Title: Public Opinion Analysis of Amharic News Using Deep Learning

Abstract

Social media has given web users a venue for expressing and sharing their thoughts on different events. Facebook is one of a famous social media platform through which users can express their opinions on various events. Facebook is our targeted domain in this study. Sentiment analysis is a fundamental branch in natural language processing. It is the process of understanding sentiment in user-generated opinionated data in social media. Amharic language imposes many challenges, due to its complex structure, various dialects, in addition to the lack of its resources in the case of sentiment analysis task. The objective of this study is used to sentiment analysis model classify users' comments were written in Amharic as positive, negative or neutral. Deep learning has shown remarkable improvements in the field sentiment analysis. In this study, we have collected 13931 unstructured data from AMC official Facebook page using www.exportcomment.com and Facepage tool. It is difficult annotated each comment that were written in Amharic language. We have manually annotated by linguistic experts and also applied text preprocessing and representation techniques. After annotated, preprocessing and representing, the dataset prepared for the experiment purpose. The dataset, we used the 80/20 train-test splitting method, and train the model using tensorflow Keras deep learning library with LSTM and GUR classifiers as it confirmed to be successful at classification problems. Finally, in our experiment, we obtained the accuracy of LSTMis 95.5% and GRU is 96% respectively using word2vec embedding model.

Keywords: Sentiment analysis, Deep learning, Amharic sentiment analysis, LSTM, Gated recurrent units

1. Background of the Study

Sentiment analysis is a method of computing and satisfying a view of a person given in a piece of a text, to identify persons thinking about any topic is positive or negative. Sentiment analysis of Facebook data is providing an effective way to expose user opinion which is necessary for decision making in various fields [1]. Sentiment analysis is a fundamental branch in natural language processing (NLP) [2]. It is the process of understanding sentiment in user-generated opinionated data in social media, product feedback

or blogs. Sentiment analysis or opinion mining aims at determining the attitude of a speaker, writer or another subject with respect to a certain topic or event. [3].Sentiment analysis or opinion mining is the computational study of people's opinions, sentiments, emotions, appraisals, and attitudes towards entities such as products, services, organizations, individuals, issues, events, topics, and their attributes[4].

Recently, deep learning has shown remarkable improvements in the sentiment analysis field in the English language [3]. However, a research has been done on using deep learning approach in the Amharic sentiment analysis[6]. Amharic is widely spoken language in Ethiopia. Amharic has own written system with a version of the Ge'ez script known as Fidel. It is the second most-spoken Semitic language in the world, after Arabic[7], and the official working language of the Federal Democratic Republic of Ethiopia.

Social media has given web users a venue for expressing and sharing their thoughts on different events[1], Face book is one of them and used as a famous social media platform through which users can express their opinions on various events or objects.

The social media site Facebook is our targeted website for this study. This is because the AMC Facebook page has many members or followers and vast user-generated data is available. The objective of this work to use word2vec technique to automatically classify Amharic as positive, negative or neutral using deep learning classifiers, LSTM and GRU

2. Statement of the Problem

Amhara Media Corporation (AMC) is one of the official media services in Ethiopia, and it covers social, economic, cultural and political subjects. AMC is distributed their programs in the way of different mediums Television, radio, magazine, and social media sites Facebook, Twitter, YouTube, Telegram with local and international languages.

In recent years [5], the exponential increase in the Internet usage and exchange of public opinion is the driving force behind opinion mining today. AMC is one of Amhara regional state governmental media organization that deliver relevant information for the population among the organization's news service is common. Currently the corporation receives comment from customers for their services are through social media sites Facebook, Twitter, YouTube, and Telegram. And from social sites by reading that much

comments which is difficult to address all customers' opinions. The analysis of this data to extract latent public opinion and sentiment is a challenging task.

A researcher Alemu(2018), [6], has been proposed sentence level sentiment analysis model for Amharic using deep learning approach. Although the researchers recently used deep learning model has improved the accuracy of the sentiment analysis used small amount of dataset, there is still more opportunity for improvement. Our study is encouraged to explore different deep learning classifiers that will be applied to Amharic text, in order to improve the Amharic sentiment analysis accuracy.

Deep learning has shown great success in the field of sentiment analysis and is considered as the state-of-the-art model in various languages [3]. The Amharic language imposes many challenges, due to its complex structure, various dialects, in addition to the lack of its resources.

We have been proposed corpus-based sentiment analysis for Amharic language using deep learning approach

This research will answer the following questions: -

- ➢ Which text representation technique applied for Amharic comments is used?
- ➢ Which deep neural networks classifiers for Amharic comments are used?
- ➢ What tools appropriate for extracting Amharic comments on social media are used?

3. Methodologies

3.1. Data Source and Data Collected Technique

In order to analyses the opinions of the users to collect the user-generated content from AMC used web scraping. Web scraping is the process of automatically mining data or collecting information from the World Wide Web. Such type of web scraping method is used to collect data from social media, Facebook Graphic API tool, Face-pageris used to collect public posts from Facebook page [9]. This study the primary data source was conducted from Amhara Media Corporation (AMC) Amharic Facebook page, because of it is legal under the Facebook company terms and condition. We focused

on special attention to socio-politics domain. The reason behind choosing these domains are the availability of user generated content in Amharic language pretty good domain.

3.2. Text Preprocessing and Representation Techniques

Text Preprocessing: Texts generated by humans in social media sites contain lots of noise that can significantly affect the results of the sentiment classification process. The Preprocessing is increasing the data quality to some extent and also needed to transform the data raw data into a coherent format. In this study, the Preprocessing techniques data cleaning: removing non-Amharic text and symbols, numbers and punctuation, stop-words removal, *tokenzation* and normalization are used in the collected datasets.

3.3. Deep Learning Approach

Sentiment analysis algorithms fall into one of three loads: Rule-based, Automatic or machine learning, and hybrid approaches. This study has been used automatic approach. Automatic methods, systems rely on machine learning techniques to learn from data. In classification algorithms or models have been selected neural network algorithm. Deep learning approaches are part of machine learning which refers to deep neural Networks. Deep neural networks consist of many networks [8], such as CNN (Convolutional Neural Network), DBN (Deep Belief Neural Network), RNN (Recurrent Neural Network), Recursive Neural Network, Long Short term Memory (LSTM), Bidirectional Long Short-Term Memory (BI-LSTM), RNDM (Recursive Neural Deep Model), and RNTN (Recursive Neural Tensor Network). We used LSTM and GRU models for training and testing the dataset

3.4. Design Science Approach

Sentiment classification model of Amharic text, we used deep neural network with word embedding technique. To realize this, data preparation like separation of data into training and test sets that is used training-test-split method, loading the data, and cleaning the data to remove punctuation and

numbers used preprocessing techniques, and defining a vocabulary of preferred words are play vital role for this work. Then, we train the model using the *Keras* deep learning library with LSTM and GUR classifiers as it confirmed to be successful at classification problems.

3.5. Tools and Techniques

In this study have been used tools that are *Tensorflow* deep learning library, Keras deep learning library, Scikit learn machine learning library and python with Anaconda navigator. And also, we used web scrapping methods; the methods are export comment site and Facepager tool to extract users' comments from AMC public Facebook page and to represent the text we used word embedding technique.

4. Related Work

As summarized, the previous researchers the majority works done on Local language and International Languages, and as well as various domain dataset and different text granularity. Almost their works are using Machine learning and Deep learning approaches. In Amharic Language using deep learning approach is work done very rare. Hence our study is focused on Amharic Language sentence level sentiment classification using deep leaning approach, in order to improve the Amharic sentiment analysis accuracy.

Author	Approach/Model	Data source & Domain	Dataset	Feature extraction method	Results (%)
Selama G.Meskel (2010)	Lexicon -Rule based approach	Movies & newspaper reviews, manually collected	303 reviews	contextual valence shifters	Movie P->94.3, 94.9, 94.5 N->66.6, 84.2, 74.3

TilahunTulu (2012)	manually crafted rules and lexicon approach	Hotel, University, and Hospital, users review	484 reviews	Aspect/Feat ure	Avg p 95.2 & r 26.1
Chilote Dessalew (2019)	Rule-based approach and ML classifiers (SVM &NB)	Amhara Mass Media Facebook page, News reviews	1200 reviews	Bag of words	NB:84, 80 & 81 SVM:87, 82 & 84
Wondwossen P and Wondwossen M (2014)	Multi-scale sentiment analysis ML approach	Facebook, Twitter, DireTube and Ethiopian reporter websites, product and marketing news	608 reviews	unigram, bigram and hybrid	43.6, 44.3, 39.5
Abraham Getachew (2014)	ML classifiers (NB, DT and ME)	EBC, tiretubeand habesha.com sites, Entertainment reviews	616 optioned texts	Unigraman d BoWs	90.9, 83.1, 89.6
Mengistu Kassa (2013)	ML approach (NB, MNB and SVM)	ERTV, FBC, and DireTube	576opti oned texts	n-grams-TF- IDF	78.8, 77.6, 74.7
Maru Kideneh (2020)	ML approach-SVM	Amhara Media Corporation Facebook page and YouTube cannel users' sport and business news review	787opti oned texts	TF-IDF	83.2
Yeshiwas Getachew (2018)	Deep Learning approach	FBC-Facebook Page,socio-political review	1600 reviews	Count Vectorizer &TF-IDF Vectorizer	90.1, 82.4, 70.1

Our proposed approach is used LSTM and GRU deep learning classifiers, and we have obtained the accuracy is 95.5 and 96% for each classifier.

5. Proposed Approach

The users' comments were collected from Amhara Media Corporation official Facebook page posted Amharic news is considered for our analysis. Our proposed approach for Sentiments Analysis for Amharic text using deep learning approach is presented in the following section. Our work divides into four main stages. Those are: firstly, we collect unstructured users' comments need to be used to feed our network. Secondly, we used the preprocessing method since the users' review data are unstructured. This data to be preprocessed using various preprocessing techniques like data cleaning, URL, HTML tag removal, punctuation and number removal, and stop word removal and so on. Thirdly, the preprocessed texts are represented using word embedding representation model, word embedding to obtain the feature vectors. Finally, configure the LSTM and GRU (Gated Recurrent Units) model to train and classify the text sentences as positives, negatives or neural.

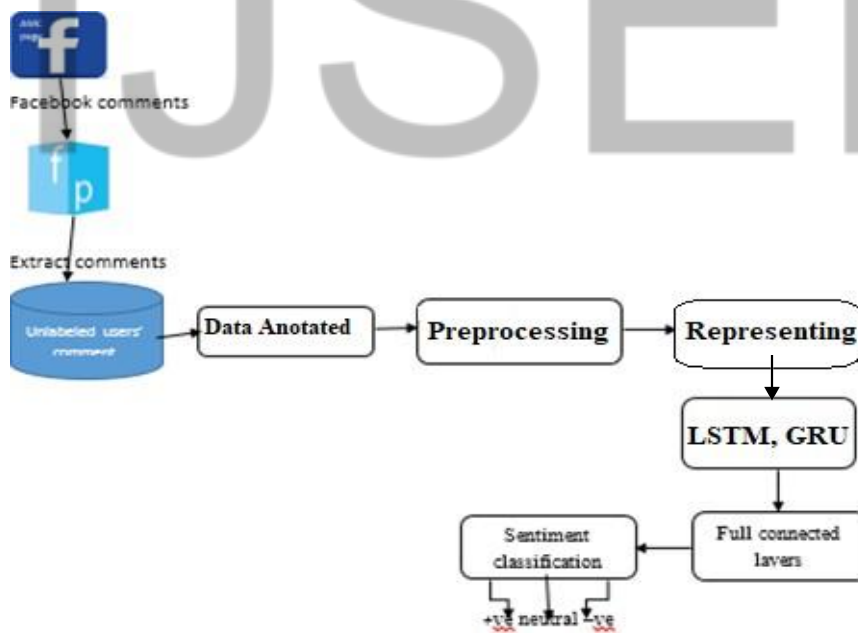## 6. Architecture of the System

Figure: proposed architectural for Amharic text sentiment analysis adopted from [10]

7. Discussion of the Result

As shown in table7 above, the experimental results revealed that deep learning algorithms achieved comparable performance with word2vec embedding.

In experiment one, we obtained the accuracy of LSTM is 95.5% and GRU is 96 respectively using word2vec embedding. As observed from this value GRU model outperforms the LSTM. This may due to GRU able to obtain the contextual information of the text, and capture better semantic relation from word2vec.

As shown in the above table, the experimental results are different for each category the reason behind this case is due to the class imbalance of the collected data. However, we try to used data augmentation techniques and improve the performance of each category result and the overall performance of the model. We have observed that the classifier's accuracy is better for the pre-trained word embedding model because we can use the advantage of large unlabeled Amharic texts to generate features. In all models, precision and recall are higher for the 'neutral' category because most of the data in our corpus belong to this class. We repeatedly performed the experiment and these findings are unchanged. Generally, the values of the evaluation metrics are encouraging and more training data is essential to improve the performance of the model. Our word2vec embedded model works well for deep learning algorithms by setting trainable parameters true to learn new features and the algorithms by itself has sequential layers to learn features or term weighting.

In general, two main observations can be made from comparing experimental results of the neural network. First, word embedding can able to capture syntactic and semantic relations of Amharic words. Secondly, models with word2vec embedding perform better. Thirdly, GRU achieved the higher accuracy than LSTM classifiers used in our experiments.

Finally, at the end this study, we have achieved the research questions that mentioned on the statement of the problem. RQ1, which basic technique of applied Amharic text representation of sentiment analysis task is used? This question is solved by word2vec word embedding model to represent the texts. RQ2, which deep neural networks classifier for Amharic text of sentiment analysis, is used? We have used the sequential data, to classify these data using LSTM and GRU

Classifiers, that is solved 2nd question. RQ3, what types of tools appropriate for extracting Amharic texts on social media are used? We have used e*xport comments site* and *facepager tool* that were collected peoples' comments from AMC Facebook page, that also is solved the 3rd questions.

Conclusion

Sentiment analysis analyzes people's opinions, sentiments, and emotions from user generated texts. In this study, different approach comparison the training of two different modes of deep neural network architectures: long short term memory and gate recurrent units. The applied dataset has been extracted from AMC Amharic official Facebook page and used to test the effectiveness and assess the robustness of our planned approach, along with constructing our proper corpus, following the setting up of a special vector of words using word2vec. On test the attained dataset via the LSTM and the GRU models, classification accuracy rates of respectively 95.5% and 96% have been reached. The present work appears conducted to apply the LSTM architecture to the context of Amharic sentiment classification area as appearing in social media. As a potential work perspective, we consider experimenting with larger dataset range useful for training other more highly thorough and deep architectures, along with attempting to plan architectural combinations in a bid to achieve even more remarkably improved accurate results.

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