Volume 64, Issue 1, 2020

Journal of Scientific Research

Institute of Science,

Banaras Hindu University, Varanasi, India.

Amharic Phrase Chunking with Conditional Random Fields

Alemebante Mulu[1*], Vishal Goyal[1]

[1] Department of Computer Science, Punjabi University Patiala, India. alembantemulu184@gmail.com, vishal.pup@gmail.com

***Abstract*: This *paper particularly presents a Conditional Random Field (CRF) based phrase chunking system for Amharic language.* Chunking is the series of actions which has divided or segmented the sentence into phrase by the arrangements of correlated word groups. Therefore, chunking is recognized by the identity of chunk labels and the boundary that describes chunks. In this research work, our goal is to develop chunking for Amharic language by using different tagging schemes for identifying the chunk boundaries and incorporate the tangs in form of contextual information. Therefore we have identified the problem, common stetting, solution and improvement of chunking as well. In addition to this, we have also constituted the special word, Part-of-Speech (POS) tagging information, morphological analysis as an input to increase the performance of the system. Totally, we are using 400,000 tagged words and have evaluated the result by the combination boundary identification and labeling. Since we are using large amount of tagged data for Part of Speech tagging, it although performs good results with chunking. Finally, the average accuracy of the system is reached to 94.2%.**

***Keywords*: Chunk, CRF, HMM, NLP, POS.**

I. Introduction

A. Background

Natural language processing (NLP is one large area or sub field of computing science that can be written, spoken, read and listened by human beings for sending or receiving information via computer devices (Lise & Ben, 2007). The pleasing communication between human beings and computer machine is performed with the help of Natural Language Processing (NLP) technology and its application to the human-computer interaction is most easy (Jackson & Moulinier, 2007). Natural Language processing (NLP) understands the requirement and the general language structure of text at phonological, at morphological, at syntactical, at semantical, at discourse and pragmatic levels (Jurafsky & H.Martin, 2019) to make, increase the instance and performance of NLP applications that have been done at different levels.

Having clear opinions, the combination of two or more phrases in a sentence is very useful to construct the full sentences and phrases by themselves for a variety of Natural Language Processing (NLP) application, and the process which directly labels the small group of words is called phrase chunking. Grover &Tobin (2006) states that considers chunking is able to be used a practical for Named Entity Recognition attentively.

Chunking is one of Natural Language Processing (NLP) task that have been used to allocate phrases by their label group of contiguous words. We can say that it's important input for constructing a sentence as well as identifying the grammatical classes. Whereas, Part of Speech (POS) is used as an input and it needs to help in developing the chunking system, especially to get a better accuracy. In addition to this, the task of it helps to make it easier for improving the efficiency of the subsequent processing like parsing and grammar chucker. Part of Speech tagging (POS) and phrase chunking are carried out almost with the same piece of work that performs, the only difference is part of speech tagging which has as an essential feature of word categorization and chunking is the place in a particular phrase level category.

Chunking is very useful for identifying the phrase level under the Natural Language Processing (NLP) application for a diverse of language, and the task labels the phrase to categorize under the system. Therefore, chunking application can consist in dividing the sentence in to phrase level in syntactically correlated parts of the word (Ibrahim & Assabie, 2013).“The syntactic level deals with analyzing a sentence that generally consists of segmenting a sentence into words and recognizing syntacticelements and their relationships within a structure” (Ibrahim & Assabie, 2014, p.297).

Phrase chunking is the stream order that helps to identify and analyze well organized data. In addition to this it is used for further investigation under the natural language processing application development like grammar checker, information extraction, information retrieval, name entity recognition and

DOI: http://dx.doi.org/10.37398/JSR.2020.640135

other related tasks decidedly, chunking has begun to be an interesting alternative of one or more things to full parsing. The arrangement of the sentence is categorized on the habit the linguistic structure or phrase chunking and its one big task is natural language processing. Hence, we describe the above statement that aim of phrase chunking is to divide a sentence in to certain syntactic units phrase level. For example, the sentence "□□□□□□□□□□□□□□□" "The big man has gone by bus". Here, the sentence can be divided as follows. A Noun Phrase [NP "□□□□□□", the big man], a Verb Phrase [VP "□□", gone], a Prepositional Phrase [PP "□□□□", by big] and another Noun Phrase [NP "□□□", Bus](Amare, 2009; Yimam, 2009). Therefore, all those tasks are above the intermediate step to fulfil the phrase chunking application. As a part of the NLP, a Part of speech tagging (POS) and chunker data for Amharic language is designed by using deep learning approach. The training annotated data for POS is 450,000 words. Out of those, all annotated data 210 000 was provided by WALTA information center and Ethiopian News Agency (ENA). Hence, the aim of this paper work is to deal with the development of phrase chunking for Amharic language by using conditional random field with the complete and highly accurate system for chunking.

B. Motivation

The intensity of motivation is made physical or mechanical being moved to act in particular doing something. On the other hand it is the way began to identify the entire problem and move to solve the problem as well to give the directions for solution. Therefore, the first movement of putting the solution is the existence of the problem and to perceive the significance of that problem. Comparison with the fact that the problem is to go with one by drawing to motivate and find the entire solution.

In the application of scientific knowledge to many of the NLP applications these have been managing for different languages for different purposes such as Morphological Analysis, Text Prediction, Part of Speech tagging, Named Entity Recognition, Parser, Chunking, Clause Boundary Identification, Information Extraction, Grammar Checker etc for English and other related languages (Ibrahim & Assabie, 2013). The interest of Natural Language Processing (NLP) research area for local languages such as Amharic has been done not long ago. Amharic language is an official language of Ethiopian government that is spoken by more than 50 millions of people. The number of speakers of the language is greater in number to compare as other local languages because of two reasons. First, it is the working language of the Federal Democratic Republic of Ethiopia, a country with more than 110 million people. Second, Amharic language is different from other African languages. It is because Amharic language has its own alphabets, the availability of written materials, actively being used every day in newspapers and other related media. The name of the alphabets is known as "*fidel" (Alphabets)* which come from Ge'ez script and also the language is different in nature for morphological analysis, constricting grammatical phrases, alphabet (*fidel*) representation and statement formation (Amare, 2009).

Therefore, the indicative purpose of this research work is to develop Amharic phrase chunker and for growing up the transformation of technology specifically for Amharic language. In this research work, we are required to manipulate the language technology gap problem, particularly for Ethiopian people. Make an initial plan for this research work approach is using Conditional Random Field (CRF).A lot of approaches have already been conducted to automate chunking application for English and other languages. When we are talking of the natural language processing technology, chunker has the important component in a variety of applications, especially for information extraction, named entity identification, search, and in machine translation. The task of chunking is ideally suited for machine learning and deep learning because of robustness and relatively easy training.

C. Problem of the Statement

The seriousness of challenge of in this research work is Amharic phrase chunking not having have the well-organized data like other different languages. There is not enough annotated corpus that has been prepared by the language experts. Like other languages, Amharic chunking or base phrase recognizer have not been available languages recognized such as Noun Phrase (NP), Verb Phrase (VP), Prepositional Phrase (PP), Adjectival Phrase (AdjP) and Adverbial Phrase (AdvP) with their correct and sequential logical order. However, text chunking developed system for Amharic language are not yet available yet. Therefore, text chunker that considers the special characteristics of the language and that achieved the stated specify compulsory needs to be developed for Amharic. In this study, we will carry out a systematic study of problems and limitations of Amharic text chunking, the consequence of developing text chunking, and try to develop the phrase chunking.

D. Objective

The objective of this paper is to develop chunking system for Amharic language by using Conditional random Field (CRF) approach.

E. Previous Work

Development of chunking system is not an easy task, and it's also needs further investigation. Therefore, we had to study other languages in chunking system for example English, Hindi, Punjabi, Hebrew, Chinese and other languages that have been studied previously. "Since most of the resources are texts they have morphological analysis of texts are crucial for deeper analysis and performing further NLP tasks on them" (Kutlu & Cicekli, 2016).All these languages have the efficient chunk system as well. Different methods have been investigated for developing a chunker such as rule based approach, statistical approach and hybrid approach by using a lot of different approaches (Ali & Hussain, 2010; Xu, Zong, & Zhao, 2006) like Conditional Random Field (CRF), Support Vector Machine(SVM) and Hidden Markov model (HMM) (Pranjal, Delip & Balaraman, 2006). .On the other hand different methods have also been investigated particularly on boundary identification and chunk labeling. Most of the earliest chunking systems have used standard HMM based tagging methods in modeling the chunking process. English chunking system has been done by (Church K, 1988) and it is used by HMM tagging methods with statistical approach. In this work, I have used the special word and part of speech and tagged text is used as an input. In addition to this we implement by using the CRF based Chunking mechanism. For further clarification this research work has focused on identification of the tag set types.Inside, or Outside of the given chunk has become the *de-facto* standard for this task (Yoav, Michael & Meni, 2006).The combination of words, special word and POS tags that gives the best result for this research work. Also, different methods are used and compared in order to get best results for labeling the chunks. The observation of fact in practical contact can be used to develop Chunkers for other languages as well.

II. CONDITIONAL RANDOM FIELD (CRF)

The degree of recognizability in outline of a Conditional Random Field (CRF) is CRFs based on the idea of Markov Random Fields or the extension of HMM and Maximum-Entropy Models. Conditional Random Field (CRF) is a form of recognized modelling that has been successfully used in different spheres such as part of speech tagging and other Natural Language Processing tasks.“Point out that each of the random variable label sequences Y conditioned on the random observation sequenceX” (Xu,Zong & Zhao, 2006, pp. 87293).Generally the bottom-up process of conditional random field is applicable on the combination of multiple features of the data and it can be putting together the probability of sequential order in the given data can be represented as P (Sequence | Data). Therefore the conditional random field is to be able to represent a graph G = (V, E), but not consider a chain. Then, it's conditioned on *X*, observation sequence variable and each node represents a value *Yv* of *Y* output label. Let G be a factor graph of Y, then P (Y|X) is a conditional random field where y is a label, and x an observation sequence (Avinesh, 2007; Himanshu & Anirudh, 2006). Based on the above concept the premises of Hammersley-Clifford theorem states that a random field is an MRF if it can be described in the form below. The exponential is the sum of the clique potentials of the undirected graph

$$P(Y|X) \quad = \frac{\exp \sum_t (\sum_i \lambda_i \, \mathrm{f}_i \, (x, \mathrm{y}_t) + \sum_j \mu_j \mathrm{g}_j \; (\mathrm{x}, \mathrm{y}_t, \mathrm{y}_{t-1} \;))}{Z(x)}$$

For further explanation we try to give a detail of each symbol as appointed to member of the above formula. Therefore, the symbol “λ” is represented by the State Feature Weight λ=10 and its one possible weight value for this state feature is strong, the symbol “f” is represented by the State Feature Function f ([x is stop], /t/) and its one possible state feature function for our attributes labels, the symbol “µ” is represented the Transition Feature Weight µ=4 and its one possible weight value for this transition feature and the final symbol “f” can be represented the Transition Feature Function g(x, /iy/, /k/) and its one possible transition feature function Indicates /k/ followed by /iy/.

A. Approach

Most of the time Natural Language Processing (NLP) application has been connected by the flexible series chain. Along with the combination of application can form by putting parts together. When the developer train to the Part of Speech (POS) tagger application for Amharic language it may use the Amharic morphological analyzer, tokenization and properly tagged taring corpus to get the root-word and possible POS tags for every word in the corpus. By using tokenization they can by constricting the root-word, morphological analyzer and suggest other POS tags information like prefix, infix, suffixes, word length indicator, sentence boundary, punctuation mark identifier and presence of special characters which is added to the training data. The POS tag assigned to every token is used to discover these positions as well it could be the most desirable input to develop excellent chunking application for every language. Before we implement the system for chunking system, it needs to manage the system on unannotated input which, a similar data (corpus) and has to be prepared before the system can predict.To recognize the chunks, it is required to be found the place where a chunk can start the new chunk and ending of the chunk can be completed (Himanshu & Anirudh, 2006). In addition to this, the system is used for two training phase approaches. The chunking set of rules is to be followed into two phases, namely: Chunk boundary identification and Chunk label identifier. We first extract chunk boundary recognizer and chunk label recognizer for each word in the corpus. In the first phase chunk tags (Chunk Boundary Recognizer-Chunk Label Recognizer) are designated to each single distinct meaningful element in the training data and the data is trained to predict the corresponding CB-CL tag. In the second phase, we teach a particular skill for the system on the above feature template to make known beforehand the chunk boundary recognizer (CB). Finally chunk label recognizer (L) from the first phase and the chunk boundary recognizer from the second phase are combined together to obtain the chunk tag. To identify the Chunk Boundary Recognizer (CB) by itself we classify it in to four main parts, namely:

BGN (Beginning the chunk word),
ISD (Inside the chunk word),
STP (Stop the chunk word),
BGN-STP (Beginning-Stop the chunk word) and
OSD (Outside the chunk word)

The second chunk label recognizer is Chunk Label Recognizer (CL) and it can be divided into five parts, namely:

NP (Noun Phrase),
VP (Verb Phrase),
AdjP (Adjective Phrase),
AdvP (Adverb Phrase) and
PP (Prepositional Phrase)

Easy to perceive putting chunk label identifier in specifying, a chunk that has been a part of markers at pre terminals.

III. EXPERIMENT

We make an effort to achieve the chunk tags using contextual information. This research work is being used by morphological analysis, special word, POS tagger and we implement by using two phases, namely:Chunk boundary identification and Chunk labeling.

The starting point of this research work is carried out by the combination of morphological analysis, POS tagger and chunking tag using CRF of the chunk tag schemes are discussed in the beginning section. Therefore we use the arrangement of chunk tags considered by special word, POS-Tag: Chunk-Tag, which are to make adequate by capable of successfully reaching the intended target.

A. Part of Speech (POS)Tagger

First of all POS tagger is the greatest significance task to develop chunking and it needs the train corpus either for developing POS tagger system or the chunking system. Therefore the POS tagging corpus should be trained with a basic template. For this reason the language expert doing process manually tagged data for corpus preparation as well. The second step for developing POS tagger is to recognize the error and try to handle the base problem like morphological analysis for recognizing the root-word. By nature Amharic language is morphologically rich and sometimes it has attached the right way to the word, it was felt to be used for prefix or suffix information. Prefix is put together for every word as the first two or three characters and suffixes were put together for every word as the last two or three characters of the word. When we compare the Amharic language to the other one like English language, the words that are categorized under proper nouns are used for capitalization and that needs to help to recognize them. However, there is no such mark is done in Amharic language and we watch attentively such kind of problem can be solved by using very modern application like Amharic Horn-Morphism.

For being associated with this research work we used the POS tag set that has been developed by using "The Annotation of Amharic News Documents" project at the Ethiopian Language Research Center. The determination of the project was to manually tag each Amharic word in its context (Abney, 1992). A new POS tag set for Amharic has been obtained from this project. In this project, the basic tag set are listed below. The tag set has 11 basic classes and 63 derived tag sets : Nouns (N), Verbs (V), prepositions (PREP), adjectives (ADJ), adverbs (ADV), pronouns (PRON), conjunction (CONJ), interjection (INT), punctuation (PUNC), numeral (NUM) and UNC which are in a particular position for unclassified words and used for words which are difficult to place in any of the classes. Some of these basic classes are further subdivided and a total of 63 POS tags have been identified.

B. Chunking

"Chunking is the task of identifying and segmenting the text into syntactically correlated word groups" Dhanalakshmi, Padmavathy, Anand, K.M., Soman, & S, 2009, pp. 436-438).

In this research work we apply two basic processes and these are used to help accomplish the chunking system. First, the POS annotated corpus is made ready for use and the second step is prepared as basic arrangement or sequence of process (Chandan, Vishal & Umrinderpal, 2015). Those processes are the Chunk Boundaries (CB), Chunk Label (CL) and both Chunk Boundary-Chunk Label (CB-CL) chunk tags. Let's say, Part of Speech (POS) tags is represented by the tag set "T" and the chunked data is represented by "C", then $T_n = (t_1, t_2,\ldots, t_n)$, $t_i \in T$ where T is a sequence of t_1 to t_n of POS tag set and $C_n= (c_1, c_2,\ldots c_n)$, $c_i \in C$ where C is a sequence of c_1 to c_n chunk tags. Therefore, the problem can be solved by the cooperation of chunk tag sequence (C) and the sequence of POS tag sequence (T). Since we are using the Conditional Random Field (CRF) approach, the probabilistic model is solve corresponding sequence of Part of Speech (POS).

The best for identification of Chunk Boundary is combination of<POS word_POS><chunk_tag>→<POS_tag> and the subsequent conversion to 2-tag set gives better results (Ashish, Arnab&Sudeshna,2005).

Since we stand to solve the problem we try to identify the basic skeleton of the solution and it should be the sequentially. The basic skeleton of this research wok is Problem, common setting, solution, improvement and the output of the chunking system

Problem →Small vocabulary
Common Setting→Input sentence: words
Input/output tags: POS
Solution→ Input sentence: POS
Input/output tags: POS + Chunks
Improvement→Input sentence: Special words + POS
Input/output tags: Special words + POS + Chunks
Chunking→Input sentence: POS
Input/output tags: Chunks

$$f_s(w_i \,.\, p_i, ch_i) = \begin{cases} (w_i \,.\, p_i,\ w_i \,.\, ch_i) & w_i \in W_s \\ (p_i\,, pi,.\, ch_i) & w_i \notin W_s \end{cases}$$

In practice: put the output of the chunking system)Modification of the Input data (ENA train and test).

Finally, our aim is to calculate the probability of POS tagging (T_n), chunking (C_n) and word (W_n). Most probable chunks of the sequence W_n. The chunks are marked with chunk tag sequence $C_n = (c_1, c_2,\ldots,c_n)$ where ci stands for the chunk tag corresponding to each word w_i, $c_i \in C$.

1) Chunk Boundary Identification

Basically, this research work is to provide for consideration by extracting the chunk boundary identification and chunk Label markers for each word in the annotated corpus. We can classify the chunk tag and chunk boundary identification in different categories. Phrase chunking can be categorized as follows, like Noun Phrases (NP), Verb Phrases (VP), Adjectival Phrases (AdjP) and Prepositional Phrase (PP) (Yimam, 2009). In spite of that, there are seven boundaries in order to recognize the boundaries of phrase chunk in the given sentences. These are BGN, ISD, STP, BGN-STP, OSD, < and >.The first formats BGN are complete chunk representation which can identify the beginning phrases. The second formats ISD are complete chunk representation which can identify the inside phrases. The third formats STP are complete chunk representation which can identify the stop phrases. The fourth formats BGN-STP are the chunk representation which can identify the combination of beginning and stop phrases. The fifth formats OSD are complete chunk representation which can identify the outside phrases. The last format is < and > which represent the initial and final chunk words respectively.

Suppose, we have a sentence as follow: □□□□□□□□□□□□□□□□□□□□□□□□□□, "The five persons ate their lunch by using a big plate" it is the sequence of word W_n= (w_1, w_2,…w_3), where W is the word set. Each word has its part of speech (POS) Tag: □□□□<NUMCR>□□□<N>□□□□□<N>□□□□<NP>□□□ <N>□□□□□<VP>□□<V> :: <PUNC>. The sequence of corresponding part of speech (POS) tags Tn = (t1, t2,...,tn), ti∈T where T is the POS tag set. Now, our aim is to create most probable chunks of the sequence W_n. The chunks are marked with chunk tag sequence C_n = (c_1, c_2,……,c_n) where c_i stands for the chunk tag corresponding to each word w_i , c_i∈C (Skut & Brants, 1998). Here the representation of C is the chunk tag set which depends upon different form of tagging arrangements:

Two – Tag: It consists of the set of symbols such as BGN and ISD.

Three– Tag: It consists of the set of symbols such as BGN, ISD and STP.

Four– Tag: It consists of the set of symbols such as BGN, ISD, STP and BGN_STP.

Five-Tag: It consists of the set symbols such as BGN, ISD, STP, BGN_STP and OSD.

Where those all tag schema stands for as follow:

BGN – It represents the chunk beginnings at this token.

ISD – It represented this token which is found inside of the chunk.

OSD– This token is found at the outstanding of the chunk.

STP – This token is found at the stop of the chunk.

BGN_STP – It represented this token position in a chunk of its own beginning and stop.

The combination of corresponding words and POS tags is used to get a new sequence token $V_n$gives sequence of C_n which maximizes the probability (Akshay, Sushma & Rajeev, 2005).

Here, we merge the close similarity words and POS tags to obtain a sequence of new tokens V_n = (v_1, v_2,…,v_n) where v_i = (w_i, t_i) ∈V. Thus the problem is to find the sequence C_n given the sequence of tokens T_n which make a greatest probability P (C_n | T_n) = P (c_1, c_2,………,c_n | t_1, t_2,………, t_n), which is equivalent to great as possible P (T_n | C_n) P (C_n) .

2) Chunk Labeling

Labeling the chunk is the second step that is used to identify once the chunk boundaries are marked. Those components are made easier to assign the label of chunk. Therefore, the labeling the chunk is used to complete successfully this research work at the intended target. With regard to this research work the chunk label task in particular category according to the feature of the chunk. In our scheme for attaining the particular objective there are 5 types of chunks– NP (Noun Phrase), VG (Verb Group), JJP (Adjectival Phrase) RBP (Adverbial Phrase) and BLK (others). We have tried to implement the machine learning based approach for deciding chunk labels.

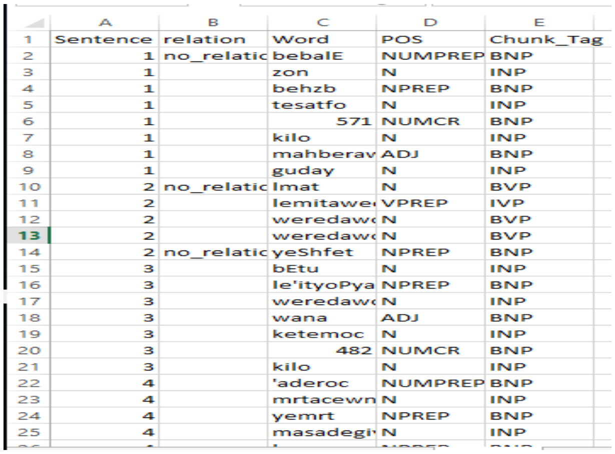
C. Result of the Experiment

The results (precision values) which we acquire can be clearly seen that for a relatively not smaller training data capable of models tend to do as well as make discriminative models. The beneficiary quality of Conditional Random Fields (CRF) can be regulated easily on large amount training data. As it is evident from the results CRF performs better for chunking than it does for POS tagging with the training on large sized data only because the number of outcomes for the former and we gate 94.2% precision with a relative great size training data part of speech tagging and chunking can be improved considerably.

Table 1. The precision values of result shown as below.

Main Task	SVM	CRF
POS tagging	95.7%	----
chunking	---	94.2

Fig. 1. Output of Amharic phrase chunking.



	A	B	C	D	E
1	Sentence	relation	Word	POS	Chunk_Tag
2	1	no_relatic	bebalE	NUMPREP	BNP
3	1		zon	N	INP
4	1		behzb	NPREP	BNP
5	1		tesatfo	N	INP
6	1		571	NUMCR	BNP
7	1		kilo	N	INP
8	1		mahberav	ADJ	BNP
9	1		guday	N	INP
10	2	no_relatic	lmat	N	BVP
11	2		lemitawe	VPREP	IVP
12	2		weredaw	N	BVP
13	2		weredaw	N	BVP
14	2	no_relatic	yeShfet	NPREP	BNP
15	3		bEtu	N	INP
16	3		le'ityoPya	NPREP	BNP
17	3		weredaw	N	INP
18	3		wana	ADJ	BNP
19	3		ketemoc	N	INP
20	3		482	NUMCR	BNP
21	3		kilo	N	INP
22	4		'aderoc	NUMPREP	BNP
23	4		mrtacewn	N	INP
24	4		yemrt	NPREP	BNP
25	4		masadegi	N	INP

CONCLUSION

Text chunking is an isolated part of information which adds more structure to the sentence used and also referred as part of speech tagging and shallow parsing. Therefore Chunker divides a solid piece of a sentence into phrase by using a label to each chunk. POS tag and chunk in a sentence are absolutely necessary and in great demand for the capability of a computer to automate for further investigation in many approaches in the area of NLP. In this era, the area of NLP application has been conducted for different languages for different purposes such as Question Answering, Morphological Analysis, Text Prediction, Part of Speech tagging, Named Entity Recognition, Parser, Chunking, Clause Boundary Identification, Information Extraction, Grammar Checker for English and other related languages. In addition to this, it is used in different area like linguistic acquisition, Psychology, Sequence Learning, and Memory Architecture, etc.

In this research work, we have the target of acquiring Conditional Random Field (CRF) based Amharic phrase chunking. Our justification behind pick out as being CRF for developing the chunker instead of other models such as HMM, SVM or Maximum Entropy Model. CRF works productively with minimum data proves to be efficient without any specific modification for other languages as well.We dig out several frame works to achieve the objective of this research work as well. For example, Amharic POS tagging, identify the boundary of the phrase, categorized the label of the chunk as the basic build task to achieve this research work.

In this paper, the chunking tagging scheme is categorized in to five boundary identifications it is to the seen if there are five boundary identification, BGN, ISD, STP, BGN-STP and OSD.

The constructed corpus for this research work is tagged manually by the language expert and the rules are generated from Amharic language to support tagged corpus like a supporter tools for this research work as well. Finally, this chunk tagged data is used as an input by the chunker next to the sspecial words and POS tagging. This research work is also formally introduced to the model Conditional Random Field (CRF) and the approach is used to capable the intended target of Amharic text chunking. Basically the CRF model is used to get best results rather than HMM or Maximum Entropy Model. In addition to this the experiments carry out by Python 3.7. System evaluation of the text chunker performance was made based on the evaluation procedures outlined in the thesis. In these paper only one parameter, the percentage of correctly chunker sentences in the sampled text has been used to measure the performance of the chunker. Based on the output, it shows the results are achieved to around 94.2%.

ACKNOWLEDGEMENT

First of all, it is proud his loge to pay obeisance and thank the Almighty God for the completion of this research work successfully. All the time, God made strong enough and this is me everything, the valuable gift from him and it's really beyond my expectation. Big response, big thanks to all who supported me and all that is up until the present to come.

Next, I have to convey my thanks to the Ministry Education of Ethiopian government who have supported me by finance and covering all educational expenses. Also, I would like to thank my brother and friend, Mr. Sintayehu Hirpassa Starting from the scratch till to the completion of this work, he was very cooperative and supportive all the time I feel obliged to stay in Punjabi University Patiala and get valuable suggestions throughout this work.

Finally, I would like to thank my family especially for my mom Zoma Mengistu. She has been lending many people and I fell grateful them. Have always supported me during my research work and I am very pleasing for that. Convey my sincere and thankful gratitude to my adviser and other faculty for extending enriched guidance and advice in accomplishing this gigantic task.

REFERENCES

A. Ibrahim., & Y. Assabie. (2013). A Hybrid Approach to Amharic Base Phrase Chunking and Parsing. Unpublished master's thesis, Addis Ababa University, Ethiopia.

A. Ibrahim, & Y. Assabie. (2014). Amharic Sentence Parsing Using Base Phrase Chunking.*International Conference on Intelligent Text Processing and Computational Linguistics*, *CICLing(*pp.297-306). Berlin Heidelberg, Germanys.

Akshay S., Sushma B., & Rajeev S. (2005) HMM based Chunker for Hindi. *Proceedings of 2nd International Joint Conference on Natural Language Processing* (pp. 126–31). IIIT Hyderabad.

Ashish,T., Arnab, S., & Sudeshna, S. (2005)A New Approach for HMM Based Chunking for Hindi. Department of Computer Science & Engineering, Indian Institute of Technology, Kharagpur.

Avinesh, P. (2007, January). Part-of-speech tagging and chunking using conditional random fields and transformation based learning. In *Proceedings of Shallow Parsing for South Asian Languages (SPSAL) workshop at IJCAI*, Hyderabad, India.

B. Yimam (2009). □□□□□□□□□. Addis Ababa, Addiasababa: Addis Ababa University BE Printing Press.

Chandan M., Vishal G., &Umrinderpal S. (2015, December). HMM Chunker for Punjabi. *Indian Journal of Science and Technology*, 8(35), 1-5.

C. Grover, & R. Tobin. (2006). Rule-based chunking and reusability. In *Proceedings of the Fifth International Conference on Language Resources and Evaluation* (LREC'06). European Language Resources Association (ELRA), Genoa, Italy.

D. Jurafsky, & J. H.Martin. (2019). Speech and language processing: an introduction to natural language processing, computational linguistics and speech recognition. Stanford University, California: Prentice Hall.

Dhanalakshmi, V., Padmavathy, P., Anand, K.M., Soman, K.P., & R, S. (2009). Chunker for Tamil. *International Conference on advances in recent technologies in Communication and Computing* (pp. 436-438), Kottayam, Kerala.

F. Xu, C. Zong, & J. Zhao. (2006). A Hybrid Approach to Chinese Base Noun Phrase Chunking. In *Proceedings of the Fifth SIGHAN Workshop on Chinese Language Processing*: Vol. 22223. (pp. 87293). Sydney.

G. Amare (2009). □□□□□□□□□□□□□□□□□□ Addis Ababa, Addis Ababa: Alpha Printing Press.

Himanshu, A., &Anirudh, M (2006). Part of Speech Tagging and Chunking with Conditional Random Fields. *International Workshop on Replication in Empirical Software* (pp. 1-4), Department of Computer Science, IIIT- Hyderabad.

Kutlu, M., &Cicekli, I. (2016). Noun phrase chunker for Turkish using dependency parser. *Lecture Notes in Electrical Engineering*. Springer, Cham.

Lise, G., & Ben, T. (2007). An Introduction to Conditional Random Fields for Relational Learning. Assistant Professor in the Department of Computer Science at the University of Maryland, Washington, D.C: MIT Press.

P. Jackson, & I. Moulinier. (2007). Natural language processing for online applications: Text retrieval, extraction and categorization: Amsterdam, Netherlands. John Benjamins Publishing Company.

Pranjal, A., Delip, R., &Balaraman, R. (2006). Parts Of Speech Tagging and Chunking with HMM and CRF. *Proceedings of CoNLL – 2000 and LLL – 2000* (pp 1-4), IIT Madras.

Steven, P. Abney. (1992). Parsing by chunks.Dordrecht, Netherland: Springer.

W. Ali., & S. Hussain. (2010). A hybrid approach to Urdu verb phrase chunking. In *Proceedings of the 8th Workshop on Asian Language Resources* (pp. 137-143). Beijing, China.

W. Skut., &T. Brants. (1998). Chunk Tagger - Statistical Recognition of Noun Phrases. In *ESSLLI-98 Workshop on Automated Acquisition of Syntax and Parsing (*1-7).Computational Linguistics, Universitity of the Saarland, Germany.

Yoav, G., Michael, E., &Meni, A. (2006). Noun phrase chunking in Hebrew. Proceedings of the 21st*International Conference on Computational Linguistics and the 44th annual meeting of the Association for Computational Linguistics*(pp. 689-696), Sydney, Australia.

***