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AI-POWERED STUDENT FEEDBACK: LEVERAGING NLP FOR PROFESSOR EVALUATION

Kanishka Mahadev Shelke[*1], Rutuja Mohan Rupanavar[*2], Shraddha Rajendra Lokhande[*3], Vaishnavi Umesh Humane[*4], Prof. A.A. Bandgar[*5]

[*1,2,3,4,5]Department of Artificial Intelligence and Machine Learning Engineering, Rajarambapu Institute of Technology (Polytechnic), Pune, Maharashtra, India.

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ABSTRACT

Educational assessment effectiveness depends on student-generated data that produces value by enhancing classroom quality. Feedback procedures based on manual assessments yield weak performance while taking up an excessive amount of time and showing subjective tendencies because various educators agree about the lengthy and subjective process. The AI-driven student feedback system utilizes Natural Language Processing (NLP) to carry out automated qualitative evaluations of feedback exactly as the research study proposes. Transformed student feedback undergoes sentimental analysis that supports topic modeling and keyword extraction to generate guidance for professors creating support plans. The feedback analysis system functions using Python to integrate NLTK and SpaCy and Transformers together with machine learning models and Python components to evaluate feedback emotions and extract main topics with required adjustments. The automated platform provides better perception of collected insights and conducts automated tasks to deliver unbiased feedback outcomes. The system supports educational institutions to create better decisions regarding instructional approaches that deliver improved student satisfaction results. Using NLP-based AI techniques creates an opportunity for academic feedback systems to build efficient objective systems to improve insight quality. Student feedback evaluations for teaching quality assessment stand as vital assessment methods which enhance academic results within educational institutions that provide higher education. Student feedback collection through traditional methods shows both substantial inefficiencies and human judgment elements before requiring substantial human labor. The research proposal introduces a technology infrastructure that uses NLP to automate student assessment of professor performance for improved evaluation processes. Python programming software together with NLTK and SpaCy and Transformational models from advanced NLP frameworks enable the system to evaluate feedback contents by locating both positive and negative performance elements which generate practical solutions.

Keywords: Natural Language Processing (NLP), Sentiment Analysis, Student Feedback System, Professor Evaluation, AI in Education, Text Classification, Topic Modeling, Machine Learning, Educational Data Mining, Automated Feedback Analysis.

I. INTRODUCTION

The fundamental feedback system within educational institutions provides teachers data through essential components linking them to their teaching approaches and format choices and student opinion feedback. Student evaluations provide professors essential tools to improve their educational approaches by resolving problems and improving education quality within their classrooms. Feedback collection performed by humans takes time to complete and remains subjective because humans naturally have biases. NLP tools under AI provide an effective method for analyzing student survey feedback due to the significant expansion of survey data. The vital capabilities realized through NLP techniques consist of student opinion classification together with sentiment extraction. Structured feedback analysis yields actionable instructional guidance by integrating machine learning with sentiment analysis while detecting topics through NLP systems. An AI student feedback system uses NLP capabilities to conduct student review assessment while providing evidence-based support to professors. Students achieve successful results when automatic assessments run in the system that delivers unbiased results that eliminate the need for human intervention. The educational benefits of PI technology consist of three major features which enhance feedback assessment quality and lead to enhanced student involvement together with better institutional choice options. The AI software with NLP technology enables effective methods for obtaining student developmental stage feedback. Educational institutions receive

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accurate data through the technology as they do not need manual workers for improved feedback distribution. Educational institutions have developed a test assessment system that performs objective evaluations and gives teachers the ability to track student results for enhancing academic performance. AI-created feedback technology systems create beneficial impacts on educational quality alongside student participation when institutions make decisions about their organizational structure. alen researchers built an AI system which process student qualitative feedback with efficiency through NLP. Teachers benefit from both sentiment analysis automation and topic detection algorithms which allows them to obtain structured educational content while reducing their workload and enhancing their outcome accuracy. Artificial intelligence systems advance education quality when used to install automated assessment methods into feedback management systems.

II. LITERATURE SURVEY

Higher education institutions must focus on creating effective feedback systems because their impact directly influences student learning performance in modern times [1]. Feedback systems of the past effectively deliver value but they are not equipped to handle diverse feedback needs that exist within large student populations. The study shows learner-centered feedback provides an optimal technique for specific teaching which produces enhanced student participation and enduring academic transformation (Hattie & Timperley, 2007).

The four fundamental core components of AI-Enabled Assessment include grading automation as well as oral presentations, peer reviews and creative project assessments together with gamification (Wang et al., 2020) [2]. Numerical algorithms in machine learning together with natural language processing models built into AI platforms conduct assignment evaluations for grading purposes and assess presentation skills and project creative abilities (Hernández & García-Peñalvo, 2019). The union of technologies produces tailored assessment information that helps students fulfill their engagement needs and motivation requirements (VanLehn, 2011).

Research shows that educational institutions employ sentiment analysis for student feedback processing to gain insight into sentiments because this leads to better educational results [3]. Student feedback analysis remains complex because educational institutions have to handle informal verbalization and emotional substance among massive amounts of data. Educational organizations use Natural Language Processing together with Deep Learning and Machine Learning technologies to advance the accuracy and operational speed of sentiment analysis applications in educational environments.

The evaluation of student feedback using sentiment analysis functions as an essential assessment instrument for educational institutions to acquire student views for better educational quality enhancement [4]. Student qualitative feedback requires difficult analysis because of its sizeable volume and various feedback styles and non-formatted data structure. Natural Language Processing (NLP) techniques enable automatic feedback processing from students that delivers important information which improves academic practice quality while also enhancing student participation.

III. PROPOSED SYSTEM

Artificial Intelligence employs the student feedback analysis model that relies on Natural Language Processing to evaluate teaching performance by processing evaluation texts. The model conducts multiple stages by collecting survey information as well as feedback from university internet sites and forms to generate end results. Textual feedback data undergoes preprocessing where the process combines tokenization with stopword removal to achieve higher quality through applying stemming and lemmatization methods. The preprocessing phase exists before evaluation through combination of Naïve Bayes and Support Vector Machines (SVM) alongside BERT and LSTM deep learning models to detect sentiment patterns. The system obtains important student response themes such as teaching quality and course level difficulty through sentiment analysis in combination with LDA and BERTopic subject modeling algorithms. The Aspect-Based Sentiment Analysis (ABSA) system provides correct feedback evaluation by analyzing sentiment patterns exclusively within explanation clarity and query response and educational teaching methods elements. The sentiment trend information becomes accessible to users through a display tool that demonstrates research data visually.

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IV. SYSTEM OVERVIEW

The Natural Language Processing technology enables unbiased feedback analysis which utilizes artificial intelligence to evaluate professor teaching effectiveness. Operations in the system complete one step after another to gather student feedback before executing analytical methods and visual outputs. The system platform includes specific processes for handling and analyzing extensive textual data content to implement sentiment analysis alongside topic classifying operations.

1. System Architecture

The NLP approaches integrate with machine learning algorithms through separate operational sections to build up a comprehensive system framework. The key components include:

Data Collection Layer: Gathers student feedback from online surveys, university portals, and course evaluation forms.

The text cleaning procedure begins its processing phase through the union of tokenization methods with stemming and lemmatization to achieve stopword elimination.

Sentiment Analysis Module: Classifies feedback into positive, negative, or neutral using machine learning and deep learning models like BERT, LSTM, and Naïve Bayes.

User feedback evaluation about teaching approach and curriculum quality and student engagement is analyzed through an integrated solution of LDA alongside BERTopic detection of recurring topics.

System appraisal occurs through the ABSA Module by combining assessments of grading integrity with internally perceived emotional reactions to different factors of engagement.

Through the Visualization and Reporting Module of the system users have access to interactive graphs for making decisions using analyzed feedback data.

2. System Workflow

The systematic sequence of the system workflow begins with Step 1 through Step 4:

1. The system collects feedback through combinations of surveys with online forms plus educational platforms.

2. Text preprocessing removes unwanted elements through NLP methods to enhance the analysis quality of unprocessed text.

3. Machine learning algorithms known as deep learning models examine feedback to identify either positive or negative or neutral sentiments.

4. BERTopic or LDA tool detects commonly discussed points in feedback through the Topic Extraction process.

5. The sentiment analysis of distinct teaching feedback elements focuses on particular aspects (whether it is teaching clarity or interaction level).

6. Educational professionals receive specific implementation recommendations through visualized data displays and statistical reports in the Data Visualization & Reporting stage.

3. Key Components of the System

Natural Language Processing (NLP) Engine: Handles text processing, sentiment classification, and topic modeling.

The platform makes use of multiple Machine Learning models which integrate Naïve Bayes and SVM classifiers together with deep learning models BERT and LSTM for highly precise sentiment analysis.

The platform has database functions which enable the storage of both feedback documents and information processing results that serve for future analytic assessments.

The program presents data visualization interactively using Matplotlib and Seaborn and combines those tools with Power BI and Tableau or allows substitution with different data visualization tools.

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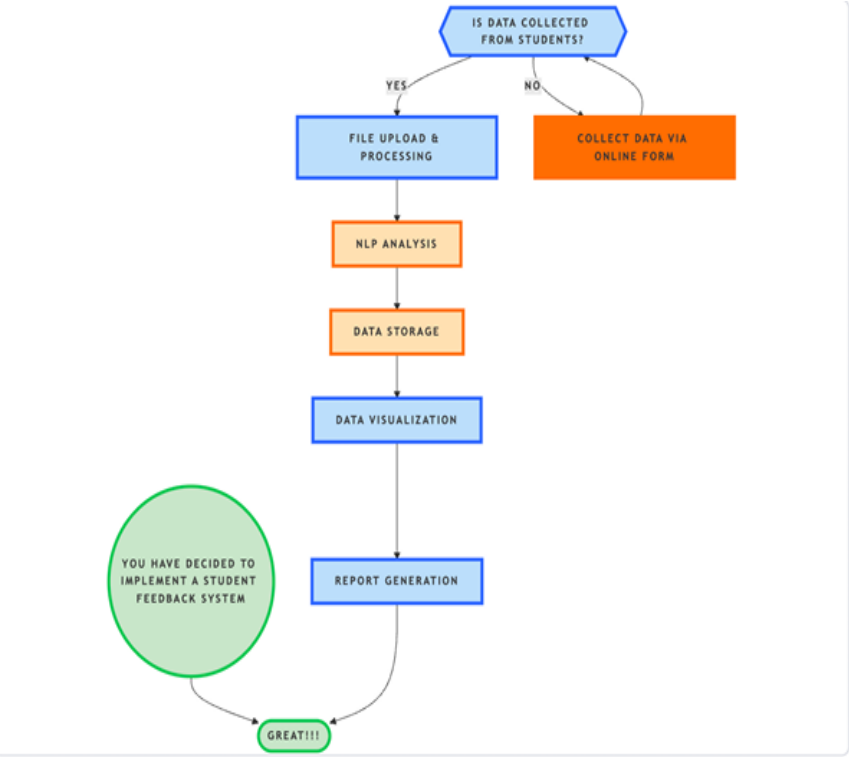

Fig: System Architecture

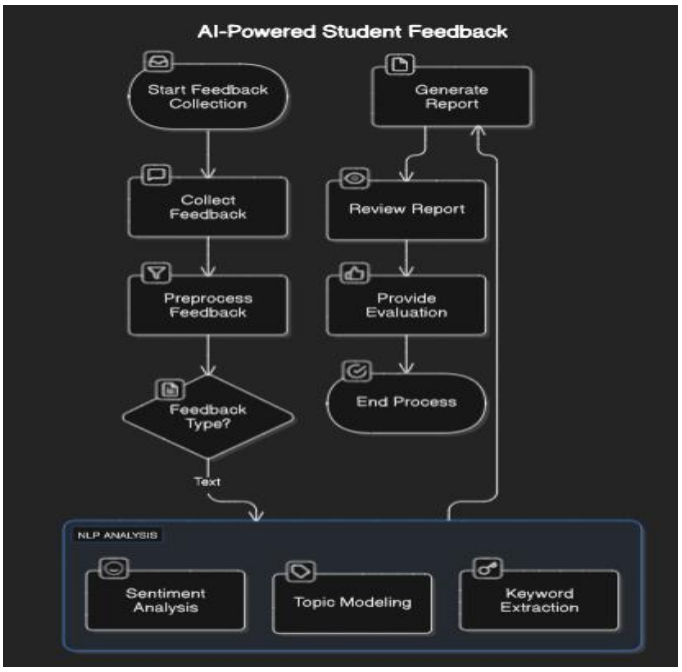

Fig: Use Case Diagram

Technology Details

1. Programming Language & Frameworks

Python functions as the chief development language because it provides robust NLP capabilities together with machine learning libraries.

The web interface development process utilizes Flask along with Django to receive student feedback.

2. NLP Libraries & Models

The system leverages the following NLP libraries for text processing, sentiment analysis, and topic modeling:

Text Preprocessing

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NLTK functions as a programming toolkit that provides programming tools for tokenization as well as stopword filtering and part of speech normalization through lemmatization process.

SpaCy succeeds in performing tokenization and both Named Entity Recognition (NER) and POS tagging functions.

TextBlob: Used for basic sentiment analysis and text correction.

Natural Language Processing (NLP) Engine: Handles text processing, sentiment classification, and topic modeling.

The system uses different Machine Learning Models including Naïve Bayes and SVM classifiers with deep learning models BERT and LSTM to achieve accurate sentiment analysis.

The system maintains a database that contains feedback documentation with processed outputs from information processes available for use in future analytical needs.

The program delivers interactive data visualization features through Matplotlib and Seaborn for presenting results that also enable display within Power BI and Tableau databases as well as different data representation systems.

B. Sentiment Analysis Models

The fundamental but reliable text-based sentiment classifier among Naïve Bayes models is MultinomialNB.

The performance of Support Vector Machine surpasses all other methods used for sentiment classification.

Deep Learning Models:

The Long Short-Term Memory (LSTM) functions as a recurrent neural network (RNN) design to handle contextual sentiment processing.

The transformer system BERT functions as a state-of-the-art model for sentiment analysis and Aspect-Based Sentiment Analysis (ABSA) at contemporary levels.

The VADER model represents a rule-based system able to maximize sentiment analysis effectiveness in short textual content.

3. Machine Learning & Deep Learning Frameworks

Users can access Naïve Bayes, SVM and Decision Trees through the text classification models available in Scikit-learn framework.

TensorFlow/Keras: Used for deep learning models like LSTM and BERT for sentiment analysis.

Hugging Face Transformers provides ready-to-use BERT, RoBERTa and DistilBERT Transformers for performing full NLP operations.

V. RESULT

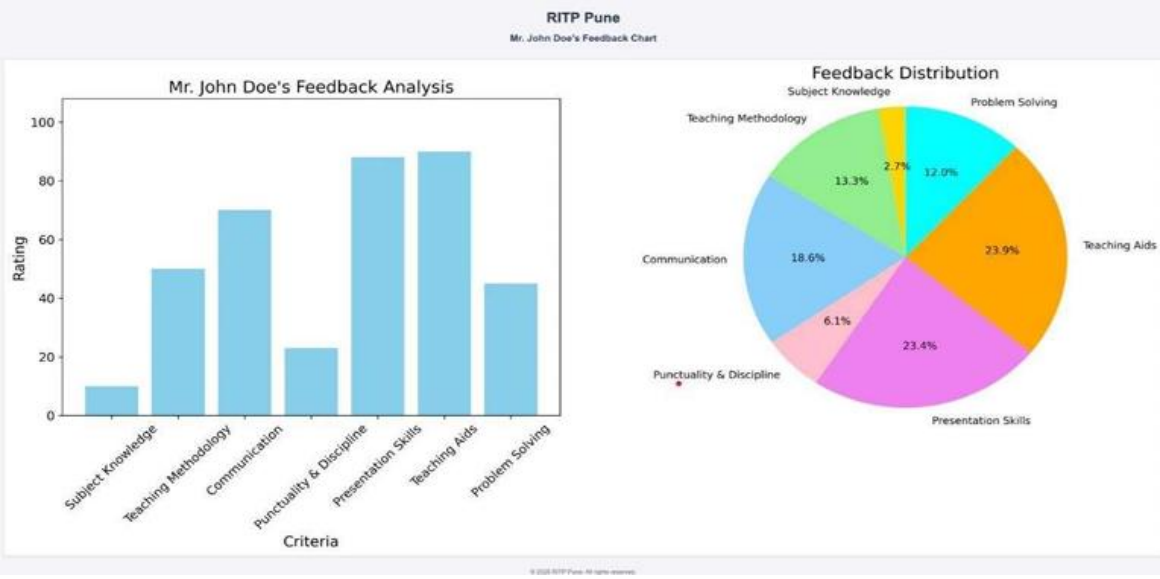

Fig: Screenshot

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Advantages

1. The automatic feedback analysis capability built into the system allows it to process every feedback assessment which reduces the workload for university staff members including both instructors and administrators.
2. High precision in sentiment detection occurs because BERT and LSTM work together for producing dependable analytical outputs.
3. LDA (Latent Dirichlet Allocation) operating with BERTopic classifies about half of student feedback data into essential topics which supports instructors to provide specific performance strength and development area feedback to students.
4. ABSA method incorporated into the system helps professors perform specific teaching assessment involving clarity alongside engagement and grading fairness by awarding feedback focused on individual aspects.
5. The system demonstrates advanced capability in handling extensive student feedback databases which enables its application for universities with large student enrollment.

VI. FUTURE SCOPE

AI systems merged with NLP technology will drive substantial academic innovation which will improve student professor feedback capabilities in the next years. New NLP technology developments will enhance student feedback understanding by improving educational evaluations that monitor teaching methods and social interactions. Students obtain automatic advisor recommendations through immediate assessment from AI systems that enhance faculty development. The refined system will use individualized educational information to identify teaching competence and monitor student satisfaction patterns through extended observation periods. More institutions choose to use AI as ongoing educational enhancement technology because they implement digital transformation strategies.

VII. CONCLUSION

NLP technology enables Maritime student feedback systems to improve their educational quality evaluation processes through better technology. Natural Language Processing applications lead to successful information extraction of educational and teaching performance data from student feedback structures. The data transfers instantly to reveal teaching weaknesses to faculty members. Each lesson receives individualized feedback generated by real-time predictive feedback systems that operate through the educational monitoring platforms. The establishment of AI-powered feedback systems requires superior sentiment analysis combined with predictive analytics as well as multi-lingual processing to react to user predictions in developing responsive teaching environments. The advancement of educational results occurs because technological progress enables new creative teaching practices in current learning space designs.

VIII. REFERENCE

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