Opinion mining from student text review for choosing better online courses

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Abstract. The process of online assessment has utilized get increased gradually as an evaluating tool in order to measure the lectures performance over Institution of Higher Learning (IHLs). However, these approaches generally have questionnaires sets consists of both quantitative and qualitative whereas the teaching assessment systems for several online lecture have concentrated on quantitative questions part due to its quick analysis. Contrarily, the part of qualitative has needed opinion from students that frequently ignored or misplaced and the opinion results level are omitted. This is due to student’s opinion which is generally in term of unstructured text that made hard to analyze the feedback manually. Moreover, the enormous data amount has produced on daily basis which can be utilized to opinion mining for extracting the student’s opinion in this exact online education area that has not widely applied in all educational system. Therefore, this paper has designed a framework by applying opinion mining concept to the student of coursera online machine learning course as the dataset whereas the comparison is accomplished using opinion mining framework to extract. The unstructured text gets processed and classification results based on polarity to obtain better outcome. Hence, this framework maintain several steps namely opinion extraction, unstructured text processing and polarity classification using NLP. Moreover, the performance of the outcome from the Opinion Mining (OM) gets evaluated using machine learning algorithms.

Keywords: IHL; Online Course; Opinion mining Concept (OM); NLP;

1. Introduction

IHLs are consistently looking for mechanism which gets utilized to enhance the process of learning and teaching whereas this enhancement has been accomplished using feedback collection from students based on their classes [1]. However, the feedback plays a vital role in accepting the student pattern opinion which may efficiently develop the performance of teaching and even producing teaching plan [2]. In order to quantify the teaching quality expressed using their lecture from student’s feedback which is significant to provide prompt insight into student level by accepting its learning process [3] [4]. Hence, its necessary to address the student feedback using IHLs for favourable development of its academic performance. Moreover, there are several methods for...
accomplishing feedback of students by the assessment system in teaching that involves their view over teaching instruction, learning environment and lesson quality [5]. This involves both questionnaires of qualitative and quantitative whereas the part of quantitative consists of questions with closed-ended namely multiple selections. When the qualitative part, the questions involved are open ended namely suggestions and comments in term of text from students. During earlier, the researcher has concentrated on questionnaires of quantitative which are entirely depend upon fixed rubric rules compared for analyzing the feedback through questionnaires of qualitative[6]. Even though, the faculties have frequently facing problems in creating feedback dense from qualitative questions. Thus, the feedback is enriched with beliefs, feel and opinion [3] [6].

Nevertheless, there are various algorithms and techniques available for tracking the textual reviews but opinion mining has better capability in trach of textual reviews [3]. One of the best suitable method to analyze students feedback with lexicon based approach based on earlier research [7] [8]. When the learning process outcome in teaching is not about the student but the skills and competency gathered by students but the skills and competency gather by student which definitely need the students to yield an energetic role in the education system [9]. The basic procedure to process the feedback of faculty is ineffectual for enabling progression and learning of student centric which doesn’t provide information during bottleneck. The general analysis of feedback is not delivered an essential input for addressing the exact issues that has been faced by every student. Additionally, it is considered high as reactive method whereas student may act as evaluator who has the capability to progress attribute for determining the teacher which is occasionally considered as a procedure of productive for extracting the exact bottleneck over the process of educational system. Therefore, the feedback analysis is not accounted for students with specific features. Moreover, the process utilized for producing feedback is subjective and not focused on their skills accomplished by the students. It is essential to implement proactive and feedback generation process, feedback validation and study for accomplishing the best results in feedback analysis using opinion mining. Thus, the research has focused in programming opinion mining with NLP and tokenization concept to obtain better accuracy in polarity from the student review text.

2. Literature Review
One of the advanced area in text mining is opinion mining which otherwise said to be Sentiment Analysis (SA) has been used as primary tool for determining the user’s opinion from big datasets involved in unstructured text [2]. It acts as usual quantification method of textual data which has ability to analyze the sentiment trends of a textual feedback. Based on these human opinions, it may generally deal with emotion which has been classified as positive, negative and neutral. In the case of education system, the emotion deal with positive polarity may believe that behaviour of student’s get an essential outcome whereas the emotion of negative polarity may illustrate an impact induced in student’s learning behaviour [10] [11]. There are many researchers who deliberated the opinion mining application to analyze student emotion. To an instance Binali et al. has proposed an idea for emotional detection method that utilized GATE’s visual environment to develop, implement and tested the modules of language processing [11]. Similarly, some researchers have utilized opinion mining to identify the emotions through feedback of student’s on courses and lecturers [12]. Moreover, there are enormous Machine Learning (ML) approaches have used for analyzing the feedback of students namely decision tree, logistic regression, Naives Bayes, Neural Network (NN) etc. The researcher Dhanalakshmi et al. has proposed one of the general ML techniques is Navie Bayes which is frequently utilized method for calculating the probability of available text associate to a specific feature [2]. In the case of multi-layer text classification and even manipulating the text data similarity using MM and k-NN. There are many researchers have illustrated that NN is the best technique to opinion mining which has capacity in analyzing text data with enormous records [13] [14]. Analysimpact and importance of pre-conceptual test through ICT tools in teaching learning process of functions in discretemathematics[15]. Nevertheless, the discovery of this study has
illustrated the NN technique is frequently producing better computation power for training the dataset to produce accurate results. The researcher has implemented Naïve bayes statistical algorithm of ML to classify the Gujarati document into predefined categories which get defined with more accurate classifier for random selection of 10 fold portion while compared with 2 fold data partition. Finally, the document utilized to test data may not been trained appropriately by the classifier [16]. Moreover, the accuracy is compared with selected feature selection and without usage of feature selection. The model without considering the feature selection is higher compared with feature selected model which is also applicable for small datasets. According to the domain of academic, there are various research studies that have been directed but the research is restricted to the opinion mining task whereas the supervised algorithm get utilized in a study for accomplishing opinion mining from the feedback of students provided in the Facebook pages [17].

The research goal has determined the performance of teacher’s by finding out orientation of feedback. The researcher has proposed repairing of teaching senti-lexicon involved in teaching corpus, sentiment weight score and category which has been experimented using various algorithms namely Naïvesbayes, Support Vector Machine (SVM) and ID3 [18]. Hence, this research gets concluded that results of satisfactory has obtained using teaching senti-lexicon instead of general lexicon. SA is performed based on comments of self-evaluation from student in developing the process of teaching [19]. Similarly, the another researcher has proposed an algorithm of decision tree for assisting report generation of annual appraisal which not only measured the student’s feedback but also utilized several performance measure to generate reports[20]. The lexicon based SA has been proposed by researcher to produce metrics which present a high correlation using Likert Scale [21]. In addition, the word cloud has produced for providing better understanding among teacher’s accomplishment in which positive words are shown in green colour and negative words with red color. Analysis of Component based Computingare studied by [22]. Simultaneously, the highly frequent words have been shown in the size of large font whereas Faculty Evaluation System (FES) has been proposed for evaluating the feedback of students textual [23]. Methodological development of mathematical modeling techniques in health care developed[24].

3. Methodology

This proposed research has focused to develop an algorithm in recommending online machine learning courses with assist of courser online machine learning datasets in order to provide awareness of latest trend courses and opinion provided by the students studying those courses.
This research involves the utilization of deep learning and deep parsing by utilization of NLP and tokenization as a concept in opinion mining is shown in figure 1. Initially, the opinion of students from courser have been analyzed based on review text provided are pre-processed and each word get tokenized using Tokenization and NLP analysis is done for performing recommended polarity based on Review text of courser student database with the records of 12,000 is shown in table 1. It consists of feedback from the students who studied and studying in the coursera online with their rating of the course and the lecturer who teach the course. There are various courses available in the feedback but this research has focused on the top 10 course which have shown in figure 2 to provide better opinion for the future students who are not aware of studying the latest trended online courses to begin the career.
Table 1. Feedback and rating from Coursera Students based on Course_ID

| Sl.No | Course ID     | Review                                                                 | Label |
|-------|---------------|------------------------------------------------------------------------|-------|
| 1     | 2-speed-it    | Boring                                                                | 1     |
| 2     | IoT           | Excellent course. Very clear                                          | 5     |
| 3     | 2-speed-it    | Very good                                                             | 5     |
| 4     | Python-data-analysis | Awesome course with good balance between Challenge, Research and Progression. | 5     |
| 5     | Machine-learning | I am halfway through the course and while the course is able to give good intuitions of what's going on at any one point in time it often lacks dept. The real reason I'm rating it 3/5 though, is that the mathematical notation is all over the place. You will find a matrix product such as A*T only to go on and implement A*B. This is SO confusing I would still recommend this course, but you should definitely record every single lesson again without mistakes and fix those errors. | 3     |
| 6     | Python-databases | Great course! Very practical lesson plan with relevant assignments. | 5     |
| 7     | Python-data-analysis | Although the test can be a bit fiddly, this is a great course if you already have a bit of background with Python and/or data cleaning. Lecture and tutorial videos are lean and information-dense. | 4     |
| 8     | Machine-learning | Good explanation and guide for machine learning.                     | 5     |
| 9     | Python-databases | This course felt a bit easy, but it was probably because I have worked with databases quite a bit already. Very useful. Great intro to databases and how to use Python with them. | 5     |
| 10    | Python-data-visualization | Course is great but I'd prefer that the tasks required writing code or editing the given code to complete the task if it'll help more, but overall course was great. | 4     |
| 11    | r-programming | It is the best!                                                        | 5     |
| 12    | r-programming | I love the teaching and assignment work here!                         | 5     |
| 13    | Python-data-visualization | Excellent program for people who would like to gain programming skills and learn Python. | 5     |
| 14    | IoT           | Boring                                                                | 2     |
| 15    | Python-data-visualization | Very good course.                                                      | 5     |
| 16    | Python-databases | Awesome part, my favorite of the first previous, but the Assessments are not challenging | 5     |

![Figure 2 Students studied in Top 10 Coursera online courses](image)

3.1 Word Tokenization and NLP

Once the review text gets imported is considered as each student feedback which get extracted in term of required tokenization and produced a needed relationship by NLP. However, this process perform through NLP has assisted in comprehensively characterized as the controlled program of natural language which may apprehensively in connection among computer and human language from the computer science are with deep learning. There are large quantity of text has been analyzed and handled with predictive analysis using NLP. This is a part of deep learning technique with some characteristics such as stemming, chunking data and stop words removal get utilized. The beneficial of NLP in making an opinion mining to segregate the words, noun, paragraph and sentences in determining the sentences as positive and negative whereas NLP also used for translator in translating.
one language to needed language. It may generate low noise which may lead to robust data. The NLP
major factor assist in feeding customer feedback as an input and it get divided into each token using
tokenizer. A sequence part of character has combined with organization involving punctuation marks,
symbols, special characters, words, etc. that has added in modifying a sentence into various words
based on word tokenization. This research has focused with Natural Language Tool Kit (NLTK) is
considered and applied with python which get assisted and interpreted to predefine the structure of
sentences along its meaning.

3.1.1 Algorithm for Tokenization and NLP

```python
#Tokenization and NLP
dfextract_NN(sentence);
grammar = r ""
NBAR: #Nouns and Adjectives, terminated with Nouns
    {<NN,*><NN,*>}
NP:
    {<NBAR>}
    #Above, connected with in/of/etc..
    {<NBAR><IN><NBAR>}
"

Chunker = nltk.RegexParser(grammar)
WC = set()
chunk = chunker.parse(nltk.pos_tag(nltk.word_tokenize(sentence))
for tree in chunk.subtrees(filter = lambda t:t.label() == ‘NP’);
    WC.add(‘’.join([child[0] for child in tree.leaves()]))
return WC
```

According to this proposed method, the research need to be modifying the student’s feedback
represented in the attribute of review text along with text of unstructured to the structured data. At
first, the data from part of speech is used in all NLP task for finding noun, verb, adjective and root to
each word over the sentence from review text. This session assist in identifying the opinion words
present in the review text such as adverb, noun and adjective that are utilized as a feature which may
represent high accuracy.

3.2 Opinion Mining

This proposed research has focused an opinion mining as beneficial analysis of reviewing the coursera
online course students review text as feedback from website. The student like to join the courses can
able to view the rating and opinion of earlier student who studied in this online course which assist to
justify the teaching of this online learning. However, it is not probable to read all the reviews from
earlier student’s feedback. Therefore, this proposed SA has assist in providing opinion polarity score
based on the adjective, adverb and noun with opinion words for the course easy way of learning and
about the teaching staffs. In order to avoid difficulty positive count and negative count are introduced
for finding the recommended “Factual label” as “1” and “0” whereas “1” for positive count is high
compared to negative count and “0” in term of negative count is higher compared to positive
count. The received opinion mining results have helped the students by not reading the review
completely instead of existing method. This proposed method has checked for recommended factual
label that help in quick decision making and even deduce the review reading. The following steps are
used to analyze the customer feedback reviews using sentiment analysis.
3.2.1 Step 1: Collection of opinion words

These reviewed word count has been vectorized in order to generate opinion words from the overall review words in word cloud is shown in figure 3.

![Figure 3 Word cloud for most frequent opinion word count from review](image)

**Step 2: Recommendation of Positive and Negative polarity words**

This step has illustrated recommended of review text which has done based on occurrence word count that may assist in identifying the emotion of the students as an opinion in their feedback. Since this model looks at both good and bad reviews but it can able to extract in term of each words as token using word tokenization which choose the best polarize by categories. Based on the opinion features of the words the count of positive and negative is mentioned as “1” and “-1” are shown in Table 3. Simultaneously, the course name, technical names are mention as neutral count but it is not accounted in the recommendation. Therefore, this proposed opinion mining has the ability in predicting potential positive or negative opinion for unlabeled reviews.
Table 2 Recommended words for positive and negative polarity

| Sl. No | Recommended words for Positive polarity “1” | Recommended words for Negative polarity “-1” |
|--------|---------------------------------------------|---------------------------------------------|
| 1      | Good                                        | Boring                                      |
| 2      | Useful                                      | short                                       |
| 3      | Excellent                                   | problem                                     |
| 4      | easy                                        | Rather                                      |
| 5      | perfect                                     | Instead                                     |
| 6      | Helpful                                     | without                                    |
| 7      | Use                                         | help                                        |
| 8      | Benefit                                     | frustrating                                 |
| 9      | Many                                        | Hard                                        |
| 10     | Well                                        | bad                                         |
| 11     | understand                                  | difficult                                   |
| 12     | enough                                      | enough                                      |
| 13     | Better                                      | little                                      |
| 14     | lot                                         | Confusing                                   |
| 15     | quite                                       | Fiddly                                      |

Step 3: Recommendation based on polarity words from review text

Moreover, this proposed model has assisted in decision making of recommended with label “1” and not recommended with label “0” to the text present in the review text. The figure 4 has illustrated the instance of student feedback who has studied python-database with the feature of opinion for both positive polarity count as “4” and negative polarity count as “0” that is said to be recommended as per factual label is “1”. In the cases student with course ID as machine-learning, the feature of opinion for both positive polarity count as “3” and negative polarity count as “-5” that is said to be not recommended as per factual label is “0”. Hence, each feedback for the respective course ID is maintained with factual label for recommending the courses for the students who like to do online courses.
Figure 4. Polarity identification of review text to recommend

| Factual label: 1 | Course ID: python-databases |
|------------------|-----------------------------|
| Positive polarity count: 4 |
| Negative polarity count: 0 |

This course felt a bit easy, but it was probably because I have worked with databases quite a bit already. Very useful. Great intro to databases and how to use Python with them.

| Factual label: 0 | Course ID: machine-learning |
|------------------|-----------------------------|
| Positive polarity count: 3 |
| Negative polarity count: 5 |

I am halfway through the course and while the course is able to give fool intuitions of what's going on at any one point in time it often lacks dept. The real reason I'm rating it 3/5, though, is that the mathematical notation is all over the place. You will find a matrix product such as A*B only to go on and implement A*B. This is so confusing. I would still recommend this course, but you should definitely record every single lesson again without mistakes and fix those errors.

Figure 4. Polarity identification of review text to recommend

4. Evaluation of Sentiment analysis using various Machine Learning (ML) algorithms

One of the best approaches to identify the recommendation for the student in the coursera online course is opinion mining with NLP and tokenization whereas the students can able to discover the recommended factual label. Once the results of traditional opinion mining are received, it is hard with quick decision making effort for the review. In this research, the analyzing study involves the test dataset of recommended label as review from the students whereas the prediction has been evaluated by confusion matrix parameters namely sensitivity, specificity and accuracy. The figure 5 represents the confusion matrix value for logistic regression and the values of confusion matrix for the respective model namely KNN, SVM, logistic regression and decision tree provided are shown in table 3.

Figure 5. Confusion matrix for Logistic regression
Table 3: Confusion matrix value for SVM, Decision tree, KNN and logistic regression

| Classification algorithm | Confusion Matrix value |
|--------------------------|------------------------|
|                          | True Positive (TP)     | True Negative (TN) | False Positive (FP) | False Negative (FN) |
| Logistic Regression      | 89                     | 90                 | 10                  | 1                     |
| KNN                      | 85                     | 91                 | 14                  | 0                     |
| SVM                      | 87                     | 90                 | 12                  | 1                     |
| Decision Tree            | 86                     | 90                 | 13                  | 1                     |

4.1 Sensitivity
The portion of true positive present in the students review with their rating is necessary to calculate the model for estimation. This is can be expressed as

\[ Sensitivity = \frac{TP}{TP + FN} \]

The sensitivity of a test is measured as a capability to determine the correct student review. Based on the value of sensitivity in table 5 and figure 6 has illustrated that KNN has the best value and precise determination of opinion mining as 1.00 but the other classification algorithm perform lesser than KNN. Hence, the KNN perform better sensitivity in this research as per students review and rating.

4.2 Specificity
The portion of true negative proportion present in the students review with their rating is necessary to calculate the model for estimation. This can be expressed as

\[ Specificity = \frac{TN}{TN + FP} \]

The specificity of a test is measured as a capability to determine the negative feedback from student review exactly. According to the specificity value shown on the table 4 and figure 6 illustrate that KNN has the best value and precise determination of opinion mining as 0.87 which is lesser value while compared with the other classification algorithm. Hence the KNN perform better specificity in this research as per students review and rating.

4.3 Accuracy
The accuracy of a test has illustrated the capability to distinguish the student’s reviews and determine the best course to choose for studying in online course. The portion of true positive and true negative present in all the calculated cases of a model gets estimated with the test accuracy which can be expressed as

\[ Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \]

The one major parameter is accuracy is shown on the above table 4 and figure 6 illustrate that logistic regression has the best value to determine opinion mining as 0.94 which has higher value while compared with the other classification algorithm. Hence, the logistic regression has performed better
accuracy in this research as per students review and rating. The recommended courses and teaching feedback is good can be determined using opinion mining gets evaluated.

Table 4. Sensitivity, Specificity and Accuracy values for various classification algorithms

| S.No | Classification algorithm | Sensitivity | Specificity | Accuracy |
|------|--------------------------|-------------|-------------|----------|
| 1.   | Logistic Regression      | 0.989       | 0.9         | 0.94     |
| 2.   | KNN                      | 1           | 0.87        | 0.926    |
| 3.   | SVM                      | 0.989       | 0.88        | 0.93     |
| 4.   | Decision Tree            | 0.989       | 0.874       | 0.926    |

Figure 6. Accuracy, Sensitivity and Specificity values for various classification algorithms

5. Conclusion

The major challenge for the students is to select the right courses while choosing online courses due to teaching performance that can’t able to justify. However, the student feedback reviews and rating may recommend the courses and lecturer quality and the way of teaching approach to the students but there is a lag in identifying the exact courses based on rating. Therefore, this research has focused to resolve the need of discovering the student’s feedback with their review text using OM. This OM has deal with NLP which assist to tokenize for making word counts. Hence the word count is compared with the opinion words along with the students rating to identify the better teaching lecturer based on course ID. This techniques need to be evaluated for discovering the better solution from OM. Thus, the OM datasets are evaluated with ML algorithms for the better performance. The test data get validated with the performance of confusion matrix parameters have illustrated that KNN algorithm performed better results in specificity and sensitivity. Logistic Regression has performed better
accuracy value as 94% which is higher than KNN algorithm. Therefore, the proposed OM with NLP has performed better with Logistic Regression to identify the good factual label recommended for the student to choose the online courses to study.

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