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Machine Translation of English News to Indian Sign Language (ISL) for Indian Deaf Community

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Abstract
Communication is a basic need of every human being in order to learn, express their emotions and discuss their plans, but deaf individuals cannot listen and speak. In order to tackle this problem, a technological solution can be facilitated. In this work, we proposed a machine translation technology to convert English News to Indian Sign Language (ISL) using synthetic animations. The proposed system performs a morphological, text normalization, tokenization, stemming, lemmatization on English news to translate it into Indian Sign Language glosses with the grammar rules and structure of ISL. To generate the ISL glosses, sign notation is used to represent 3D synthetic animations. In addition, we developed a parallel bilingual dictionary in the English news domain, which consists of 4926 words. Corresponding to these words, we prepared at least three synonyms and inflections that cover approximately 20, 000 words. The words that are not available in our database are represented through finger spelling. We evaluated our machine translation system on this corpus and concluded that our translation system provides an accurate translation of approximately 80% of the translated English News. This paper provides a comprehensive explanation of the system architecture, machine translation-based rules, synthetic animations and extensive experiments

Keywords: HamNoSys Notation, Synthetic Animations, English News, Indian Sign Language, Machine Translation, Gestures.

Introduction
The deaf population uses body language, also known as sign language (SL), to communicate through postures, facial expressions, and gestures. The deaf, stupid, and hard of hearing people in India are the reason the language was created. There are several communities of deaf and dumb people all throughout the world, and as a result, their languages will vary. English, French, Urdu, and other languages are spoken all over the world. Similar to this, hearing-impaired persons around the world utilize a variety of sign languages and phrases. Each language differs from the spoken language of that area in terms of its signs, syntax, and word order.

Sign language differs from place to place, region to region, country to country, and nation to country, it is not a universal language. Every nation has its own grammar standards and sign language. For instance, although the average person in the United States (US) and the United Kingdom (UK) speaks the same spoken language, American Sign Language (ASL) and British Sign Language (BSL) are different and incomprehensible to one another. Certain regions or nations that speak only one spoken language may have two or more gesture languages, whereas other regions may have many spoken languages but only one sign language. Deaf persons can access audio information through sign languages. They can be used to provide linguistic homogeneity of spoken word and to convey pertinent aural information. Sign language interpretation is important on television. Those who are hard of hearing can understand the content of television shows with the aid of sign language interpreters. Laws governing the use of sign language on television vary by nation. Because news and current affairs programs are so vital to viewers, they are typically supplied to sign language interpreters. However, experienced translators and sign language specialists are more expensive and not always available.

Literature Review
To overcome barriers, many scholars have put forth a variety of methods for translating spoken language to sign language. The translation of spoken language into sign language differs greatly from the translation of sign language into spoken language, as does the translation between two spoken languages. Cox et al. developed a spoken-to-British Sign Language translation system to help a deaf individual interact with postal workers. The post office provides input for this system. Speech by an employee. British Sign Language is used to translate that voice.

Virtual player avatars serve as representations of the speech signals. Once all the gestures have been integrated, the avatar can move. However, the participants' ability to speak with one another is restricted because there are just a few sentences available to use as templates. As a result, TESSA is a rather specialized system [6]. Ronnie et al. published an approach for creating and implementing sign language programs in the setting of digital television. Three steps were engaged in the gesture language content creation process: capture, transmission, and representation [7]. In 1998, GrieveSmith developed The SignSynth project, which used the ASCII-Stokoe architecture to represent signs. An animation outcome of converting the ASCII-Stokoe model to VRML (Virtual Reality Modelling Language) [8]. Manoharan et al. suggested an ISL (Indian sign language) maker for smartphones to assist those with hearing impairments [9]. Kar et al. developed the INGIT project, which involved converting Hindi strings to ISL (Indian Sign Language), specifically for Indian Railway reservations using HamNoSys [10]. The e-learning interface for GSL was presented by E. Efthimiou et al. using animation and avatar technology [11].

System Architecture and Methodology

We created a bilingual dictionary with about 3,300 signs in it. To help with comprehension, each entry includes the English term, its associated ISL symbol, and examples from the context.

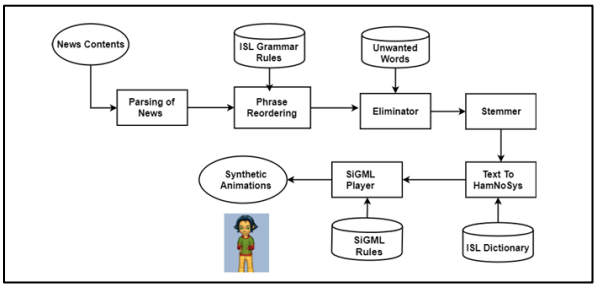

Figure 1. Block Diagram of English News.

Rule-Based Translation

We created 151 grammatical rules to guide the translation process using a rule-based technique. These rules provide accurate phrase and sentence conversion by handling the syntactic differences between English and ISL.

Creation of Synthetic Animations

We used HamNoSys to create a synthetic animation for each symbol in our lexicon. By graphically depicting the signs, these movies help students understand hand gestures, facial expressions, and body position.

Results

The system was evaluated by a team of sign language interpreters, deaf school teachers, and students. A strong foundation for regular communication was created with a translation accuracy of roughly 80%.

Figure 2. Bar Graph Representing Outcomes for English News to ISL.

Conclusion and Future Scope

Currently, the system is adept at translating simple, complex, compound sentences and even paragraphs. Efforts are underway to expand the rule base, which will enable the translation of idioms. The target system lacks the proficiency to handle cases where an English word does not have a corresponding notation in the bilingual dictionary. These terms are left out of the translation, which leaves the target sentence meaningless. Nevertheless, we are developing methods that use fingerspelling to handle similar situations. Our goal is to improve the English to ISL bilingual dictionary in order to increase the system's capabilities. Furthermore, the output produced by the existing system can be a useful resource for the development of bilingual parallel collections. The advancement of statistical transformer-based sign language machine translation will be greatly aided by the availability of high quality resources.

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