Approaches for multilingual translator for Indian Languages

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***Abstract*—** India has multilingual population. Based on languages, the country is divided into states. The same state may have multiple spoken languages, that is why the common people may not be able fully understand literature of all regions. In this situation, information technology may be a helpful gadget to remove the gap. Natural language processing (NLP) combines two different research fields i.e. linguistics with computer science. NLP research is a field that affords interaction between human and computer in a language spoken by human. The NLP research and analysis needs good understanding of computer science, statistics and linguistics. So NLP research is a research area having multiple disciplines. NLP will play awfully helpful role in language translations such as from Hindi to Punjabi, Marathi to Punjabi, and Gujarati to Punjabi etc. In this way, it can provide access to diverse literature present in regional language to other regions of country. In case of Indian languages, some are very close relatives to each other and can easily be converted, but some others are so different that it is a very cumbersome task to convert. A multilingual translation system will be awfully helpful for Business applications, Government agencies and public to approach for information from separate localities of country under one umbrella. This paper discusses the approaches that can be used to develop a multilingual translator for Indian Languages using Natural Language Processing.

Keywords*—NLP, Translations in Indian Languages, Approach in Language Translation, Steps of NLP.*

I. INTRODUCTION

Languages that we call the natural ones are basically spoken languages. On the other hand computer languages are made for computer systems. Artificial Intelligence (AI) is makes use of NLP to deal with languages. Here the motive is to make the machines understand the natural languages. Natural languages are used for oral as well as written communication among people whereas the knowledge of a computer language is required to set a communication with computing machines. Every written language is a set of some symbols and some predefined rules that are followed by people to convey messages among themselves. The people use a predefined set of words from their vocabulary to communicate in a way of spoken or written.

Hindi is declared as the national language of the country still English is the official and business language in which most of the documents are prepared. Hindi is that the voice communication language and understood by giant cluster of the population. Most provincial offices work in their own local language called language of state. So in legal and government sectors of the country, the conversions from a particular language to another language is needed as per requirements. The language conversions are also needed in business sectors to fulfill the easiness of targeted population. Keeping in view the particular population in the country, some newspaper publishers publish in multiple languages. These bulky tasks are very cumbersome to do manually sentence by sentence, that is why some automation is the need of the time and that automation can be provided by Natural Language Processing.

Now a day, there is a need as well as a trend in digitizing the literature in the country which raises a giant challenge since literature is available in multiple languages. Natural Language Processing can prove itself very helpful in overcoming the language restrictions.

II. HISTORICAL REVIEW OF NLP SYSTEMS

Before the invention of digital computer, there were some proposals about mechanical translators of languages. But the very first NLP system recognized was developed in 1948 at Birkbeck College, London. Warren Weave during Second World War was involved in code-breaking in which a document written in code could be output in another language if code is broken. The concept attracted the research groups. In the beginning, the translation systems developed were for converting German to English. Later on the research expanded to other languages like Russian and French. Earlier systems were not so accurate in producing output. Those systems needed the help of Linguistics to get the required accuracy.

US Funding was stopped for NLP system development after the Automatic Language Processing Advisory Committee (ALPAC) report which concluded the negative view of NLP Research. After that there is much less NLP research work however there were a number of significant developments. Some basic inventions were:

A. Augmented Transition Network

Augmented Transition Network (ATN) is a powerful syntax processing system the make use of grammars. It was not just a syntax processing system instead it is a very powerful

searching software. The system proved itself a very powerful building block in NLP research area where it can produce parses of English sentences.

B. Case Grammar

It is related to semantics. English like languages make use of prepositions to express the relationship among nouns and verbs. Charles Fillmore described that many human languages do not use prepositions; still they encode the same type of meaning. Some languages make use of strict word order. Fillmore described that there are very less number of cases where the possible relations among a noun and verb are represented. Individual languages express these relationships using a variety of ways, such as prepositions, word order, word inflection (i.e. the endings of words are changed). It contributed in NLP research in a way that allowed relatively easy theory of implementation such as processing semantic information with little effort.

C. Semantic representations

Conceptual Dependency theory was introduced by Schank and his workers, which is a way of representing language using semantic primitives. Some systems were developed without processing syntax. Quillian's research described the scheme of semantic network, which is awfully helpful for knowledge representation in a number of systems. William Woods described the scheme of procedural semantics for intermediate representation among a database system and a language processing system.

And some popular systems developed were:

D. SHRDLU

SHRDLU system was developed by Terry Winograd which was able to manipulate blocks on a table. It was able to understand commands such as "Pick up the blue pyramid" and was able to answer the queries such as "What is there in black box?". SHRDLU makes use of combination of semantics, syntax and reasoning to produce a system capable to understand natural language. The systems was very limited to restricted number of sentences and to only the world of blocks.

E. LUNAR

LUNAR was an interface between a database system and a common user and was developed based on ATNs and Woods' Procedural Semantics. The name LUNAR is the name of the database of information about lunar rock samples. The system was introduced in 1971 at the Second Annual Lunar Science Conference. It was able to handle 78% of queries without error.

F. LIFER/LADDER

LIFER/LADDER is a very important development in the area of NLP research. It was developed for the database of information about US Navy Ships to extract information using natural language and proved as a milestone in the NLP research area. It make use of a semantic grammar which made it domain dependent system like SHRDLU. The developers included capability to define new dictionary records, to manage

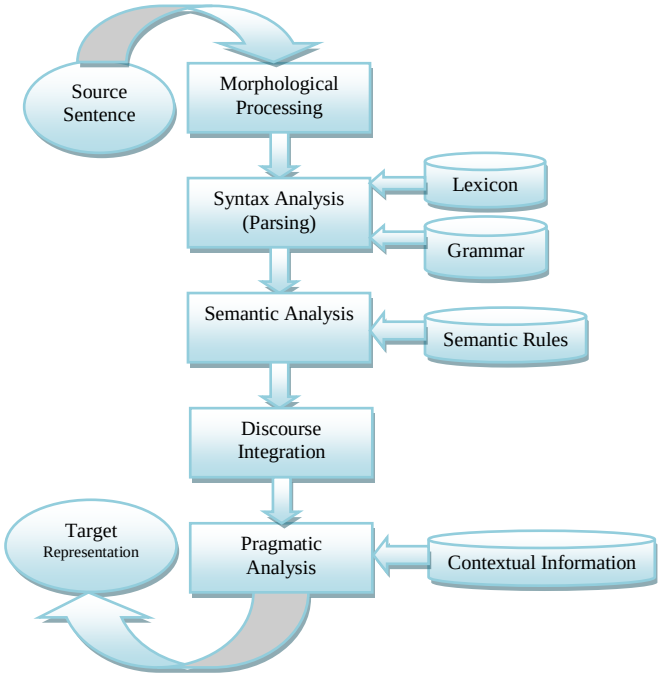

Fig. 1

incomplete text and to classify paraphrases. These were very impressive features.

III. NATURAL LANGUAGE PROCESSING – IN BRIEF

NLP is a processing of some language through five different phases. The phases are interconnected but are not followed in any sequence. They are separate but can provide output to another (Fig. 1):

A. Morphological Processing Phase
B. Syntax Analysis (Parsing) Phase
C. Semantic Analysis Phase
D. Discourse Integration Phase
E. Pragmatic Analysis Phase

A. Morphological Processing Phase

The input text is composed of words and when processed, these words are called tokens. A token can be any textual part such as word or symbol. A word can be composed for two separate words and by decomposing such words two separate tokens are formed. For example the word predefine can be decomposed into two separate tokens:

"pre" and "define"

The morphological phase is responsible to find the base words from the composed words. The prefixes and suffixes are some tiny words that are attached to words to make those words suitable for a sentence in a language.

B. Syntax Analysis (Parsing) Phase

Syntactic analysis phase is responsible to check the correct format of the sentence as per rules. If it finds that it is ok then converts it into a structure that can demonstrate the word relationships in that sentence. This component is also called parser and makes use of dictionary and rules of grammar to do the job well.

C. Semantic Analysis Phase

Semantic analysis phase makes use of semantic definitions of all separate words to generate phrase semantics. For this purpose, the lexicon is expanded to contain the semantic definitions of words.

D. Discourse Integration Phase

Discourse Integration phase is responsible to find the meaning of a sentence when it is related to the sentence preceding it. E.g. in the text "it is very good", here what "it" refers to depends on preceding sentence.

E. Pragmatic Analysis Phase

Pragmatic analysis phase performs its task based on a specific context. The results of semantic analysis phase are fed to the pragmatic analysis phase for further processing. The semantic analysis phase provides some object references that are fit by pragmatic analysis phase to do its task. This phase performs more complicated tasks than the other analysis phases discussed above.

IV. INTER LANGUAGE CONVERSION APPROACH

The research in Natural Language Processing in India is being performed at regional levels. These efforts are very limited to fulfill individual needs of a particular group of users. Most of the research projects are done at state universities and are not linked or communicated with other universities in the country. It fulfills the requirements of language translations at regional levels but the other part of the country is not taking any advantage of this type of research projects. Most of the research in language translation is done to acquire some educational degree such as Ph.D. and it is mostly for the individual interest of the research scholar or the research guide.

Although a number of language translators are developed by research community related to Natural Language Processing, but they hardly make any concern with other similar research projects being done in other languages. For example, the NLP research in North India is almost unaware of the research in NLP in South India and vice-versa. It may be because of the very difficulty in understanding each others' languages.

The researchers in NLP research community, adopted direct conversion approach in developing language translation systems at regional levels:

A. Direct Conversion

The approach to combine the efforts made by Natural Language Processing researchers and build a multilingual translator from the present translation systems without much additional efforts is just to assemble the developed translation systems into a single multilingual translation system. But it requires some centralized organization to step up so that any difficulties in combining such efforts can be overcome by communicating with each other through that centralized organization. The central government has to establish such organization in a more practical way than it is being done at present.

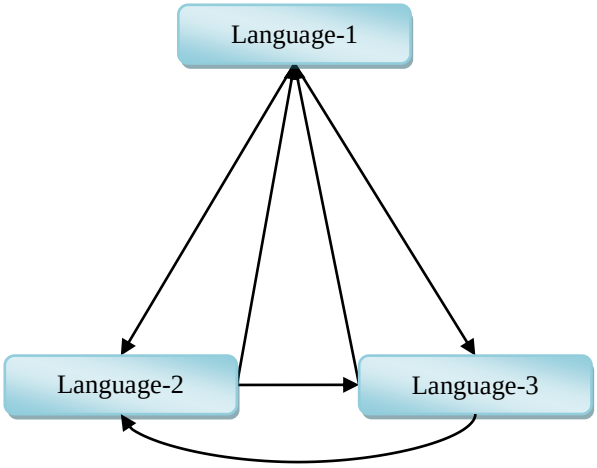

Fig. 2

The approach will make use of separate translator to translate every input language to other output language directly. The translators are already developed at regional levels, the only requirement is to do some modifications in their functioning so that they can be assembled under a single umbrella. The system will be a group of large number of translators. If there are n languages it means that n-1 number of translators are needed for each separate language, most of which may be already available, and others could be developed to fulfill the requirement. That is, n(n-1) no. of translators are necessary. For example, if there are 10 languages then 10x19=190 separate translators are needed by the system.

V. CONCLUSION

The research in Natural Language Processing in India is being performed at regional levels. These efforts are very limited to fulfill individual needs of a particular group of users. Other users are unable to get any benefits from this research in NLP. In Legal and Government sectors of the country, the conversions from a particular language to another language are needed. The language conversions are also needed in business sectors to fulfill the easiness of targeted population. A multilingual translator will be awfully helpful to fulfill the need.

The approach is to combine the efforts made by Natural Language Processing researchers and build a multilingual

translator from the present translation systems. The system requires contributions from all the researchers presently developed or developing NLP systems at regional levels plus a centralized organization to assemble these systems together.

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