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LEVERAGING HYBRID DATA TO ENHANCE STUDENT FEEDBACK SENTIMENT CLASSIFICATION

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Abstract—*Student Sentiment Analysis with their Feedback data: This research article offers a thorough examination of student sentiment analysis utilizing feedback data gathered from students within our college. The study endeavors to explore the sentiments, opinions, and perceptions conveyed by students through their feedback, furnishing valuable insights into the student experience and satisfaction levels within the educational journey. The research methodology encompasses the collection of feedback data from students via surveys administered across diverse departments within our college. The amassed feedback covers a broad spectrum of facets, including the quality of teaching, course content, availability of learning resources, adequacy of campus facilities, and the effectiveness of overall student support services. Through this comprehensive approach, the research endeavors to uncover insights that can inform strategies for enhancing the educational experience and fostering a more conducive learning environment for students within our institution*

Keywords - Sentiment Intensity Analyze, Sentiment Analysis, Feedback Analysis, Real-time data analysis

INTRODUCTION

In the ever-evolving landscape of education, feedback stands as a cornerstone for enriching the learning experience. It not only mirrors students' perceptions of educational practices but also offers profound insights into their sentiments and attitudes within the academic sphere. Understanding these sentiments is imperative for educators and institutions striving to tailor learning environments to meet the diverse needs of students. This research embarks on a comprehensive analysis of student feedback, aiming to uncover nuanced insights that inform strategies for enhancing the educational experience. Through the utilization of qualitative and quantitative analysis techniques, the research seeks to derive meaningful insights from the feedback collected from students across various departments within our college. By analyzing both qualitative responses and descriptive data, this research endeavors to gain a holistic understanding of student sentiments and perceptions.

The analysis process is complemented by visualization techniques, which aid in effectively presenting the derived insights to college management.

II. LITERATURE REVIEW

Analysing the sentiment is performed in many fields such as Entertainment, Education, Business, e-learning, etc. for the improvement in the particular domain. For Analysing Student Sentiment the course evaluation model is utilized, which includes employing classification techniques like Naive Bayes, k-nearest, and Support Vector Machine[1]. Analyser's has gained traction, particularly in evaluating teaching performance through students feedback comments. Various studies have explored sentiment analysis in education, focusing on both quantitative and qualitative data[2]. The frequent features and opinion words extraction from students' feedback datasets using pattern mining algorithms such as Apriori and Generalized Sequential Patterns is proposed to analyse the students Sentiment . Automated sentiment analysis from teacher feedback assessments using Hidden Markov's Model and Support Vector Machine is performed[3]. The online education teacher evaluation model based on opinion mining, collecting students' comments from learning management systems[4] and proposed a sentiment analysis approach for e-learning environments, combining lexicon-based techniques and machine learning[5]. Additionally, The teaching evaluation sentiment lexicon for automated sentiment polarity is contructed to analyse the polarity of the Quantitative responses[6]. These studies underscored the importance of sentiment analysis in education, emphasizing the need for effective evaluation models considering both quantitative and qualitative data sources.

III. WORKFLOW MODEL

In the workflow model the detailed description of Fig.:1 is mentioned.

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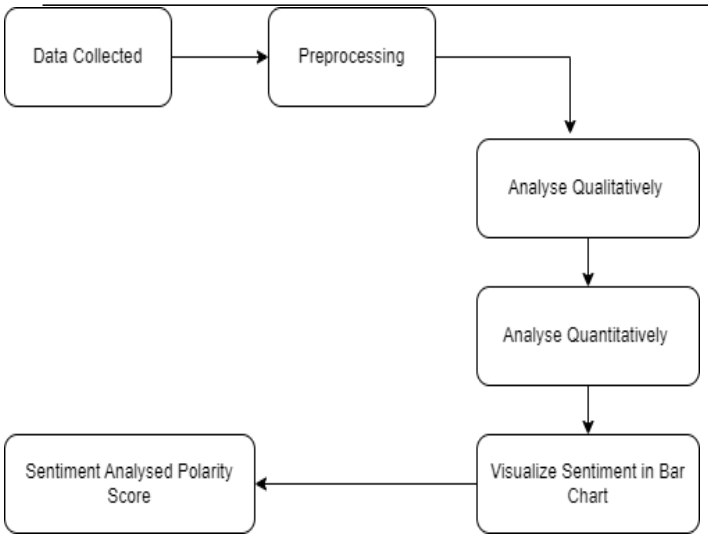

Fig.:1 Work Flow model

A. Collecting Feedback from Students

This initial step involves gathering feedback from students across various departments within our college. Feedback may be collected through survey method. The feedback obtained comprised of quantitative responses as well as descriptive data. Totally 1406 student's responses received. There are about 14 questions are objective type and considered as quantitative metric attributes and about 6 questions are descriptive type considered as qualitative data. Sample questions are as follows:

Quantitative type:
1. Synchronization of Theory and Practical
2. Availability of Textbooks / Study materials
3. Coverage of Modern / Advanced Topics
4. Do the subjects satisfy ones need?
Etc.

Qualitative type:
14. Whether the Curriculum is helpful in making you as an entrepreneur?
15. New subjects to be added to the proposed curriculum
16. Subjects to be removed from the present curriculum.
Etc.

B. Pre-processing

Before analysis, the collected feedback undergoes pre-processing to ensure data cleanliness and consistency. Pre-processing tasks may include removing irrelevant information, handling missing values, standardizing text formats, and correcting any inconsistencies in the data. Out of 1406 responses, 11 rows of missing values records removed during the preprocessing.

C. Mapping and Analyzing Quantitative Data:

Once pre-processed, qualitative data from the feedback, example responses like "Excellent," "Very Good," "Good," and "Satisfactory," are mapped to numerical values. These numerical values allow for quantitative analysis of qualitative feedback. Analysis of qualitative data involves exploring patterns, trends, and sentiments expressed by students in their feedback.

D. Analyzing Qualitative Data:

Simultaneously, the descriptive data collected from the feedback undergoes quantitative analysis. Machine learning algorithms, such as Sentiment Intensity Analyser, are applied to recognize sentiments conveyed in the descriptive feedback. These algorithms enable the classification of feedback into distinct sentiment categories, including Positive, Negative, and Neutral.

E. Visualizing the Data

Following the analysis of both qualitative and quantitative data, visualization techniques are employed to present the findings effectively. Visualizations may include various types of plots and charts generated using tools such as Matplotlib and Seaborn. Visual representations aid in conveying insights derived from the data, allowing for easier interpretation and comprehension by stakeholders.

IV.IMPLEMENTATION AND RESULT

IMPLEMENTATION PROCESS

The implementation process of the research is explained in the Fig.:2. It includes the step-by-step process of this article.

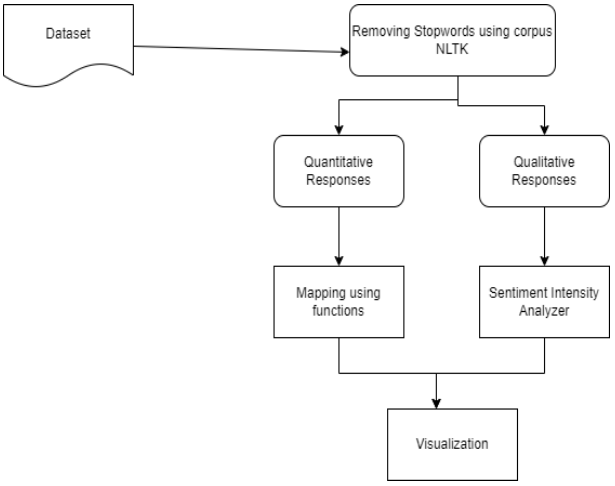

Fig.2 Implementation Process

At first let us see the qualitative implementation of this article and visualizing it.

i. *QUANTITATIVE PROCESS A. MAPPING AND VISUALIZING*

Feedback data consists of qualitative responses that need to be converted into quantitative values for analysis. This process, known as mapping, involves assigning numeric values to qualitative feedback categories to facilitate further analysis, in our sentiment analysis process. In the context of our research focused on sentiment analysis in the all the Departments of our college, the mapping module plays a crucial role in converting subjective feedback responses into numerical representations.

The mapping module aims to transform feedback responses, which may include subjective assessments such as into numeric values that can be easily processed and analysed. In the total of 16 questions in our Dataset we have 3 categories of Qualitative Responses as Follows,

The first category is from Question 1 to Question 8, there are 4 possibilities in it.

And the result of this category is displayed in the Fig.:3

Fig.:3 Quantitative type-1

Then the second category is from contains Question 9 to Question 13, then there are two possibilities.

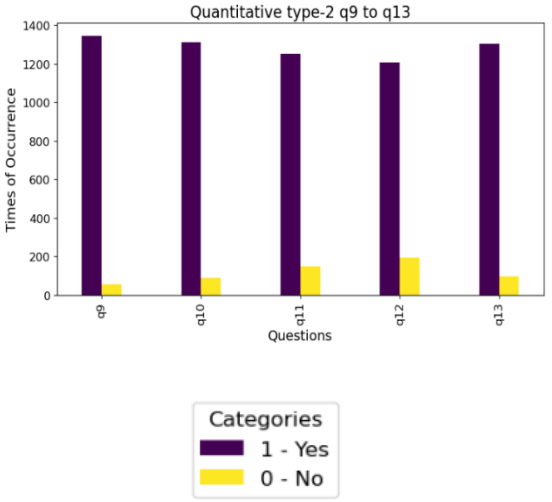

Fig.:4 Quantitative type-2

The result of second category is presented in Fig.:4 which contains Boolean value.

Then the last category contains only one Question that is Question 14, it contains five possibilities.

The result is presented in the Fig.:5

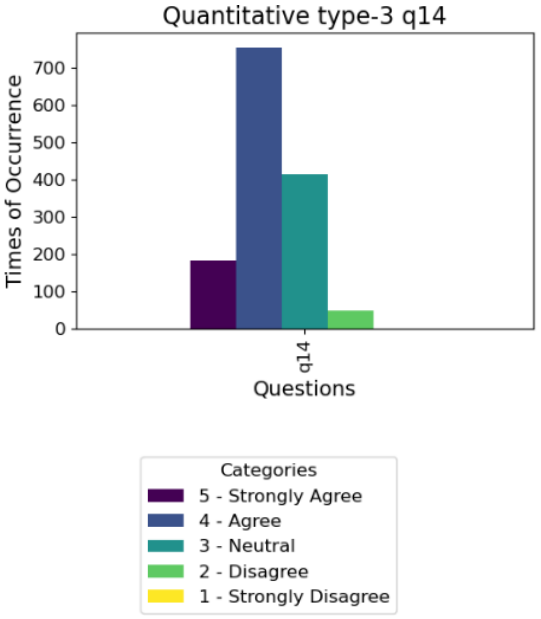

Fig.:5 Quantitative type-3

QUALITATIVE PROCESS

To analyse the descriptive data Sentiment Intensity Analyser is used. The detailed description of Sentiment intensity analyser is as follows,

A. SIA INTRODUCTION

1) The sentiment intensity analyzer is a crucial component of the student sentiment analysis project, designed to

quantify the sentiment expressed in feedback data collected from students across various departments within the college.

This detailed description provides an overview of the sentiment intensity analyzer and its role in analyzing sentiment polarity with varying degrees of intensity.

B. PURPOSE

The purpose of the sentiment intensity analyzer is to assess the sentiment polarity of textual feedback data, ranging from highly positive to highly negative, with varying degrees of intensity.

By assigning intensity scores to sentiment categories, the analyzer provides a nuanced understanding of sentiment expressed in student feedback, allowing stakeholders to identify subtle shifts in sentiment and prioritize areas for improvement accordingly.

C. FUNCTIONALITIES

The sentiment intensity analyzer utilizes pre- trained models or lexicons to evaluate the sentiment polarity of text data. These models typically assign intensity scores to sentiment categories, enabling the analyzer to differentiate between weak and strong expressions of sentiment.

Common sentiment categories analyzed by the intensity analyzer include positive, negative, and neutral sentiments, each associated with intensity scores that reflect the degree of positivity or negativity expressed in the text.

Text preprocessing techniques such as tokenization, stemming, and removal of stop words is applied to prepare the text data for sentiment analysis, ensuring accurate assessment of sentiment intensity.

The sentiment intensity analyzer employs sophisticated algorithms to calculate intensity scores based on the presence of sentiment-bearing words, phrases, and linguistic patterns in the text data.

Intensity scores are often normalized to a consistent scale, such as a range from -1 to 1, facilitating comparative analysis and interpretation of sentiment intensity across different feedback responses.

The analyzer incorporates domain-specific dictionaries to enhance the accuracy of sentiment analysis, accounting for context-specific nuances and terminology prevalent in student feedback.

D.SIA IMPLEMENTATION

1) In the student sentiment analysis project, the sentiment intensity analyzer is implemented using Python library VADER (Valence Aware Dictionary and Sentiment Reasoner), which provide pre- trained models for sentiment analysis with intensity scoring capabilities.

TextBlob's sentiment analyzer, for example, assigns polarity scores ranging from -1 (negative) to 1 (positive), allowing for the assessment of sentiment intensity based on the magnitude of the polarity score.

VADER, on the other hand, employs a lexicon- based approach to sentiment analysis, assigning intensity scores to sentiment categories while considering context-specific valence shifts and emotive nuances in text data.

E. OUTPUT

The output of the sentiment intensity analyzer includes sentiment polarity scores with associated intensity values, providing stakeholders with insights into the sentiment expressed in student feedback.

Intensity scores enable stakeholders to identify the strength of sentiment expressed in feedback responses, distinguishing between subtle nuances and strong expressions of positivity or negativity.

A visualization technique, bar charts is used to present sentiment intensity scores, allowing stakeholders to visually interpret sentiment trends and patterns in the feedback data.

Here are the visualization of the Question 15 to Question 19 which has 3 classification namely Positive (1), Negative (-1) and Neutral (0), is displayed in the Fig.6, Fig.:7, Fig.:8, Fig.:9, Fig.10, Fig11 respectively.

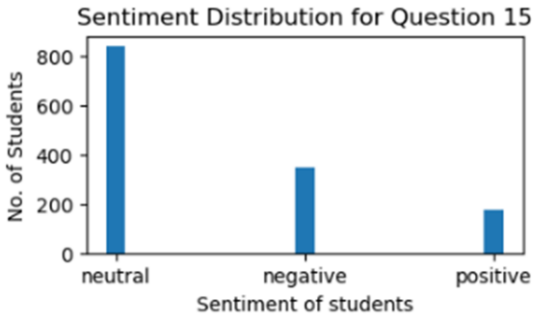

Fig.6 Quantitative Q15

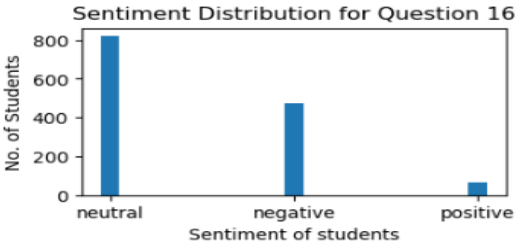

Fig.7 Quantitative Q16

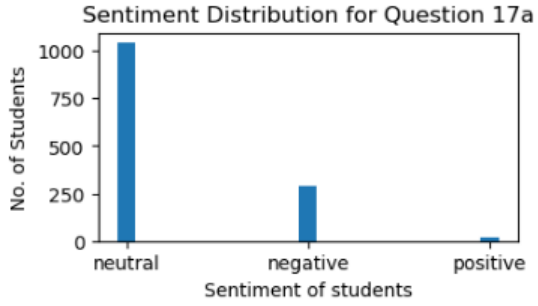

Fig.8: Quantitative Q17a

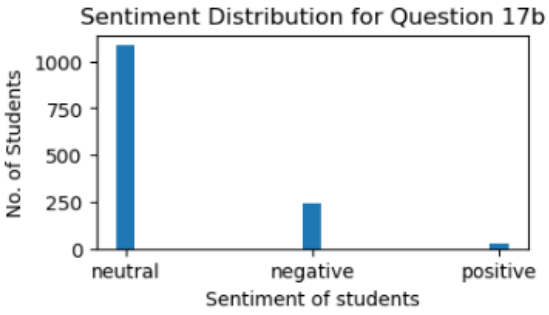

Fig.9 Quantitative Q17b

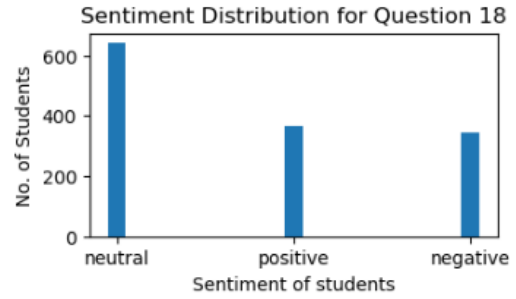

Fig.6 Quantitative Q18

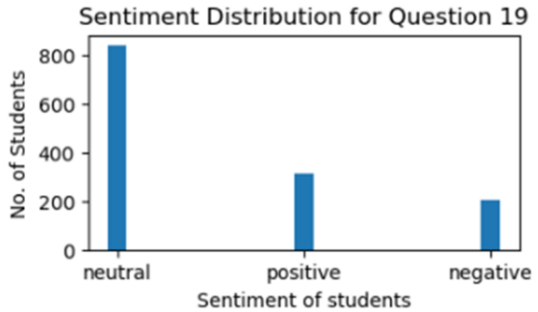

Fig.6 Quantitative 19

F. BENEFITS

By incorporating sentiment intensity analysis into the student sentiment analysis project, stakeholders gain a deeper understanding of the nuanced sentiment expressed in feedback data, enabling informed decision-making and targeted interventions to address areas of concern or capitalize on strengths.

The granularity provided by intensity scores allows stakeholders to prioritize actionable insights and allocate resources effectively to improve student satisfaction, enhance departmental performance, and foster a positive learning environment within the college.

V. CONCLUSION

The incorporation of sentiment intensity analysis in the student sentiment analysis project yields invaluable insights into the nuanced sentiments expressed in feedback data, facilitating informed decision-making and targeted interventions to enhance the educational experience. By quantifying sentiment polarity with varying degrees of intensity, stakeholders can prioritize actionable insights and allocate resources effectively to address areas of concern and capitalize on strengths.

The sentiment intensity analyzer provides stakeholders with a comprehensive understanding of sentiment trends and patterns, enabling them to identify subtle shifts in sentiment and prioritize interventions accordingly. Visualization techniques such as bar charts, further aid in the interpretation of sentiment intensity scores, allowing for easy visualization of sentiment trends across different feedback responses.

Overall, the granularity provided by sentiment intensity analysis empowers stakeholders to foster a positive learning environment, improve student satisfaction, and enhance departmental performance within the college. Through targeted interventions informed by sentiment analysis, institutions can adapt and evolve to meet the evolving needs and expectations of students, ultimately enriching the educational journey for all stakeholders involved.

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