Sentiment Analysis for Reviews of Restaurants in Myanmar Text

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***Abstract*—Sentiment analysis is the analysis of the feeling such as attitude, emotion and opinion. Sentiment analysis on English Language has become large and popular field of research area with many commercial applications. Researchers from different countries want to build sentiment analysis systems in their own language. This paper proposes the creation of Myanmar sentiment lexicon for food and restaurant domain and analyses the Myanmar text reviews of customers using lexicon-based sentiment analysis for the recommendation. To our knowledge, this is the first work for sentiment analysis of Myanmar text comments. The first challenge is the absence of annotated data and sentiment lexicons. In this paper, we address this approach to sentiment analysis for Myanmar Language and generate the context-independent sentiment rules for Myanmar Language.**

Keywords—sentiment analysis; sentiment lexicon; lexicon-based; context-independent sentiment rules; Myanmar language

I. INTRODUCTION

Sentiment Analysis can be seen as a natural language processing (NLP) task that aims to analyze opinions, sentiments, and emotions expressed in unstructured data. A common task in this research area is polarity classification, which consists in classifying the overall sentiment present in a document or sentence. Usually this task is simplified by classifying a text or a sentence in 3 classes: positive, negative or neutral. In order to build sentiment classifiers, two main approaches have been investigated: lexicon-based methods and machine learning algorithms [4].

Most of the research for sentiment analysis has focused on many commercial applications such as hotel review, product review and movie review, etc. This research focuses on restaurants' review. Textual restaurants' reviews of any kind can contain plenty of information. It is often difficult to work with such unstructured data. Customers' reviews give inconsistency between the star rating and textual reviews. For example, a reviewer wrote a highly positive review but rated the restaurant unfavourably, and vice versa. This paper addresses one way to extract information from text by evaluating its positivity and negativity.

Sentiment lexicons are important components of sentiment analysis systems. For English Language, there are many sentiment lexicons, which were manually created by experts or by crowdsourcing [6]. For other language, researchers face a challenge for building resources such as lexicons, dictionary and corpora. Sentiment analysis in Myanmar Language is still unexplored due to the non-availability of various resources and tools such as annotated corpora, lexicons, part-of-speech (POS) tagger etc. In Myanmar Language, there is typically a large difference between formal and informal writing style. We have tried to cover both formal and informal cases in our lexicon. Besides, sentiment analysis of domain-specific texts requires adaption of machine-learning models or sentiment lexicons to the target domain. So, some opinion word can lose their polarity in specific domain [7]. Our approach is based on sentiment lexicon enriched with sentiment polarity. In attempting our objective, we are faced with language-specific challenges and constraints. The absence of any reference, we started by manually collecting sentiment bearing words from the collected reviews based on our knowledge.

In this paper, we described how we approach the language-specific challenges when designing and implementing a lexicon-based sentiment analysis method for Myanmar text. An evaluation of this method is also presented.

This paper is organized as follows. In section 2, the relevant previous work on sentiment analysis of other languages is presented. The methods in sentiment analysis are discussed in section 3. Section 4 describes the construction of Myanmar sentiment lexicon for food and restaurant domain. Section 5 presents the architecture of our proposed system. The next section presents the case study and results about the sentiment analysis of customers' review for restaurant domain. Finally, we conclude the paper in section 7.

II. RELATED WORK

Sentiment analysis which is related to people opinions, comments, sentiments, attitudes and emotions towards target objects such as products, services, culture or even individuals (politicians) is a recent topic in natural language processing. Related works of sentiment analysis for other languages are described in this section.

Amiri, Scerri and Khodashahi [1] described a lexicon-based sentiment analysis method considered about the Persian language. For lexicon-based sentiment analysis technique, they needed a wide range of Persian vocabulary entries, and their sentiment. As no Persian API was available for achieving this requirement, they chose to manually gather a number of Persian adjectives, words and expressions from two online Persian language resources. An evaluation of the developed GATE pipeline shows an encouraging overall accuracy of up to 69%.

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Avanco and Nunes [4] presented some results on lexicon-based classification of sentiment polarity in web reviews of products written in Brazilian Portuguese. Translation was used to make use of existing sentiment lexicons for other languages. The prior polarity of words according to a sentiment lexicon and used some linguistic knowledge about contextual valence shifting (negation and intensification) to compute the polarity value of each sentence and text. In this work they considered the classes positive and negative. The average F-measure achieved 0.73.

Santarcangelo, et.al. [11] discussed how Social Networks Mining represents one of the most important tasks for Opinion Mining Systems, considering the state of art literature. Then, authors showed an interesting approach based on Adjectives (A), Intensifier (I) and Negations (N) (called AIN) developed for Italian. This approach was based on the use of an Italian Sentiment Thesaurus (AIN Thesaurus). The sentiment analysis was applied on the filtered content of each opinion. This one was accomplished thanks to their Italian thesaurus of pre-recorded words, containing a number of adjectives and intensifiers and their polarity, which is represented by an integer. There are five classes used in their approach: Strongly positive, Slightly Positive, Neutral, Slightly Negative, Strongly negative.

Nguyen and Pham [2] proposed an approach to mining public opinions from Vietnamese text using a domain specific sentiment dictionary in order to improve the accuracy. The sentiment dictionary was built incrementally using statistical methods for a specific domain. They developed an application to extract public opinions on online products and services to experiment and evaluated the efficiency of the approach. A list of all English adjectives, adverbs and verbs extracted from SentiWordnet 3.0. An English-Vietnamese dictionary was used to translate all the words in the previous list to Vietnamese. Accuracy of the domain specific dictionary could give was 84.54%.

Mohammad, Salameh and Kiritchenko [9] presented several large sentiment lexicons that were automatically generated using two different methods: (1) by using distant supervision techniques on Arabic tweets, and (2) by translating English sentiment lexicons into Arabic using a freely available statistical machine translation system. They translated existing English sentiment lexicons (four manually created ones and two that were created automatically) into Arabic using Google Translate. And they compared the usefulness of new and old sentiment lexicons in the downstream application of sentence-level sentiment analysis. There is no sentiment analysis for Myanmar Language. To our knowledge, this is the first work for sentiment analysis of Myanmar text comments.

The aims of this paper are to improve the problems in the existing research about language-specific challenge for Myanmar Language and analyze the Myanmar text reviews of customers for the restaurants by using lexicon-based sentiment analysis.

III. Methods in Sentiment Analysis

Generally, two techniques are used for opinion mining and sentiment analysis: (1) Machine learning based techniques (2) Lexicon based techniques. In machine learning based techniques various machine learning algorithms are used for sentiment classification. Both supervised and unsupervised learning algorithm can be used to classify text. In Lexicon based techniques, a sentiment dictionary with sentiment words is used for sentiment classification. The dictionary contains polarity of each word whether they are positive, negative and objective words. Polarity of the opinion words can be determined by matching those words with dictionary words [5].

A. Lexicon Based Approach

This approach is an Unsupervised Learning approach since it does not require prior training data sets [8]. Sentiment words are used in many sentiment classification tasks. Positive and negative sentiment words are used to express some desired and undesired states respectively Lexicon based approach deals with searching the axioms such as adjective, adverb, noun etc. from the sentence and comparing with seed words. Two approaches are:

1) Dictionary Based Approach: Sentiment words are collected manually to form a small list, which is later developed by searching more words from a known corpora wordnet. Wordnet is a corpora which produces synonyms and antonyms for a word. The new words found exclusive of the seed words are included to the list. The process continues until now new words are found from the corpora.

2) Corpus Based Approach: This approach is to resolve the problem of dictionary based approach. Corpus based approach is not as efficient as dictionary based approach because there is a need to make a huge corpus for covering words and this approach is very difficult task [3]. It requires annotated training data to produces accurate semantic word.

IV. Linguistic Resource Building

For our proposed, we collected data and extract the sentiment lexicon containing sentiment bearing tokens.

A. Dataset

The largest problem we faced is the lack of freely available annotated data for Myanmar Language. To overcome this problem, we compiled our own dataset. We manually collected data for restaurant's reviews from the Facebook page. The corpus contains the positive reviews, negative reviews, mixed and neutral reviews without any segmentation. Some review contains only positive or negative. Some review contains any number of different opinions for both positive and negative categories. Some reviews do not have any clear sentiment.

B. Constructing of Myanmar Sentiment Lexicon for Restaurant Reviews

This section presents the construction of Myanmar sentiment lexicon for restaurant reviews. For our lexicon based sentiment analysis technique, we made use of a base

dictionary which was available from Myanmar lexicon. The absence of any reference, we started by manually collecting sentiment bearing words from the collected restaurants' reviews for Myanmar Language based on our knowledge and developed by searching more synonyms and antonyms.

Small set of Myanmar sentiment words for restaurant's reviews and emoticons of customers' feeling in reviews are collected. The polarity of the sentiment words and emoticons are assigned positive, negative and neutral according to their target such as food and taste, place, price, staff, service and common. We convert the polarity of each word into a numeric value to perform further computation i.e. positive is 1, neutral is 0 and Negative is –1. There are 766 sentiment words which included 38 intensifiers words, 14 neutrals, 377 positive words and 337 negative words. We also considered emoticons. The sentiment lexicon (L) is made up of a set as

L = {Target, Sentiment Word, POS, Polarity}

TABLE I. AN EXAMPLE OF MYANMAR SENTIMENT LEXICON FOR RESTAURANTS' REVIEWS

No.	Target	Sentiment Word	POS	Polarity
1	Food & taste	လတ်ဆတ် (fresh)	Adj	Positive
2	Staff	ရိုင်းပျ (rude)	Verb, Adj	Negative
3	Price	ဈေးကြီး (be expensive)	Verb	Negative
4	Place	ကျဉ်း (narrow)	Adj	Negative
5	Staff	ဖော်ရွေ (be affable)	Verb	Positive
6	Service	နှောင့်နှေး (delay)	Verb	Negative
7	Place	အေးဆေး (be peaceful)	Verb	Positive
8	Common	အလွန် (very)	Adv (Intensifier)	15%
9	Common	:D	Emoticon	Positive
10	Common	:-(	Emoticon	Negative

Intensifiers are mostly adverbs, but sometimes noun phrases and prepositional phrase. These are used to show an increase or decrease in power of verbs, adjectives and adverbs. Amplifiers are strengthen the meaning of other expressions and show emphasis such as အလွန် (very). Downtowners are words or phrases such as အနည်းငယ်(slightly) which reduce the power of another phrase or word.

Some Myanmar intensifier word such as လွန်း which is particle suffixed to verbs or adjectives to convey the meaning of excessive. Example: ဟင်းတွေက လက်ရာ ကောင်းလွန်းလို့ အရမ်း ကြိုက် သွားပီ။ The polarity of intensifiers based on 100%. The sentiment dictionary is the polarities of the words in the dictionary are set according to a specific domain such as restaurants' reviews. Same word in different domains can have different meanings; the dictionary used in this approach is made for restaurant review domain. The dictionary also contains the polarity of every word.

V. SENTIMENT ANALYSIS OF RESTAURANT REVIEWS

This section describes a method of performing the sentiment analysis of restaurants' reviews by using lexicon based.

A. Data Preprocessing

Restaurants' reviews are input texts for sentiment analysis. Myanmar text is a string of characters without explicit word boundary markup, written in sequence from left to right without explicit word boundary delimiters. We need the preprocessing steps of Myanmar formal and informal texts.

1) Myanmar word segmentation: Word Segmentation is an essential step prior to natural language processing (NLP) in Myanmar Language. A Myanmar syllable has a base character, and may also have (or not) a pre-base character, a post-base character, an above base character and a below-base character. Syllable segmentation and syllable merging are two phases in word segmentation.

a) Syllable segmentation: A syllable is a basic sound unit or a sound. A word can be made up of one or more syllables. In Myanmar, a syllable is formed based on rules that are quite definite and unambiguous. A rule-based heuristic approach adopted for syllable segmentation.

b) Syllable merging: Segmented syllables are merged into words. Dictionary-based approach with longest matching is used to perform syllable merging [10].

2) Part of speech tagging: POS tagging is a basic task in NLP. It is the process of labeling a part of speech or other lexical class maker to each in a sentence.

B. Sentiment word extraction and assign polarity score

The basic approach is to match with the sentiment dictionary for adjective, verb or adverb words. We decided that words in nouns that express emotions would be extracted. And then the polarity scores are assigned to each word by using sentiment dictionary.

C. Myanmar Sentiment Calculation

In the sentence level sentiment analysis, the polarity of each sentence is calculated.

$$P(E) = P(SW) \quad (1)$$

$$P(E) = [\ 100\% + P(I)\ ] * P(SW) \quad (2)$$

$$P(E) = [\ 100\% + P(I)\ ] * [\ 100\% + P(I)\ ] * P(SW) \quad (3)$$

$$P(E) = (-1) * P(SW) \quad (4)$$

Total polarity score can calculate the sum of polarity score of the excerpts.

$$P(T) = \sum_{i=1}^{n} P(E)_i \quad (5)$$

The average of the scores of the excerpts,

$$P(R) = \frac{P(T)}{N} \quad (6)$$

where:

P(SW) is polarity of sentiment word,

P(E) is polarity of the excerpt,

P(I) is polarity of intensifier based on 100%,

P(T) is the total polarity score of excerpts,

P(R) is the average polarity of review.

N is the number of experts.

According to the overall resulting value, opinions can be considered to be positive, negative or neutral. This assessment is given in the table II.

TABLE II. AN EXAMPLE OF MYANMAR SENTIMENT LEXICON FOR RESTAURANTS' REVIEWS

Polarity	Value
Positive	Equal or greater than +0.3
Neutral	Between −0.3 and +0.3
Negative	Equal or less than −0.3

If the sentence has only sentiment word, (1) is used for sentiment analysis. Example:

မင်္ဂလာပါမြန်မာ စားသောက်ဆိုင်မှ မြန်မာ့ရိုးရာစားအစားနဲ့ မုန့်သရေစာ တွေက ကောင်း ပါတယ် (Myanmar traditional foods and snacks are good from Mingalarbar Myanmar Restaurant.)

Extract word: ကောင်း (good)

P(E) = 1

If the sentence has sentiment word with one intensifier, (2) is used for sentiment analysis. Example:

မင်္ဂလာပါမြန်မာ စားသောက်ဆိုင်မှ မြန်မာ့ရိုးရာစားအစားနဲ့ မုန့်သရေစာ တွေက အရမ်းကောင်းပါတယ် (Myanmar traditional foods and snacks are very good from Mingalarbar Myanmar Restaurant.)

Extract word: အရမ်းကောင်း (very good)

P(E) = [100% + 25%] * 1 = 1.25

If the sentence has sentiment word with two intensifier, (3) is used for sentiment analysis. Example:

မင်္ဂလာပါမြန်မာ စားသောက်ဆိုင်မှ မြန်မာ့ရိုးရာ အစားအစားနဲ့ မုန့် သရေစာတွေကအရမ်းအရမ်း ကောင်းပါတယ် (Myanmar traditional foods and snacks are very very good from Mingalarbar Myanmar Restaurant.)

Extract word: အရမ်း အရမ်း ကောင်း (very very good)

P(E) = [100% + 25%] * [100% + 25%] * 1 = 1.5625

If the sentence has sentiment word with negation, (4) is used. Example:

အသား တွေကမလတ်ဆတ်ဘူး (Meats are not fresh.)

Extract word: မလတ်ဆတ်ဘူး (not fresh)

P(E) = (−1) * 1 = −1

VI. CASE STUDY AND PRELIMINARY RESULTS

We collected the 500 restaurants' reviews from social media. These reviews are simple which consist of positive reviews, negative and neutral reviews. In this section, reviews are tested for calculation and opinion results of all reviews are classified as positive, negative and neutral.

Example: Review of customer

မင်္ဂလာပါမြန်မာ စားသောက်ဆိုင်မှ မြန်မာ့ရိုးရာစားအစားနဲ့ မုန့်သရေစာ တွေကို ကြိုက် ပါတယ် ဖော်ရွေတဲ့ ဝန်ထမ်းတွေနဲ့ ဝန်ဆောင်မှု အရမ်း ကောင်းတဲ့ဆိုင် သန့်ရှင်းသပ်ရပ်တယ် :D (I like Myanmar traditional foods and snacks from Mingalarbar Myanmar Restaurant. Neat and clean with an affable staff. Service is very good. :D)

The polarity score of the customer's review (the average of the scores of the excerpts) is +1.04166 (positive) due to the input of:

ကြိုက် (like) = 1,

ဖော်ရွေ (affable) = 1,

အရမ်းကောင်း (very good) = [100% + 25%] * 1 = 1.25

သန့်ရှင်း (clean) = 1

သပ်ရပ် (neat) = 1

:D (amuse) = 1

Total polarity score is calculated by (5).

P(T) = 1 + 1 + 1.25 + 1 + 1 + 1 = 6.25

The average polarity of review is calculated by (6).

P(R) = 6.25/6 = +1.04166 > 0.3 (Positive)

A. Performance Evaluation

For each review, we used manually sentiment labeled by human annotating to compute the accuracy. We collected

358 positive reviews, 125 negative reviews and 17 neutral reviews. We calculated the polarity by evaluating of the customers' reviews and we choose four indexes to analysis of the results.

These four indexes are computed as follows:

Accuracy: number of Correctly Classified Polarity

Precision = TP[1] / (TP + FP[2])

Recall = TP / (TP + FN[3])

F-Measure = 2 * Precision * Recall / (Precision + Recall)

The results of 500 customers' reviews are shown in Table 3 and Figure 1.

TABLE III. ASSESSMENT OF OPINION RESULTS

	Accuracy	Precision	Recall	F-Measure
Positive	97%	0.9943	0.9777	0.9859
Negative	92%	0.9829	0.92	0.9504
Neutral	88%	0.7143	0.8824	0.7895

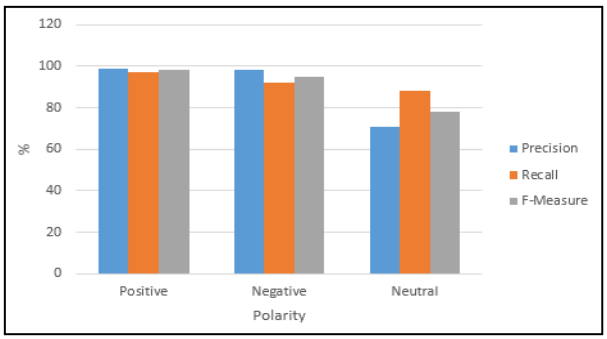

Fig. 1. Opinion results for food and restaurant reviews

Experiment results show the encouraging overall accuracy of up to 96%. We proved the sentiment lexicon with calculation for Myanmar Language. Thus, we generate the context-independent sentiment rules at each level of sentiment grammar for Myanmar text as follows. We considered the sentiment rules to compute the sentiment polarity at a clause level. The categories of separate words are positive, negative, intensifier, invertor and neutral. The final sentiment of the clause can be positive, negative, very positive, very negative or neutral.

These rules are:

Intensifier + Positive > Very Positive (R1)

Positive + Intensifier > Very Positive (R2)

Intensifier + Negative > Very Negative (R3)

Negative + Intensifier > Very Negative (R4)

Invertor + Positive > Negative (R5)

Invertor + Negative > Positive (R6)

Positive + Positive > Positive (R7)

Negative + Negative > Negative (R8)

Neutral + Neutral > Neutral (R9)

Neutral + Positive > Positive (R10)

Neutral + Negative > Negative (R11)

Rules R1 to R11 are sorted from the most common ones to the least common.

VII. CONCLUSION

In this paper, we described how we approached the language-specific challenge by designing a lexicon-based sentiment analysis for reviews of foods and restaurants in Myanmar text. We described the new Myanmar sentiment lexicon for food and restaurant reviews and calculate the sentiment polarity. This system is successfully annotated data for the resource of Myanmar Language at 96% overall accuracy of 500 customers' reviews of food and restaurant domain. This paper described the context-independent sentiment rules for Myanmar Language. In this paper, we evaluated performance with only 500 customers' reviews. This evaluation do not contain unseen and confuse objective reviews. So, overall accuracy is high. We may further require to consider the classification of objective and subjective for confuse reviews of Myanmar Text. In future, we will implement to classify the objective and subjective reviews, the aspect and rule-based sentiment analysis for Myanmar text.

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[1] True Positive
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