Sentiment Analysis on Student Feedback Using Natural Language Processing

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ABSTRACT

Text classification is the process of classifying or labeling text into predefined labels created by the user and has numerous applications in various industries such as sentiment analysis and topic modeling.In this work, it has been analyzed that the student feedback of text data is evaluated with various preprocessing namely, tokenization and word vector matrix and classified using the Multinomial Naïve Bayes algorithm. It can provide valuable insights into how students perceive their learning experience. The data used in this work is collected from the Ayya Nadar Janaki Ammal College, Sivakasi. This work can be used to analyze the emotions and opinions expressed in student feedback, educational institutions can identify areas of improvement and make data-driven decisions to enhance student satisfaction and student support services.This work can be used to improve the quality of organizing workshop and other events, which help to analyzing the student feedback, and organizations can make decisions to enhance future programs.

Keywords: Sentiment Analysis, Tokenization, Word Vector Matrix, Preprocessing, Multinomial Naïve Bayes

I. INTRODUCTION

Text classification is the process of categorizing or labeling text into predefined categories or categories created by the user. It is a fundamental task in natural language processing and has numerous applications in various industries such as sentiment analysis, spam detection, and topic modeling. Machine learning algorithms are commonly used for text classification, including support vector machines, Naive Bayes, andRandom Forest [1].Sentiment analysis is a subset of natural language processing (NLP) that involves classifying text as positive, negative, or neutral. Sentiment analysis is a key application of text classification, where the categories are emotions or opinions expressed in the text [2].Sentiment analysis is a powerful tool used in various applications such as customer feedback analysis, political polling, and social media monitoring. Techniques used for sentiment analysis include machine learning algorithms, and deep learning models. These techniques help to categorize and analyze text data based data and allow businesses and organizations to make informed decisions.Sentiment analysis of student feedback using machine learning can provide valuable insights into the perspectives and opinions of students. Natural language processing techniques can automatically classify student feedback and can also identify specific topics and themes that are driving the sentiment. It can help the institutions to make informed decisions about course design, teaching methods, and student support services, leading to improved learning outcomes and student satisfaction hence, the natural language processing is very essential for analyzing and extracting insights from student feedback data[4].Section 2, related works are presented. In section 3, Methods are explained. Section 4, describes experimental results and discussion.

II. RELATED WORKS

The sentiment analysis is often known as opinion mining and extracts the human intents from evaluations. Shaik *et al*. have stated that opinion mining is used in educational industry to analyze the student comments and pedagogically improve the learning and teaching practices. The development of sentiment analysis technologies and processing of student comments to identify their ideas and insights from educational institutions [5]. Pooja

and Bhalla [6] have stated that the role sentiment analysis in quality education to using the SVM model which is helps to identifying and supporting low-performing students in educational institutions. Tarnowska and Ras [7] have analyzed the customers worth to a business is determined not just by their financial impact but also by how satisfied they are. Dissatisfied clients spread negative word-of-mouth whereas happy ones spread positive. Johar and Mubeen[8] have reviewed that the sentiment analysis on large scale dataset such as Amazon product reviews to get the positive and negative comments from the users.Liu [9] has stated that the branch of study known as sentiment analysis and opinion mining examines how people's opinions, sentiments, assessments, attitudes, and emotions are expressed in written language. Singh *et al.* [10] have proposed a method is optimization of sentiment analysis using machine learning classifiers. They have analyzed the four classification methods effectiveness are investigated and contrasted. While OneR appears more promising in producing the accuracy of 91.3% in precision, 97% in F-measure, and 92.34% in correctly classified instances, Naive Bayes was discovered to be fairly quick at learning. Jagdale *et al.*[11] have analyzed sentiment on product reviews using machine learning techniques.They have analyzed and extracted the information from text data from numerous sources, including Facebook, Twitter and Amazon data set. The study showed that the data collected from Amazon includes online product reviews for cameras, laptops, mobile phones and tablets. Hemalatha *et al.* [12] proposed the sentiment analysis on product reviews and results showed that the high accuracy provided classifying sentiment on Naive Bayes and maximum entropy classification method. Baid et al. [13] have proposed a sentiment analysis of movie reviews using machine learning techniques using Naïve Bayes, K-Nearest Neighbour and Random Forest and they have obtained the results on Naïve Bayes classifier as 81.45% accuracy, Random Forest classifier as 78.65% accuracy and K-Nearest Neighbour classifier as 55.30% accuracy. One of the most popular NLP applications is sentiment analysis, often known as opinion mining, which extracts human intents from evaluations. Opinion mining is done in the educational industry to analyze the student comments and pedagogically improve learning and teaching practices. The development of sentiment analysis technologies and the processing of student comments to glean their ideas and insights have received significant investment from educational institutions and reviewed applications based on student feedback sentiment analysis.Hence from the related works, an effective method is needed for the student satisfaction survey and to classify student feedback.

III. METHODOLOGY

The proposed method has three phases, namely, i. tokenization, ii. word vector matrix, and iii. Analysis of student feedback using Multinomial Naïve Bayes Classification.The flow of the proposed methodology is explained in the figure 1.

A. Procedure

Step 1: Read the raw dataset
Step 2: Break the text features into tokens
Step 3: Prepare the word vector matrix of preprocessed data
Step 4: Split the data as training and testing set
Step 5: Build the model using the Multinomial Naïve Bayes algorithm
Step 6: Identify the student sentiment on feedback information

B. Tokenization

In the first phase, tokenization is performed. Tokenization [14] refers to the process of breaking down text into smaller units called tokens. This can be done using various techniques, including word-level tokenization, character-level tokenization, and sub word-level tokenization. Tokenization is an important step in many natural language processing tasks, such as text classification, sentiment analysis, and machine translation.Word tokenization is the process of breaking down text into individual words or phrases, which can be useful for text classification, sentiment analysis, and language translation. It helps to split the input text into smaller units, enabling the model to understand and analyze the text more effectively.

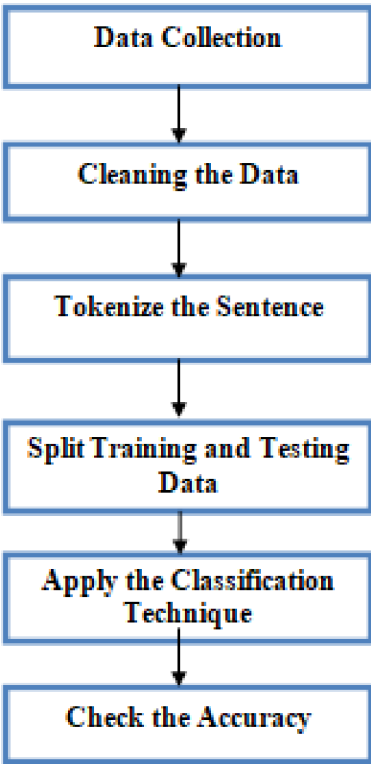


Figure1: Semantic Flow Diagram of Proposed Method

C. Word Vector Matrix

In the second phase, the tokenized data is converted into the word vector matrix. A word vector matrix [15] is used in natural language processing and machine learning tasks. It represents each word in a vocabulary as a dense vector in a high-dimensional space, capturing the semantic meaning of words and their relationships. This allows for efficient computations, such as word similarities, clustering, and classification, and can be used for various applications like text classification, sentiment analysis, and language modeling.In a word vector matrix, each row represents a word, and each column represents a document or a text sample.

D.Multinomial Naïve Bayes Classification

In the third phase, the word vectored matrix is used to build a classification model using Multinomial Naive Bayes (MNB) classification. MNB classification [16, 17] is a popular machine learning algorithm used for classification tasks when the feature set is large and the class distribution is imbalanced. It is based on Bayes' theorem and assumes that each feature is independent of the others, given the class label. MNB models are simplified versions of Bayes' theorem, making them computationally efficient and easy to implement. It's a simple and efficient method that assumes independence between features. MNB can also be extended to handle categorical data and missing values. It has many advantages, such as improved accuracy, robustness to noise and reduced complexity.

IV. RESULTS AND DISCUSSION

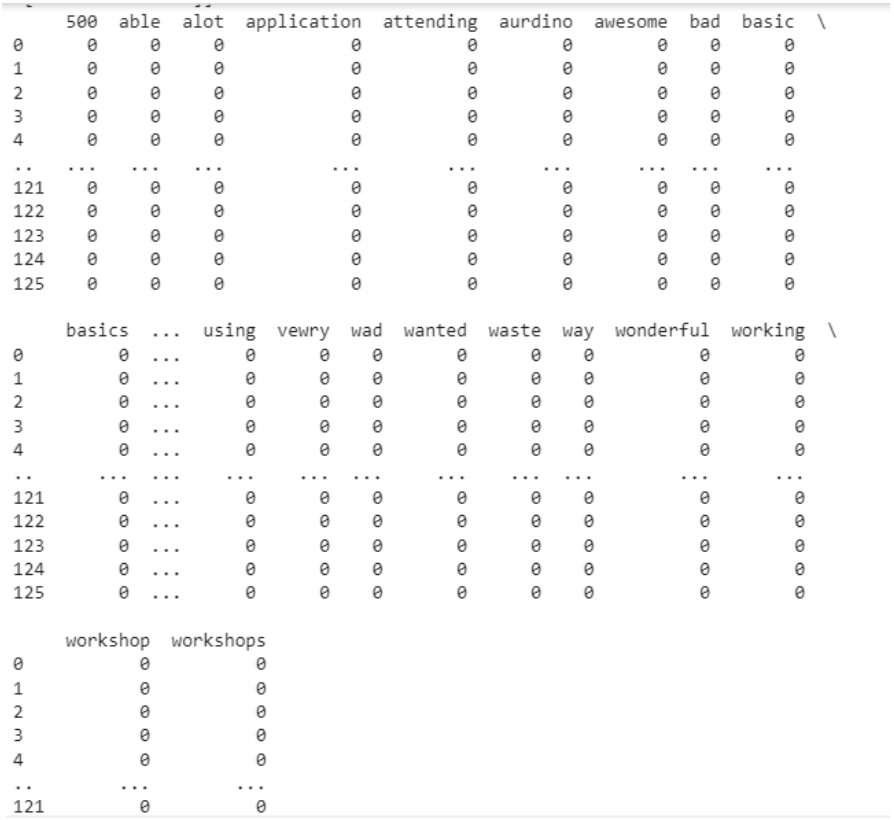
The experiment is carried out by using the nltk package in Python. In this work, the dataset is collected from feedback submitted by the student from the Ayya Nada Janaki Ammal College, Sivakasi. There are 125 students who submitted feedback on the workshop. The data consist of two columns, the first column represents the feedback collected from the student and the second column represents the class label such as positive or negative. Figure 2 represents the raw data which is submitted by the students.

Sentence	Sentiment
It was very interesting to learn	Positive
Usefull	Positive
Thank you so much for the workshop earlier today, so glad I was able to book .	Positive
Time is too short. in this two days only	Negative
Workshop was awesome	Positive
Very useful	Positive
I'm very useful in this session	Positive
Teacher's and students are very kindly	Positive
Very Useful	Positive
Very useful and good teaching Thank	Positive
Very useful	Positive
Workshop wad awesome	Positive
I found the workshop to be very informative. The workshop provided you	Positive
Way of teaching is excellent and I learn	Positive
It is vewry useful for me	Positive

Figure 2: Raw Data Collected From the Student Feedback

```
(0, 44)       1
(1, 44)       1
(2, 99)       1
(3, 62)       1
(3, 129)      1
(3, 78)       1
(3, 79)       1
(4, 117)      1
(5, 115)      1
(5, 153)      1
(5, 71)       1
(6, 85)       1
(6, 2)        1
(7, 98)       1
(8, 58)       1
(9, 131)      1
(10, 117)     1
(10, 167)     1
(11, 117)     1
(11, 60)      1
(11, 146)     1
(11, 109)     1
(12, 30)      1
(12, 122)     1
(12, 72)      1
:     :
```

Figure 3: Text Count on Sentiment data



	500	able	alot	application	attending	aurdino	awesome	bad	basic	\
0	0	0	0	0	0	0	0	0	0	
1	0	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	0	
..	...	...	...	...	...	...	...	...	...	
121	0	0	0	0	0	0	0	0	0	
122	0	0	0	0	0	0	0	0	0	
123	0	0	0	0	0	0	0	0	0	
124	0	0	0	0	0	0	0	0	0	
125	0	0	0	0	0	0	0	0	0	

	basics	...	using	vewry	wad	wanted	waste	way	wonderful	working	\
0	0	...	0	0	0	0	0	0	0	0	
1	0	...	0	0	0	0	0	0	0	0	
2	0	...	0	0	0	0	0	0	0	0	
3	0	...	0	0	0	0	0	0	0	0	
4	0	...	0	0	0	0	0	0	0	0	
..	...	...	...	...	...	...	...	...	...	...	
121	0	...	0	0	0	0	0	0	0	0	
122	0	...	0	0	0	0	0	0	0	0	
123	0	...	0	0	0	0	0	0	0	0	
124	0	...	0	0	0	0	0	0	0	0	
125	0	...	0	0	0	0	0	0	0	0	

	workshop	workshops
0	0	0
1	0	0
2	0	0
3	0	0
4	0	0
..	...	...
121	0	0

Figure4: Word Vector Matrix

```
MNB = MultinomialNB()
MNB.fit(X_train, Y_train)

#Caluclating the accuracy score of the model
predicted = MNB.predict(X_test)
accuracy_score = metrics.accuracy_score(predicted, Y_test)
print("Accuracuy Score: ",metrics.accuracy_score(predicted, Y_test))
```

```
Accuracuy Score:  1.0
```

Figure 5: Accuracy of Proposed Method

First, the raw data are preprocessed by the converting tokens to identify keywords and phrases of the text. Then the tokenized text data is counted to create the word vector matrix. Figure 3 represents the text count of the preprocessed data. The process of creating a word vector matrix follows tokenization and converting each word into a vector representation using techniques such as bag-of-words. Figure 4 represents the word vector matrix. The resulting word vector matrix can be used for Multinomial Naïve Bayes classification. Multinomial Naïve Bayes classification algorithm combines the Naïve Bayes and multinomial models. In this step, each sentiment feature is assigned a prior probability to each class label. The algorithm can handle missing data and is known for its simplicity and computational efficiency. The result of sentiment analysis is typically positive or

negative. The figure 5 represents the accuracy of the algorithm. The proposed method provides 100 % accuracy on Multinomial Naïve Bayes classification.

V. CONCLUSION

In this work, it has been proposed a method to analyze the student feedback of text data is evaluated with various preprocessing namely, tokenization and word vector matrix and classified using the Multinomial Naïve Bayes algorithm.The student feedback data is collected from workshop conducted by from the Ayya Nadar Janaki Ammal College, sivakasi. The data can provide valuable insights into the effectiveness of the workshop and the level of satisfaction among participants. From this work, it has helped workshop organizers identify areas of improvement and make necessary changes to enhance the overall learning experience. Proposed method is used to analyze the feedback and organizers can gain a better understanding of what worked well and what didn't. This information can be used to improve future workshops for the student's benefits. This work can be used to improve the quality of organizing workshops and, the organizations can make decisions to enhance future programs.

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