [7] proposed a system that uses statistical machine translation (SMT) to align thematic roles in grammar rules and provide reference template for Taiwanese Sign Language (TSL) structure translator. System has learned templates stored in memory.

Proposed Methodology

The system will be used for banking applications. The input to the system is an English text. The input text will be processed to generate ISL structure using POS tagging. The processed input will be converted to HamNoSys notations which will be fed to a avatar module.

A. Data Collection

The input data will be text consisting of corpus related to bank domain. Table 1 shows the words related to banking domain.

.1	Balance Opening/cl - osing	Cash Book	Declaration
Account Blocked	Bank Nationalised	Cash Credit	Deposit Safe Custody
Account Holder	Bill overdue	Cheque Crossed	Differenti - al rate of interest
Account Charges	Bills Purchase	Cheque postdated	Half Yearly
Applicant	Bills Receivable	Claim	Identifica - tion

Table 1 Identified words related to bank domain

A. System Architecture

The system is divided into three modules.

1. Input text processing module.
2. ISL generation module. 3.

Animation Module

Fig. 1 shows the system architecture.

Module 1: Input Text Processing

The user will provide input string i.e. an English text to the system. The provided string may consists of unwanted data which is needed to be filtered out. The unwanted data such as prepositions and punctuation can be removed. This process is called stop-word removal.

Example:

Input: *I will give you a form.*

Output: I give you form.

Input: *What is your name?*

Output: *What your name*

Module 2: ISL generation

Once the unwanted data is removed, the string is needed to be converted into ISL form. Unlike English which has subject verb object (SVO) structure, ISL follows different structure of words. It follows subject object verb order. Following are some examples:

Input: *You submit the form.*

Output: *You form submit.*

In ISL the position of Wh questions are placed at the end of sentence.

Input: *What is your name?*

Output: *Your name what?*

Parts of speech tagging (POS) is necessary to be done initially so as to obtain the ISL structure. Position of tag helps to identify noun, verb, Wh-adverb etc. Following table gives tag description.

Parts of Speech	Tags
Noun	PN
Verb	VB
Personal Pronoun	PRP
Wh adverb	WRB
Adjective	ADJ

Example:

Input: What is your name?

Output: What _<WRB> is_<VBZ> your_<PRP> name_<NN>

Once the string is tagged, ISL form can be constructed using tagged string.

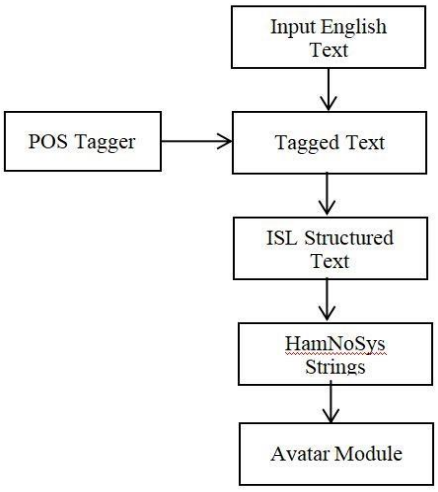

Figure 2. System Architecture

Module 3: Animation Module

For displaying signs dynamically, an avatar module is used. eSignEditor is used for avatar module. The editor requires input a HamNoSys string which is a string of notations. It is used to describe manual as well as non-manual gestures.

Following figure shows a HamNoSys symbols and description:

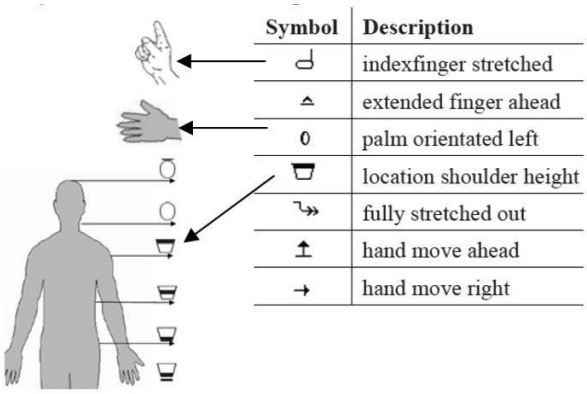

Figure 2. HamNoSys Symbols and Descrption

The software name SiGML too can be used to generate this symbols. SiGML is Signing Gesture Markup Language.

Example for HamNoSys string:

Letter:□□□□□□□□□□□□□□□□□□□□□□□□□□□

Around/Roughly:

□□□□□□□□ Read:

□□□□□□□□□□

Once the string is generated, it can be fed to avatar module which displays corresponding sign.

Result and Discussions

The system contains the database of which has words and their corresponding HamNoSys symbols. The user has to login once so as to use the system.

The input is taken from text box. For the given input text, pre-processing is carried out and bank related words are retained. The processed string is then tagged using tagger and ISL structured string is generated. For this string, corresponding HamNoSys notations are fetched from database and fed to avatar module to generate signs.

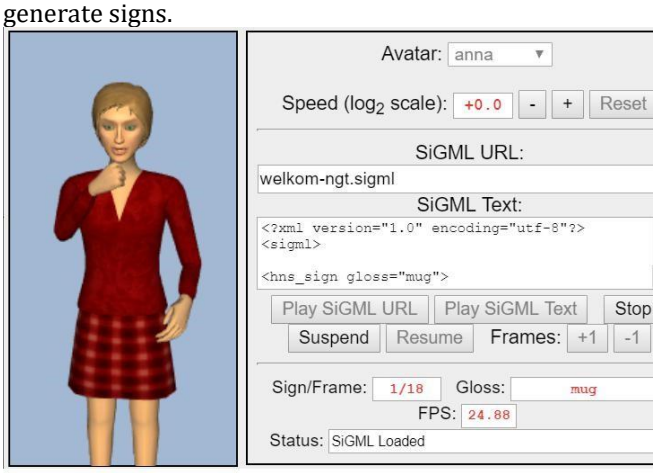

Figure 3. Avatar Module

Conclusions

The system can be used by hearing impaired people in banking application. The system generates signs dynamically which is easy to understand rather than playing video streams or sequence of images as proposed by traditional system. The signs can be played multiple times. The system provides the user with functionality to add new words and their corresponding HamNoSys notations into the database.
author should mention limitations of the proposed system. The author is also asked to mention the future research line.

References

[1]. Chung-Hsien Wu, Hung-Yu Su, Yu-Hsien Chiu, Chia-Hung Lin, “Transfer-Based Statistical Translation of Taiwanese Sign Language Using PCFG,” ACM Transactionson Asian Language Information Processing,Vol. 6,April 2007.

[2]. Minho Kim, Sung-ki Choi, Hyuk-Chul Kwon, Aesun Yoon, “Practical Target Word Selection Method in Korean to Korean Sign Language Machine Translation,” IEEE International Conference on Computer and Information Technology 2015.

[3]. Purushottam Kar, Madhusudan Reddy, Amitabha Mukerjee and Achla M. Raina, “INGIT: Limited Domain Formulaic Translation from Hindi Strings to Indian Sign Language,” IEEE International Conference on Computer and Information Technology 2009

[4]. Toqueer Ehsanand Sarmad Hussain, “Analysis of Experiments on Statistical and NeuralParsing for a Morphologically Rich andFree Word Order Language Urdu”, IEEE Access, October 2019

[5]. Zhenghua Li, Jiayuan Chao, Min Zhang, Wenliang Chen, Meishan Zhang, and Guohong Fu, “Coupled POS Tagging on Heterogeneous

[6]. Annotations”, IEEE/ACM Transactions on Audio, Speech, and Language Processing, March 2017

[7]. Penfei Zhang, Yi Cai, Junying Chen,Wenhao Chen, And Henjie Song, “Combining Part-of-Speech Tags and Self-Attention Mechanismfor Simile Recognition”, IEEE Access, October 2019

[8]. Chung-Hsien Wu, Hung-Yu Su, Yu-Hsien Chiu, Chia-Hung Lin, “Improving Structural Statistical Machine Translation for Sign Language With Small Corpus Using Thematic Role Templates as Translation Memory,” ACM Transactionson Asian LanguageInformation Processing,Vol. 6,April 2007.