**Course Review using Sentiment Analysis System**

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**Abstract**

This technical paper presents the design and implementation of a Sentiment Analysis System for processing and analysing student feedback in an educational setting. The system utilizes natural language processing (NLP) techniques to classify feedback into positive, neutral, and negative categories. The goal is to provide educators and administrators with real-time insights into student sentiments, allowing for timely adjustments to course content and teaching methods. Additionally, the system includes features for exporting feedback data as an Excel file and ensures that only authorized users can access sensitive data. This paper outlines the system’s architecture, implementation details, challenges faced, and future improvements.

**1. Introduction**

In modern education, understanding student feedback is essential for improving teaching effectiveness and student satisfaction. Traditional methods of collecting and analysing feedback, such as manual surveys and review forms, can be time-consuming and prone to bias. This paper introduces an automated Sentiment Analysis System designed to analyse large volumes of student feedback efficiently. By leveraging machine learning and natural language processing techniques, the system categorizes feedback into three distinct sentiments: positive, neutral, and negative. The resulting sentiment analysis can guide educators in refining course content, enhancing the learning experience, and addressing areas of concern.

**2. System Architecture**

The architecture of the Sentiment Analysis System consists of several key components:

1. **Frontend Interface:**
   * A user-friendly web-based interface that allows students to submit feedback.
   * Features for submitting feedback, analysing sentiment, and exporting results in Excel format.
   * A responsive design that works across various devices.
2. **Backend Processing:**
   * The backend is responsible for handling user authentication, feedback submission, and sentiment analysis.
   * Sentiment analysis is performed using a machine learning model trained to categorize text into positive, neutral, and negative categories.
   * Data is stored in a relational database for easy retrieval and analysis.
3. **Machine Learning Model:**
   * The sentiment analysis is powered by a pre-trained NLP model that uses supervised learning algorithms to classify text.
   * The model is fine-tuned using a labelled dataset of student feedback, ensuring high accuracy in sentiment classification.
4. **Database:**
   * The system uses a relational database to store student feedback, including metadata such as submission time and course details.
   * A secure database is employed to ensure the privacy and confidentiality of the feedback data.

**3. Implementation**

The Sentiment Analysis System was implemented using the following technologies:

* **Frontend:**
  + HTML, CSS, and JavaScript for designing the user interface.
  + Bootstrap was used for responsive design.
  + The web application is built using Flask, a Python web framework.
* **Backend:**
  + Python and Flask handle server-side logic and routing.
  + Sentiment analysis is performed using the **VADER (Valence Aware Dictionary and sEntiment Reasoner)** model, a lexicon and rule-based sentiment analysis tool for text processing.
* **Database:**
  + SQLite was used for development and testing, while PostgreSQL is recommended for production due to scalability and robustness.
  + The feedback data is stored in tables with fields such as feedback, text, sentiment, timestamp, and course\_ id.

**4. Features**

The Sentiment Analysis System includes several features to enhance user experience and functionality:

1. **Feedback Submission:**
   * Students can submit feedback for a specific course.
   * The system supports multiple feedback submissions per student.
2. **Sentiment Analysis:**
   * Once feedback is submitted, it is processed and categorized into positive, neutral, or negative sentiments.
   * Sentiment percentages are displayed in real-time to help educators understand overall student sentiment.
3. **Data Export:**
   * The system allows users (typically administrators) to export the feedback data and sentiment analysis results into an Excel file.
   * This feature enables easy sharing and further analysis of the feedback.
4. **Admin Features:**
   * Admins can view all feedback submissions, perform sentiment analysis, and export results.
   * Admin authentication ensures that only authorized users can access sensitive data.

**5. Challenges**

Several challenges were encountered during the development of the Sentiment Analysis System:

1. **Data Quality and Preprocessing:**
   * The effectiveness of the sentiment analysis model depends on the quality of the feedback data. Preprocessing tasks such as text cleaning, tokenization, and lemmatization were necessary to ensure accurate sentiment classification.
2. **Model Accuracy:**
   * Achieving high accuracy in sentiment classification required careful tuning of the sentiment analysis model. Using VADER, which is optimized for social media and short text, improved results, but further training with custom datasets could increase precision.
3. **Scalability:**
   * As the system is designed to handle large volumes of feedback, ensuring that it scales efficiently as the number of users and feedback submissions grows is crucial. Optimizing database queries and using a more robust database management system like PostgreSQL can help with this.
4. **User Authentication and Access Control:**
   * Implementing secure authentication features for administrators required extra attention to prevent unauthorized access and ensure that only the correct users could perform actions like exporting data or analysing sentiment.

**6. Conclusion**

The Sentiment Analysis System successfully automates the process of analysing student feedback, providing educators and administrators with valuable insights into student sentiments. By utilizing machine learning and natural language processing techniques, the system can classify feedback into sentiment categories, making it easier for educators to make data-driven decisions. While the system has proven to be effective, future improvements could focus on refining the sentiment analysis model and optimizing the system for larger datasets.

The system’s design can be easily extended to support more advanced features such as real-time feedback analysis, more granular sentiment categories, and integration with other educational tools.

**7. Future Work**

Future developments of the Sentiment Analysis System could include:

* **Improved Sentiment Analysis Models:**
  + Experimenting with more advanced NLP models such as BERT or GPT for even more accurate sentiment analysis.
* **Real-Time Feedback Processing:**
  + Allowing for real-time sentiment analysis as feedback is entered, providing immediate insights.
* **Enhanced User Interface:**
  + Providing more detailed analytics and visualizations, such as heatmaps and trends over time, to better assist educators in interpreting feedback.
* **Broader System Integration:**
  + Integrating the sentiment analysis tool with Learning Management Systems (LMS) like Moodle or Google Classroom for seamless feedback collection and analysis.

**References**

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This concludes the **Technical Paper** for the Course Review Using Sentiment Analysis System.