

Personalized Learning Assistant: Integrating Language and Machine Learning Models for Enhanced Skill Development

Abstract:

This project introduces an innovative approach to personalized learning through the integration of advanced Natural Language Processing (NLP) and Machine Learning (ML) techniques. The system employs a Large Language Model (LLM) to analyze textual content from uploaded books, extracting key information and generating diverse question formats to evaluate user understanding. Key mathematical concepts underpinning the NLP component include text preprocessing, word embeddings, Named Entity Recognition (NER), and Part-of-Speech (POS) tagging. These techniques involve mathematical operations such as tokenization, stemming, lemmatization, and the use of algorithms to represent words in a semantic vector space and analyze linguistic structures within the text.

The Machine Learning (ML) component acts as an evaluator, leveraging supervised learning algorithms, classification techniques, and performance metrics to assess user responses and provide personalized feedback. Supervised learning algorithms are trained on labeled data to discern patterns and classify user responses, employing classification algorithms such as Decision Trees, Random Forests, Support Vector Machines (SVM), or Neural Networks. Performance metrics such as accuracy, precision, recall, and F1-score are utilized to evaluate model effectiveness.

Furthermore, the ML model utilizes techniques such as sentiment analysis, topic modeling, and error analysis to gain deeper insights into user responses and identify areas for improvement. Cross-validation and hyperparameter tuning are employed to optimize model performance and prevent overfitting.

By leveraging these mathematical concepts and techniques, the system aims to provide users with a tailored learning experience, enhancing their knowledge and skills effectively.

The project's ultimate goal is to provide users with a personalized learning experience that adapts to their individual needs and learning pace. By leveraging the power of NLP and ML technologies, this system offers a dynamic and effective approach to education, empowering users to enhance their knowledge and skills in a targeted manner.

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