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Combined Approach for Teachers' Evaluation Aspects Identification Using Dictionary and Patterns Based

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***Abstract*—**Teacher performance evaluation is a common method and often used for evaluates teaching quality in higher education. With the rapid growth of opinion mining technique. Aspect-based opinion mining application has been possibly employed to extraction and summarization of students' comments for teacher evaluation. However, to automated teacher evaluation features identification from a large number of students' comments collection is very hard work. This study has the goal to address this problem. The main objectives of the proposed method are: (1) to identify teacher evaluation aspects, (2) to compare the efficiency of dictionary based, patterns based and the combination of them, and (3) to enhance the accuracy result in the teachers' evaluation aspects identification from the unstructured text of students' feedbacks. The students' feedbacks were collected by questionnaires and the dataset was constructed manually with a total of 4,496 sentences from 300 undergraduate student responses in 10 subjects by purposive sampling and the collection of positive and negative sentences from 30 participants group interviewed in the workshop. Both approaches were applied to identify the frequency teachers' evaluation aspects. The experimental results found that our proposed approach provided reasonably more accurate results, the combination approach enhanced a significantly average of precision and recall. For future work, we focus on the application of new linguistic patterns and non-frequency aspects in order to increase the accuracy result.*

***Keywords*—**aspects identification, lexicon relation, linguistic pattern, opinion mining, teacher evaluation.

I. INTRODUCTION

With the rapid growth of the internet and social media, people can discuss and share their opinions about several issues in forums, blogs, microblogs, and each other social network sites. Recently, with a large number of those textual information. Many scholars tried to analyze and apply them into more valuable issues such as product reviews, tourism, political, stock price, medical and et al. However, it is very difficult to read and analyze those unstructured data. Therefore, the automated tools for discovery those hidden opinions and summarized them into the usable forms are required [1], [2], [3]. Since 2006 Pang & Lee proposed the technique namely Opinion mining or sentiment analysis to deal with their problems for the extraction and summarization of people's opinions from a large volume of unstructured texts [4]. It is the field of automatic extraction the evaluation information from subjective text and the computational analysis about people's attitudes, opinions, appraisals, emotional and sentiments which express in text [1], [3]. In recent year, sentiment analysis was grown up. Therefore, it has been widely used in the evaluation of products and services from customer reviews and it has been applying to the evaluation of political, tourism, medical and other areas [5], [6], [7], [8], [9]. However, with the rapid growth of sentiment analysis technique. The main objective of this technique is to discover opinions and sentiments which express in text, and then classify their polarity. The classification process was divided into three levels: (1) document-level aims to classify an opinion document as expressing a positive or negative opinion, (2) sentence-level aims to classify sentiment expressed in each sentence, and (3) aspect-level aims to classify the sentiment with respect to the specific aspects of entities. The opinion holders can define different opinions for different aspects of the same entity [2], [10].

Regarding the teacher evaluation from the students' feedback, most scholars focused to numerical students' feedbacks analysis using the statistical technique while some scholars have been done on students' text comments by applying sentiment analysis to analyze the student's feeling and their opinion about the particular teacher. As mentioned in [11] the authors employed the sentiment analysis to study the student's perception. The result shown the word "confuse" from 60 percentages of all student comments. Then he decided to improve his teaching style and repeat this section again. Moreover, in our previous paper the result indicated that it might be possible to convert from qualitative to a quantitative type of teacher evaluation by performing lexicon-based sentiment analysis [12]. As mentioned above this indicate that it might be possible to apply this technique to teacher

evaluation. Aspect-based opinion mining application has been possibly employed to extraction and summarization of students' comments for earth teacher evaluation aspects. However, the analysis of students' text comment is difficult and implicates various stages to get summarize results. It consists of three core sub-tasks: (1) identifying teacher evaluation aspect that student commented on, (2) determining sentiment polarities on teacher evaluation aspects, (3) generating the teacher evaluation summary [1], [13].

In this paper, we focus on the identifying of teacher evaluation aspects from student commented. We studied the efficiency of dictionary based, patterns based and the combination of them to enhance the teachers' evaluation aspects identification from the unstructured text of students' feedbacks. The rest of this paper is divided as follows: Section II describes the related works done previously, Section III describes the proposed methodology, Section IV describes the research results and Section V describes the conclusion and future work.

II. RELATED WORK

Sentiment analysis is implemented to explore the hidden knowledge for evaluation. In educational domain, it was applied to explore the answers relevant to student opinion from open-ended questions in the evaluation process. We discovered seven works that specified this idea as follows.

First, in [14] proposed the system for analyzed and summarized the student feedbacks about each topic. According to [8] studied the course evaluation form student comments using sentiment dictionary to identify the frequency words and sentiment words, calculated the sentiment scores and represented with tag clouds. Moreover, [15] proposed the system for analyzed and summarized the student feedbacks from SMS and calculate the sentiment scores. Their system represented the output in a graph. On the other hand, [16] used the lexicon resource to study the students drop out behavior in Massive Open Online Course (MOOC). However, this work has some limitation. The sentiment word polarity was predicted based on the lexicon recourse of product reviews. In [17] proposed a combined method between Spanish lexical based sentiment analysis and machine learning techniques to analyze the students' feedback on Facebook. The results suggested that it is possible to perform sentiment analysis to analyze the students' feedback in Facebook with high accuracy. However, this work still has some limitation, all the words tagged as the same polarity get the same score. Similar to [18] proposed the construction of their teaching evaluation lexicon resource. In this work, the weight score of terms as defined by the experts with the ranged from 1.00 to 1.00. They employed three machine learning algorithms in their experimental in order to perform the sentiment classifications with a 97% highest accuracy of SVM. This proposed method can address the problem of automated sentiment orientation polarity definition in teaching evaluation, but it was constructed in Thai language. According to [19] study sentiment analysis about faculty evaluation. They considered Noun and Adjective extraction. In this study the frequency features and opinion words extraction from students' feedback using two pattern mining algorithms; e.g., Apriori and Generalized Sequential Pattern (GSP). The experimental results indicated that GSP is more efficient than Apriori for frequent features and opinion word extraction.

As mentioned above, in educational domain the application of sentiment analysis was used in various objectives; e.g., faculty evaluation, teaching evaluation, course-online evaluation and, teacher evaluation. It is possible to perform sentiment analysis in students' comment. Current researchers in this area focus on aspect-based sentiment analysis for extract and summarize the opinion about each teacher's evaluation aspects. The target of automatic sentiment analysis is improving the better accuracy result of teacher evaluation aspects identification, sentiment classification, and summarization. Therefore, in this study we proposed the new method to enhance teacher evaluation aspects identification.

III. PROPOSED METHODOLOGY

In this section, we described the overview of our proposed method. In order to automatic identify teachers' evaluation features from students' comments, we divided this section into three tasks as follows; 1) Setting teacher evaluation criteria 2) Data Sets and 3) Identifying Teachers' Evaluation Features.

3.1.Setting Teacher Evaluation Criteria

In this study, the teacher evaluation criteria were set up based on the teaching and learning theory literature reviewed and tree educational experts interviewed to filter and set up the appropriate teacher evaluation criteria for Malaysian environment. Therefore, it was set up based on teacher-based learning. The teacher evaluation items consisting of 4 main aspects and 16 sub-aspects as shown in Table 1.

TABLE 1
SUMMARY OF TEACHERS' EVALUATION ASPECTS

Measured Item		Literature
Criteria	Sub-criteria	

Instruction	Leading Delivery Communication	[20], [21], [22], [23], [24], [25], [26], [27], [28], [29], [30], [31].
Lecturer	Helpful Motivation Enthusiasm Relationship	[20], [21], [22], [23], Barth [24], [25], [26], [27], [28], [29], [30], [31].
Content	Material Difficulty Organization Preparation Objective	[20], [21], [22], [23], [24], [25], [26], [27], [28], [29], [30], [31].
Assessment	Grade Assignment Marking Feedback	[20], [21], [22], [23], Barth [24], [25], [26], [28], [29], [30], [31].

3.2.Data Sets

In this study, based on the teacher evaluation criteria above the positive and negative students' feedbacks were collected from two sources as present in Table 2. Then the teachers' evaluation dataset was constructed manually from those data. We describe the stages of dataset construction as follows.

TABLE 2
STATISTIC OF DATA COLLECTION

Sources	Number of students' feedbacks
Questionnaires	300 students' feedbacks with a total of 3,296 sentences.
Group interview	1,200 positive and negative sentences regarding each teacher evaluation aspects

3.3.Stage 1: Questionnaires

The open-end questionnaires were designed based on the teacher evaluation criteria in Table 2. Then the students' feedbacks were collected from 10 subjects of Computing Faculty in Universiti Teknologi Malaysia during the second semester of 2015. In this stage, the purposive sampling was done to collect a small dataset from 300 undergraduate student responses with a total of 3,296 sentences.

Ex: - Student 1

This class was well organized. The teacher managed class time well. Her explanation is very clear. She willing to help students. Willing to spare time for students. Tolerance in giving comment to improve. Given enough time to properly do the assignment. Motivates student interest in learning.

Ex: - Student 2

Good communication with students. The instructor gives respond to each activity in class. Good in communication and body language. The delivery is quite interesting. The resource material clearly before starts the class. Students were allowed to express their suggestion about any assignment or examination schedule. Instructor was easy to approach anytime. Instructor presented the real situation suitable with the real life. Strict in examination. There is too much assignment.

3.4.Stage 2: Group Interview

To construct the bigger dataset, the open-end questionnaires were designed based on 16 teachers' evaluation sub-aspects from Table 2 and the 30 undergraduate students in each faculty were invited as the workshop participants. Then the positive and negative students' feedbacks regarding those teachers' evaluation sub-aspects were collected from them by group interviewed. In this stage, we could collect 1,200 positive and negative sentences regarding each teacher evaluation aspects. Example of positive and negative feedbacks as shown in Table 3.

3.5.Stage 3

In this stage, based on text data from those previous stages. The teachers' evaluation small dataset was constructed manually with a total of 4,496 sentences.

3.6.Stage 4

To construct the annotated dataset, then we tagged the teacher evaluation in each sentence from the collection of students' comments manually. In order to annotate the positive, negative sentences and the opinion target in each sentence.

TABLE 3
EXAMPLE OF POSITIVE AND NEGATIVE FEEDBACKS

Positive feedbacks	Negative feedbacks
• Instructor gives clear explanation. • Instructor delivers the lecture clearly. • The amount of work is reasonable. • The grading system was well designed. • The material is easy to understand.	• He cannot explain well. • Bad approach in delivery lecture. • Too many assignments given at once. • The grading system was confused. • The teaching materials were not up-to-date.

3.7.Pre-processing

In this stage, we applied Python NLTK to prepare students' comments corpus from a collection and perform some data preprocessing to prepared text data for teacher evaluation aspects extraction as follows;

- Split document to sentences
- Converting to lower case
- Removing punctuation
- Removing numbers
- Stripping white spaces
- Removing stop words

- Stemming

3.8.Identifying Teachers' Evaluation Aspects

In order to identify teachers' evaluation aspects from students' comments. In this paper, we describe the detail of the teacher evaluation aspects extraction approaches as follows.

1. Dictionary-Based Approach

Based on the teacher evaluation criteria in Table 2, the teacher evaluation items were collected as a small set of teacher evaluation opinion target words manually, and then based on dictionary-based approach a small set of seed teacher evaluation opinion target words was used to grow this set by searching their semantic relation from WordNet [32] using Python NLTK [33] for their semantic relation of synonyms (Syn), antonyms (Anto), hyponyms (Hypo) and hypernyms (Hyper). The newly found words are added to the seed list of teacher evaluation aspects words list and stop when no more new words are found. This newly words list was constructed as the lexicon resource for identify teachers' evaluation aspects from students' comments [34], [35], [36], [37], [38], [39].

2. Patterns-Based Approach

Since the opinionated sentences consisting of opinion targets and opinion words. Many scholars have used the sequences of noun and adjectives to identify opinion targets. This linguistic pattern called base noun phrase has been employed by various research work. In this paper we employed linguistic patterns in [40] as follows;

- Base Noun Phrases (BNP)
  NN, NN NN, JJ NN, NN NN NN, JJ NN NN, JJ JJ NN
- Definite Base Noun Phrase (dBNP)
  Noun phrases (BNP) with the definite article "the".
- Beginning Definite Base Noun Phrases (bBNP)
  The noun phrases in between article "the" and a verb.

TABLE 4
SUMMARY OF DATA COLLECTION

Patterns	Type	Examples
NN	BNP	assignment/NN
NN NN	BNP	reading/NN material/NN
JJ NN	BNP	difficult/JJ examination/NN
JJ NN NN	BNP	good/JJ teaching/NN method/NN
DT NN NN	dBNP	the/DT grading/NN system/NN

3.9.Experiments

In the stage of identifying teachers' evaluation aspects from students' comments in this study, the experiment was designed and conducted by three automated techniques. We describe the detail of those three different teachers' evaluation aspects extraction approaches as follows.

1. Using Dictionary-Based Approach

In this stage, we employed a simple technique of dictionary-based approach to identify teachers' evaluation aspects to constructed teachers' evaluation aspects words list. Then using the constructed words list to identify teacher evaluation aspects from students' comments and compared with the annotated sentences. The experimental was set up by using four different types of semantic relation words, e.g. (1) Syn, (2) Syn+Anto, (3) Syn+Anto+Hypo, and (4) Syn+Anto+Hypo+Hyper.

2. Using Patterns-Based Approach

In this stage, we employed the patterns-based approach to identify teachers' evaluation aspects by using Python NLTK, POS tagging and linguistic patterns [40] to identify teacher evaluation aspects from students' comments and compared with the annotated sentences. The experimental was set up by using three different patterns, e.g. (1) BNP, (2) dBNP, and (3) bBNP.

3. Using Combined Approach

Based on the previous stages above in this stage, we employed the combination of dictionary and patterns-based approach to identify teachers' evaluation aspects from students' comments and compared with the annotated sentences. The experimental was set up by using three different types of the combination of dictionary and pattern-based approach, e.g. (1) Syn+Anto+Hypo+Hyper+BNP, (2) Syn+Anto+Hypo+Hyper+BNP+dBNP, and (3) Syn+Anto+Hypo+Hyper+BNP+dBNP+bBNP as shown in Figure 1.

3.10.Evaluation

In order to evaluate our proposed teacher evaluation aspects identification algorithm performance, we perform the standard evaluation measures. To calculate Precision, Recall, Accuracy, and F-score all parameters was set up as follows;

- True Positive : Number of extracted aspects which are target aspects.
- True Negative : Number of non-target aspects which are not extracted.
- False Positive : Number of extracted aspects which are not target aspects.
- False Negative : Number of target aspects which are not extracted

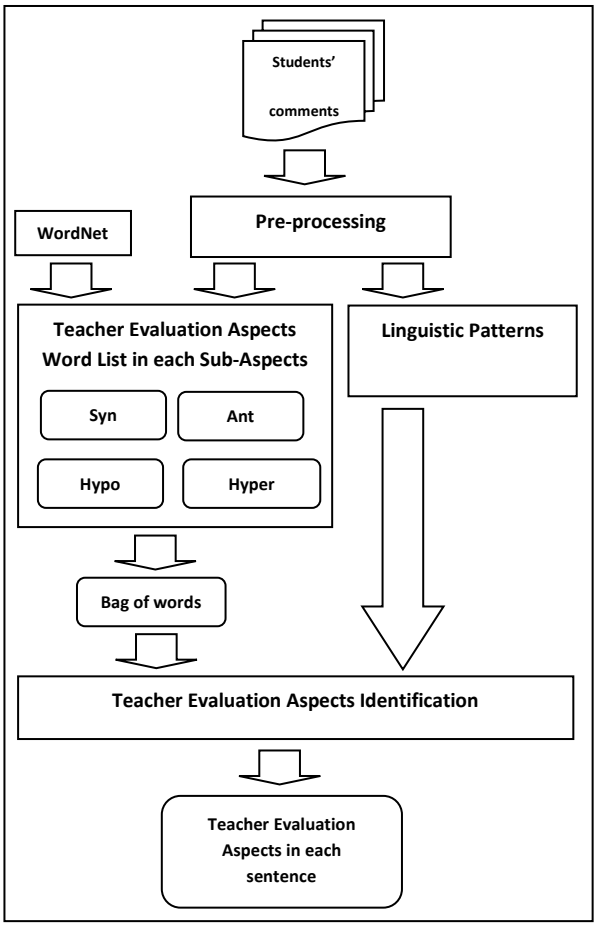

Fig. 1 Teacher evaluation aspects identification using the combination of dictionary and patterns-based approach

IV. RESULTS

Based on the experimental results, in order to investigate and compare the efficiency between three different teacher evaluation aspect identification approaches, e.g (1) dictionary based, (2) pattern based and (3) combination approach as present in Table 6.

TABLE 5
THE RESULTS OF THE DICTIONARY BASED APPROACH

Feature sets	Precision	Recall	Accuracy	F-score
Dictionary based approach				
Syn	33.59	96.17	43.92	49.79
Syn+Anto	33.59	96.17	43.92	49.79
Syn+Anto+Hypo	42.13	**98.68**	50.71	59.05
Syn+Anto+Hypo+Hyper	**49.90**	98.53	**56.87**	**66.25**
Pattern based approach				
BNP	54.68	97.61	58.71	70.09
dBNP	56.91	97.65	60.77	71.91
bBNP	**57.23**	**97.72**	**60.97**	**72.18**
Combination approach				
Syn+Anto+Hypo+Hyper+ BNP	61.24	99.02	65.16	75.68
Syn+Anto+Hypo+Hyper+ BNP+ dBNP	61.85	99.22	65.81	76.20
Syn+Anto+Hypo+Hyper+ BNP+ dBNP+ bBNP	**63.30**	**99.43**	**67.20**	**77.36**

As indicated in Table 5, the results obtained by the dictionary-based approach. We found that the using of Syn+Anto+Hypo+Hyper has higher accuracy than other semantic relations, it indicated that the using of semantic relation and the hybrid of them can improve the accuracy of teacher evaluation aspects identification. However, it was found that dictionary-based approaches which depend on semantic relation was not completed to identify teachers' evaluation opinion targets. There is some limit to identify the semantic relation between the similar of a single word and compound words, e.g. 'Teaching', 'Teaching style', 'Teaching material', 'Material'.

From the results obtained by the pattern-based approach. We found that the using of bBNP has the highest accuracy and all linguistic patterns have higher accuracy than each semantic relation, it indicated that the using of linguistic patterns can improve teachers' evaluation aspects identification. However, there is some limit to identify the semantic relation and lexicon relation between the other related opinion targets, e.g.

The syllabus is not clear. (#syllabus)

The room is very hot. (#room)

This course is very interesting. (#course)

As mentioned above, syllabus, room and course are Noun that we obtained the pattern-based approach to identify teachers' evaluation aspects. However, these are not the opinion target in teacher evaluation domain. It was found that the patterns-based approach which depends on semantic relation were not completed to identify teacher evaluations' aspects.

From the results obtained by using the combination of dictionary and pattern-based approach. We found that Syn+Anto+Hypo+Hyper+BNP+dBNP+bBNP is outperformed. This indicated that the combination technique can improve the identification of both semantic relation and lexicon relation between the related teacher evaluation opinion targets.

V. CONCLUSION AND FUTURE WORK

In this paper, we explored the identification of teacher evaluation aspects from students' comments using dictionary and patterns-based approach. It was found that both dictionary-based approach which depends on lexicon relation and the patterns-based approach which depends on semantic relation were not completed to identify teacher evaluation opinion targets by its' technique. While the combination of them can improve the identification of both semantic relation and lexicon relation between the related teacher evaluation opinion targets. For future work, we focus on the application of new linguistic patterns and

non-frequency aspects in order to increase the accuracy result.

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