



Review Paper on Name Entity Recognition of Machine Translation

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Abstract— Machine Translation is an important part of Natural Language Processing. Machine Translation refers to using machine to convert one natural language to another language. In this paper, transliteration of machine for English to Punjabi and Hindi languages pair has been done by using statistical rule based approach. Various statistical rules are constructed with the help of syllabification approach. In this paper Name entity recognition (NER) techniques are explained and how they find name entity from the text. Translation model calculate the probability of target sentences given the source sentence and decoder maximizes the probability of translated text of target language. Paper contains five sections. In the first section introduction of natural language processing has been described. Second section explains machine translation and its approaches. In third, how name entity can be recognized and method of recognition. Last section represents the literature of all research.

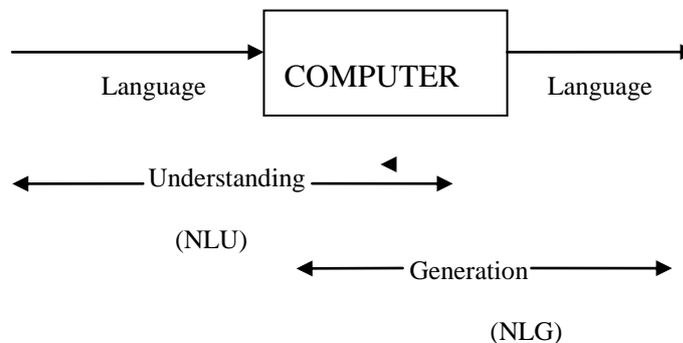
Keywords— Natural Language Processing, Machine Translation, Name Entity Recognition, Different Languages.

I. INTRODUCTION

Natural Language Processing (NLP) is the field whose aims to convert the human language into the formal representation that is easy to manipulate for the computer. The application includes information retrieval, information extraction, speech recognition summarization, machine translation, search and computer interfaces for human.

Natural Language Processing (NLP) has various Tasks:-

- 1) Part-of-Speech Tagging (POS):- labelling each word with a unique tag which indicates its syntactic role, e.g. verbs, noun, adverbs, adjectives.
- 2) Chunking:- aims at labelling segments of a sentence with syntactic constituents such as verb or noun phrase (VP or NP). Each word is assigned only one unique tag, often encoded as a begin-chunk or inside-chunk tag.
- 3) Named Entity Recognition (NER):-labels elements in the sentence into categories viz “person”, “company”, or “location”.
- 4) Semantic Role Labelling (SRL):- aims at giving a semantic Role to a syntactic constituent of a sentence. The precise arguments depend on a verb’s frame and if there are multiple verbs in a sentence some words might have multiple tags. In addition to the ARG0-5 tags, there are 13 modifier tags such as ARGM-LOC (locational) and ARGM-TMP (temporal) that operate in a similar way for all verbs.
- 5) Languages Models:-A language model traditionally which estimates the probability of the next word being “w” in a given sentence.
- 6) Semantically Related Words (“Synonyms”):- It is the task of predicting whether two words are semantically related which is measured using the Word Net database as ground truth [1].



II. MACHINE TRANSLATION AND ITS APPROACHES

Machine Translation: - Machine Translation is the sub field of computational linguistic that investigates the use of computer software to translate text or speech from one natural language to another natural language. At the basic level, Machine translation performs simple substitution of word in one natural language for words in another. The literary work is fed to the machine translation system and translation is done. Machine translation system can break the language

barriers by making available work rich sources of literature available to people across the world. MT also overcomes the technological barrier. Most of the information available in English which is understood by only 3% of the population. In Punjab, most of population is not so familiar with English language. As most of the information available on web or electronic information is in English, people who are not capable to learn English cannot make use of this electronic information without any person's help. In order to make it possible for everyone to use web based, automatic language translation is required. Our aim is to develop the System which can translate English into its Punjabi and Hindi equivalent [2]. In the development process, there are two major goals for machine translation: - (1) accuracy of translation and (2) speed. Accuracy-wise, smart tools for handling transfer grammar and translation standards including equivalent words, phrases, expressions and styles in the target language which are to develop [3].

APPROACHES OF MACHINE TRANSLATION

Machine translation system analyse the source language, and apply processing on it and then transferred it into the target language. There are different translations approaches in which one language is translate into another language [14]. Machine translation has been classified into following:-

- 1. Direct Approach:** - A direct translation system has a Word-to-word translation with the use of bilingual dictionary. It takes a parser, which performs preliminary analysis of the source language sentence to produce its parts of speech information by a rule based to transform the source language sentence into a target language Sentence. These rules include bilingual dictionary rules and rules to re-order the words. The direct machine translation system with parser also known as Transformer.

Word-by-word translation

ਅਮਰ ਸੱਤਾ ਵਿਚ ਬਾਗ਼ ... (1.1)

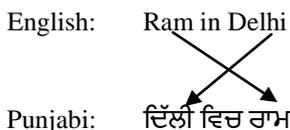
amar suttā vic bāg

Syntactic rearrangement:

ਅਮਰ ਬਾਗ਼ ਵਿਚ ਸੱਤਾ ... (1.2)

amar bāg vic suttā

- 2. Rule Based Approach:** - There are various problems in Direct approach. To overcome their problem rule based approach has been proposed. It parses the source text and produces an intermediate processing, which may be a parse tree. The target language is generated from the intermediate processing. These systems rely on specification of rules for syntax analysis, lexical selection, semantic analysis, morphological transfer and generation process. E.g. If a sentence is of the form [Noun] in [Noun], then in the translated word, the Punjabi meaning of second noun will be at first position followed by ਵਿਚ (Punjabi translation of "in") and Punjabi meaning of first noun E.g. The translation of English sentence "ram in Delhi" can be shown as given [2].



This approach is further classified into different approaches:-

- a. Transferred based approach:-** It is used to take the meaning of the original sentence to produce an intermediate representation. It has three intermediate stages in translation process that include an analysis stage- to analyse the source text to produce the source structure, a transfer stage- to transfer source structure to target structure and synthesis stage- to generate target language.
- b. Interlingua-Based MT:-** the source language text is Converted into a language independent meaning representation. This internal representation is then converted into final output. It has 2 stages in analysis stage to deeply analyse the source sentence for producing a language independent representation and in synthesis stage the target language is generated [14]
- c. Corpus-Based MT:-** In this it require sentence aligned parallel text for each language pair and cannot be used for language pairs for which such corpus does not exist. It is also divided into three categories statistical machine translation, example based machine translation and knowledge based machine translation.

III. NAME ENTITY RECOGNITION AND ITS APPROACHES

Name Entity Recognition:- Named Entity Recognition is the process of identification and classification of all proper nouns in a given text document or a sentence into pre-defined classes such as persons, locations, organizations, date, address and time expressions. Named Entities are defined as the proper names identified in a text. Identified text may be

a person's names, organization's names, location's names, and date and time expressions. To make a computer acceptable and divide these named entities into pre-defined categories, which are important tasks of NLP. This task is defined as Named Entity Recognition. It is also called Information Extraction [15].

For example:-

Name entity type	Examples
ORGANIZATION	Global India
PERSON	President Pranab Mukherjee, Navneet
LOCATION	Chandigarh, Mount Everest
TIME	three fifty a m, 12:30 p.m.
MONEY	\$567,175 million Canadian Dollars
DATE	12-06-1991, June
PERCENT	25.22 %, fifty pct,
FACILITY	Stonehenge Washington
GPE	Greenland, Bhutan

APPLICATIONS OF NAMED ENTITY RECOGNITION

Name entity recognition is useful in many Natural Language Processing applications, like- information retrieval, extraction information, question answering (true or false), parsing, and machine translation (from one language to another), the metadata for the Semantic.NER can also give the information to users who are looking for person or organization names with fast information [8]. Name entity recognition systems are used in the areas of entity identification in the field of medical images. Earlier, NER systems were used by primarily extraction from journalistic articles and then Automatic Content Extraction (ACE) evaluation also included several types of text styles, such as WebPages and detects text from the speech or any audio.

APPROACHES FOR NAME ENTITY RECOGNITION

There are different approaches to name entity recognition. It can be categorized into two broad categories:-

A) Rule based (Linguistic) approaches: - Rule based approaches rely on hand-crafted rules, written by language experts, to recognize and classify NEs. Rule-based approaches may contain Lexicalized grammar, Gazetteer lists, List of triggered words etc. [17]. There are two disadvantages for using this approach: first is to developing and maintaining rules and dictionaries is a tedious and costly task. Second these systems cannot be transferred to other languages or domains.

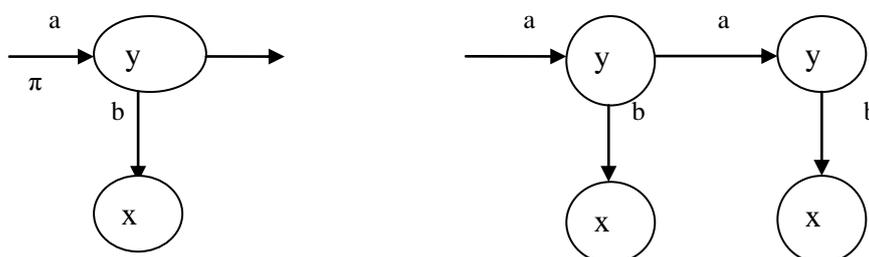
B) Machine learning (Statistical) approaches:- Machine learning approaches rely on statistical models to make predictions about name entities in given text. Large amounts of annotated training data are required for these models to be effective, which can prove costly [8]. There are three main machine learning approaches:-Supervised, Semi-supervised, Unsupervised.

a) Supervised Learning:- Supervised learning approaches build predictive models based on the labelled data and true labels. Some of the supervised machine learning techniques is:

- Hidden Markov Model (HMM)
- Decision Trees
- Maximum Entropy (MaxEnt)
- Support Vector Machines (SVM)
- Conditional Random Fields (CRFs)

I. Hidden Markov Model (HMM)

HMM is a probabilistic automata based on markov model where a label corresponds to a state and an observation symbol to a word at a state. Both state transition and observation symbols are described in probabilistic manner. HMM has a model $M=(O,Q,A,B,\pi)$ where $A=\{a_{ij}, i, j=1, \dots, N\}$, $B=\{b_i(y_t), i=1, \dots, t=1\}$ and O, Q mean a finite set of observation symbol of x and y . [17]



II. Maximum Entropy (MaxEnt)

ME conditional probabilistic sequence model. In this multiple features are extracted from one word and handle their dependency for the long term. Maximum entropy is that in which model for least biased that considers all known facts is the one which maximizes entropy. Every source has a model of exponential that takes the inspection feature as input and distribution over possible next state as a output. The result output labels are associated with states. It solves the problem of multiple feature representation and long term dependency issue occurred in HMM. It has increased the recall and greater precision than Hidden Markov Model. The probability conversion leaving any given state must sum to one, so, it is influence towards that states with lower or less outgoing transitions. The state with one outgoing state transition will ignore all observations. To overcome Label Bias Problem we can change the state-transition structure or we can start with fully connected model and let the training procedure decide a good structure [19].

III. Conditional Random Fields (CRF)

CRF is a type of discriminative probability model. It has all the advantage of maximum entropy instead the label bias problem. CRFs are undirected graphical models and also called random fields which are used to calculate the conditional probability of values on assigned output nodes given the values assigned to other assigned input nodes.

Random field:- Let $G = (Y, E)$ be a graph where each vertex Y_v is a random variable. Suppose $P(Y_v - \text{all other } Y) = P(Y_v - \text{neighbours}(Y_v))$, then Y is a random field. Let $X =$ random variable over data sequences to be labelled $Y =$ random variable over corresponding label sequence. Definition Let $G = (V, E)$ be a graph such that $Y = (Y_v)_{v \in V}$, so that Y is indexed by the vertices of G . Then (X, Y) is a conditional random field, when conditioned on X , the random variables Y_v obey the Markov Property with respect to the graph: $P(Y_v - X, Y_w, w \in N(v)) = P(Y_v - X, Y_w, w \in N(v))$, where 'w' 'v' means that 'w' and 'v' are neighbours in G .

IV. Support Vector Machines (SVM)

The SVM is based on discriminative approach which is use for positive and negative examples to learn the variance between the two classes. The SVMs are known to robustly manage large feature sets and to develop models that maximize their generalizability Take two set of training data for a two-class problem: $\{(x_1, y_1), \dots, (x_N, y_N)\}$, where $x_i \in \mathbb{R}^d$ is a feature vector of training data of i th sample and $y_i \in \{+1, -1\}$ is the class to which x_i related. The main goal is to find a decision function that accurately predicts class y for an input vector x . A non-linear support vector machine classifier states a decision function $f(x) = \text{sign}(g(x))$ assumed value of $f(x)$ is 1 for this section. Here, $f(x) = +1$ means x is a member and $f(x) = -1$ means x is not a member of a certain class. z_i called support vector and representative of training examples, m is the number of support vectors. So the computational complexity of $g(x)$ is proportional to m . SVM and different constants are determined by solving a certain quadratic programming problem, $K(x, z_i)$ is a kernel that implicitly maps vectors into a higher dimensional space. Typical kernels use dot products ($K(x, z_i) = k(x, z_i)$). A polynomial kernel of degree d is given by $K(x, z_i) = (1+x \cdot z_i)^d$ It can use different kernels, and the design of each kernel for a particular application is an important research issue [21].

V. Decision Tree

Decision Tree is a popular and powerful tool for categorizing and forecast. Rules are used for artificial intelligence and neural network in decision tree. That rules can easily be expressed so that human can well understand and directly use rules in a database access language like SQL so that records failing into a particular classification may be tree. Decision Tree is a classifier in the form of a tree structure where each node represent a leaf node, indicates the value of the output attributes of expressions, a decision, specifies some text to be carried out on a single attribute value with one branch and sub-tree for each possible outcome of the text. It is an inductive approach to acquire knowledge on classification [22].

b) Unsupervised Learning

Unsupervised learning approaches don't expect any implicit or structural information about the data they are processing. The typical approach to unsupervised learning is clustering. For example, one can try to collect names from clustered groups based on the similarity of context. There are other methods also, which are unattended. Basically, the techniques based on lexical resources (e.g. WorldNet) calculated on lexical patterns and statistics on a large unannotated corpus.

c) Semi supervised Learning

The term semi-supervision or weak supervision is still relatively young. The main SSL technology is called bootstrapping and includes a small measure of control, like a row of seeds, for the beginning of the learning process. In semi-supervised approach, a model is trained on an initial set of labelled data and true labels, then, predictions are made on a separate set of unlabeled data, and then improved models are created iteratively using predictions of previously developed models. [16]. For example, a system aimed at "disease names" could prompt the user to give a small number of example names.

IV. Related Work

Many researchers have been discussed about Name entity recognition of machine translation.

Deepti Bhalla [23] in this name entity comprises two tasks; they can be translated or transliterated with the help syllabification. In this translation of English to Punjabi by using statistical rule based approach. Syllabification algorithm is used for translation of name entity. They calculated n-gram probability for syllable.

Kamal deep [24] rule based approach is used for addressed the problem of transliterating Punjabi to English language. The proposed transliteration scheme uses grapheme based method to the transliteration problem.

Sharma et al. [5] show English-Hindi transliteration by using statistical machine translation in the different notation. This paper WX-notation gives the better result over UTF –notation by English Hindi corpus by using phrase based statistical machine translation.

Dhore et al [7] have addressed the problem of MT where give named entity in Hindi using Devanagari script by using conditional random field as a statistical probability tool. In this approach, they show machine transliteration of name entities for Hindi-English language using CRF as statistical probability tool. The accuracy of this system is 85.79%.

Sweta Kulkarni [15] this paper shows the survey of name entity recognition. Then, they describe the various approaches used for name entity recognition, followed by the Performance Metrics which is used to evaluate the system of name entity. They consider the existing NER systems for each of the four main South Indian languages: Kannada, Telugu, Tamil, and Malayalam and analyze them.

Nusrat Jahan [17] in this paper they describe the various approaches used for NER and summery on existing work done in different Indian Languages using different approaches and also describe introduction about Hidden Markov Model (HMM) and the Gazetteer method for name entity recognition. We also present some experimental result using Gazetteer method and HMM method that is a hybrid approach. Finally in the last the paper also describes the comparison between these two methods separately and then we combine these two methods so that performance of the system is increased.

Ryohei Ageishi [18] combination of statistical with rule based approach is used to recognize name entity in the morphological analysis. HMM is use for tagging the English text. They discuss rule based approach over n consecutive word for the rule extraction.

Thoudam Doren Singh [21] there are two different models, one using an active learning technique based on the context patterns generated from an unlabeled news corpus and the other based on the well known Support Vector Machine have been developed. The Manipuri news corpus has been manually annotated with the major name entity tags, namely name of the person, Location name, and name of Organization and to apply SVM. The SVM based system makes use of the different contextual information of the words along with the variety of orthographic word-level features which are helpful in predicting the NE classes.

Georgios Paliouras [22] a NERC system assigns semantic tags to phrases that correspond to named entities, such that persons, locations and organisations. Typically, such a system makes use of two language resources: a recognition grammar and a lexicon of known names, classified by the corresponding named-entity types. we evaluated the behaviour of C4.5 on the task of learning decision trees to recognise and classify named entities in text. This approach reduces significantly the effort needed for customising a NERC system to a particular domain.

Yunita Sari [25] in this, to extract important facts from unstructured text which later help to populate database entries. Name Entity Recognition is one of the main task needed to develop text mining systems in which it is used to identify and classify entities in the text into predefined categories such as the person's name, organization's name, locations, dates, times, quantities, percentages, etc. Mainly they focuses on studying the optimum solution to perform name entity recognition. Many algorithms have been reported for NER ranging from simple statistical methods to advanced Natural language processing methods. This paper describes the possibility to apply Link Grammar (LG) and Basilisk Algorithm in NER.

V. Conclusion

Machine translation has been an active research sub-field of AI from years. But the challenges faced during translation need to be solved for which more detailed study of various natural languages is required. So still a lot of work is required to develop a completely automatic translation system. Improved Name entity recognition is most important part of machine translation. There are some characters exist in English which are double meaning like you is also written in u. The major inaccuracies in the transliteration are due to poor word selection. In this paper, there have described the recognition system build on statistical techniques. There are many issues left for further improvement. The system itself could be improved. In this investigation, we have discussed how to recognize name entity.

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