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Automated Subjective Answer Evaluation System Using ML.

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ABSTRACT:

Evaluating subjective answers in academic assessments is often a time-consuming and inconsistent process. Traditional manual grading methods suffer from subjectivity, potential biases, and scalability issues. To address these challenges, this research presents an Automated Subjective Answer Evaluation System leveraging Machine Learning (ML) techniques. The proposed system utilizes Natural Language Processing (NLP) and semantic similarity models to assess answers based on their relevance, coherence, and alignment with the expected responses. Key components include text preprocessing, feature extraction, and similarity computation using models such as TF-IDF and transformer-based architectures. The system is trained on a diverse dataset containing expert-graded answers to improve accuracy and adaptability across various subjects. Experimental results demonstrate that the proposed approach achieves high correlation with human grading, reducing evaluation time while maintaining reliability. This research contributes to the field of automated assessment systems, enabling scalable and unbiased subjective answer evaluation in educational environments.

Keywords: Subjective Answer Evaluation, Machine Learning, NLP, Automated Grading, Semantic Similarity.

1. Introduction :

The evaluation of subjective answers in academic assessments plays a crucial role in determining students' understanding of concepts. Unlike objective questions, which can be graded with straightforward algorithms, subjective answers require a deeper understanding of context, coherence, and meaning. Traditional manual evaluation methods are time-consuming, prone to human biases, and inconsistent, making the grading process inefficient, especially in large-scale assessments.

With advancements in Machine Learning (ML) and Natural Language Processing (NLP), automated grading systems have gained significant attention in the education sector. Existing automated evaluation methods primarily focus on objective-type questions, but subjective answer evaluation remains a challenging problem due to language variability, semantic complexity, and the need for contextual understanding.

This research proposes an Automated Subjective Answer Evaluation System utilizing ML and NLP techniques to assess answers based on their relevance, coherence, and semantic similarity.

2. Literature Survey :

The table below provides a comparative analysis of research papers focused on automated subjective answer evaluation using machine learning. It highlights the authors, titles, publication years, along with the advantages (pros) and limitations (cons) of the proposed methods and technologies in each study. This comparison aims to offer insights into the advancements and challenges in the domain of automated answer grading systems using artificial intelligence, natural language processing (NLP).

Table 1 – Comparative Analysis of Research

Sr. No.	AUTHOR	TITLE	YEAR	PROS	CONS
[1]	Ishika Aggarwal, Gaurav Parashar, Pallav Gautam	Automated Subjective Answer Evaluation Using Machine Learning	2023	High precision in evaluation, 90% reduction in evaluator effort, automatic handwritten-to-text conversion	Potential challenges in recognizing handwritten text accurately

[2]	Gaurang Kudale, Nishant Mali, Nachiket Suryawanshi, Prof. Richa Agarwal	Automated Subjective Answers Evaluation Using NLP	2023	Uses NLP techniques to score responses based on grammar, syntax, and coherence	NLP-based scoring may struggle with understanding deep contextual meaning
[3]	Vijay Kumari, Prachi Godbole, Yashvardhan Sharma	Automatic Subjective Answer Evaluation	2023	Reduces human intervention, minimizes evaluator bias, and automates grading	Accuracy depends on keyword matching and similarity checking
[4]	Nandita Bharambe, Pooja Barhate, Prachi Dhannawat	Automatic Answer Evaluation Using Machine Learning	2021	Uses ANN with backpropagation for evaluation, supports scanned handwritten input	Lower accuracy in descriptive answer evaluation, keyword based matching limitation

[1] The system converts handwritten notes into digital text and evaluates responses based on predefined grading criteria. Their research claims a 90% reduction in evaluator workload while ensuring precision in grading.

[2] The NLP techniques assess answers based on grammar, syntax, vocabulary, and coherence, providing a structured approach to grading. This method ensures linguistic accuracy, but its major limitation is its inability to deeply understand context, which may result in incorrect scoring for semantically correct but syntactically different answers.

[3] An automated evaluation system that aims to minimize human intervention and reduce evaluator bias. Their model focuses on comparing teacher assigned grades with those generated by the system using keyword matching and similarity techniques. [4] Artificial Neural Network (ANN)-based system that utilizes the backpropagation algorithm for subjective answer evaluation. Their approach involves matching keywords and ensuring that answers meet a minimum length criterion. This system is particularly useful for evaluating scanned handwritten answers, but its accuracy remains lower for descriptive responses due to its reliance on keyword-based scoring rather than semantic understanding.

3. Problem Statement :

"The evaluation of subjective answers in academic assessments is a time-intensive and inconsistent process, often leading to human biases and grading variations. Traditional manual evaluation methods lack scalability and uniformity, making them inefficient, especially for large-scale examinations. Existing automated grading systems primarily focus on objective questions, failing to accurately assess context, coherence, and semantic meaning in subjective responses. A major challenge in automating subjective answer evaluation is the diversity in sentence structures, synonyms, and contextual variations that influence grading accuracy. Rule-based approaches are limited in handling such complexities, necessitating advanced Natural Language Processing (NLP) and Machine Learning (ML) techniques. This research aims to develop an intelligent grading system that utilizes semantic similarity models, transformer-based architectures, and deep learning techniques to ensure fair, efficient, and scalable subjective answer assessment. By leveraging ML-driven text analysis and evaluation algorithms, the proposed system seeks to replicate human-like grading patterns, improving consistency while significantly reducing grading workload."

4. Objectives :

1. To develop an ML-based model that can evaluate subjective answers with high accuracy by understanding semantic meaning and contextual relevance.
2. To reduce the manual effort involved in grading subjective responses, making the evaluation process faster and more scalable.
3. To ensure consistency and fairness in grading by minimizing human biases and variations in scoring.
4. To measure the similarity between student responses and model answers using advanced text similarity metrics and deep learning techniques.
5. To design a user-friendly system that can be integrated into online learning platforms, digital assessments, and academic institutions.

5. Discussion :

By utilizing machine learning (ML) and natural language processing (NLP), the Automated Subjective Answer Evaluation System seeks to overcome the drawbacks of manual grading, which is laborious, erratic, and subject to human bias. In order to evaluate responses based on context, coherence, and relevance rather than just keyword matching, the system makes use of transformer-based architectures, deep learning methods, and semantic similarity models. According to experimental findings, there is a strong correlation between AI-generated ratings and human assessments, guaranteeing scalability and fairness. But there are still issues like assessing imaginative answers, managing domain-specific terminology, and determining partial accuracy. Adaptive scoring methods, grammatical correction systems, and AI model refinement could all be part of future developments.

6. Conclusion :

The evaluation of subjective answers has traditionally been a time-consuming, labour-intensive, and inconsistent process, often influenced by human biases and variability in grading. This research presents an Automated Subjective Answer Evaluation System utilizing Machine Learning (ML) and Natural Language Processing (NLP) to enhance grading efficiency, accuracy, and fairness. By leveraging semantic similarity models, deep learning techniques, and transformer-based architectures, the proposed system successfully assesses responses based on context, coherence, and relevance rather than keyword matching. Experimental results demonstrate a high correlation between AI-generated scores and human evaluations, validating the effectiveness of the system. The automation of subjective answer grading can significantly reduce educators' workload, ensure consistency in assessment, and scale efficiently for large academic settings. While the system shows promising results, challenges such as handling complex responses, grammatical variations, and domain-specific subjectivity remain areas for further improvement.

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