AUTOMATED ESSAY GRADING

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**Abstract**

Automated Essay Scoring (AES) is an application of Deep Learning that utilizes Long Short Term Memory (LSTM) networks to assess essays based on set criteria. The main goal of AES is to simplify the grading process by training a system to assign grades in line, with how human educators score using datasets with scoring information. By using Natural Language Processing (NLP) methods AES enables the system to understand and evaluate essays written in language leading to a detailed and precise evaluation of students writing abilities. This combination of technologies not improves efficiency but also supports fairness and consistency in assessing academic work fostering a more objective and standardized approach to evaluation, in educational settings.

**Keywords**

Rubric Alignment , Artificial intelligence , Modal Training , Accuracy

**1.Introduction**

Automated Essay Scoring (AES) involves utilizing Deep Learning, Long Short Term Memory (LSTM) networks to assess essays according to established criteria. The goal is to simplify the grading procedure by teaching a system to assign grades that match the scoring trends of educators drawing from datasets, with scoring data. AES utilizes Natural Language Processing (NLP) to empower the system to understand and assess essays composed in language.

**2.Related works**

Recent advancements in deep learning have demonstrated promising outcomes in multimodal emotion recognition, where diverse data modalities like text, images, and audio are amalgamated to accurately infer emotions. This strategy presents a substantial potential for automated grading systems by enabling a more comprehensive assessment of student essays beyond textual data alone. Through the integration of multimodal deep learning techniques, these systems can take into account various factors such as the emotional undertone conveyed in an essay, the visual representation of concepts via images or graphs, and even the oral delivery of a presentation if accessible. This holistic methodology not only amplifies grading accuracy but also furnishes valuable insights into the overall caliber and efficacy of student communication and expression. With the ongoing evolution and enhancement of deep learning models in handling multimodal data, the incorporation of such techniques into automated grading systems is poised to bring about a revolutionary change in the evaluation of student assignments within educational environments, thereby fostering more nuanced and insightful assessments

**3.Implementation**

This Flask application serves as an automated essay assessment system. It functions by receiving an essay input from users through a web form. Upon submission, the application forwards the essay text to the LanguageTool API for grammar analysis. After receiving the grammar analysis response, the system processes it to pinpoint any unnecessary content or grammar suggestions within the essay.

The application then proceeds to evaluate the essay based on various criteria including its quality, grammar accuracy, and the presence of superfluous content. These evaluations contribute to generating individual scores which are then aggregated to calculate the final essay score, typically ranging from 0 to 100. The quality score is determined based on the correctness of sentences, while the grammar score reflects the number of identified grammar errors. Additionally, the assessment considers the relevance of flagged content to calculate an unnecessary content score.

These computed scores collectively provide comprehensive feedback to users regarding the overall quality of their essays and areas that require improvement. Technically, the application is built using the Flask framework to handle incoming HTTP requests, render HTML templates for user interaction, and seamlessly integrate with external APIs like LanguageTool for grammar analysis. This implementation exemplifies a practical approach to automated essay assessment within a user-friendly web application environment.

4.Comparative Analysis:

A detailed comparative analysis between Automated Essay Scoring (AES) systems and traditional manual grading methods reveals several advantages and limitations of each approach. AES systems offer efficiency benefits by significantly reducing the time required to grade essays compared to manual grading. While manual grading can be time-consuming and labor-intensive, AES systems can process and score essays rapidly, leading to faster feedback turnaround times.

In terms of accuracy, AES systems can achieve high levels of consistency in grading, ensuring that essays are evaluated based on predefined criteria without subjective biases. However, they may encounter challenges in assessing complex writing styles or unconventional essay structures that human graders can better interpret. Human graders often provide more nuanced and qualitative feedback, considering factors beyond predefined rules, which AES systems may struggle to replicate.

Scalability is a key advantage of AES systems, especially in handling large volumes of essays efficiently. As the number of essays increases, manual grading becomes increasingly impractical and resource-intensive, whereas AES systems can scale up to process a vast number of essays without significant additional costs.

Cost-effectiveness is another aspect where AES systems excel, as they reduce the need for hiring and training numerous human graders. This cost-saving benefit makes AES systems an attractive option for educational institutions aiming to streamline assessment processes while optimizing resource utilization.

While AES systems offer speed, scalability, and cost advantages, they may face challenges in accurately evaluating subjective aspects of writing, handling unconventional essay formats, and addressing ethical considerations such as bias mitigation and transparency in grading algorithms. Human graders, on the other hand, provide qualitative insights, adaptability to diverse writing styles, and a human touch in feedback delivery, but they are limited in scalability and efficiency.

**5.User Acceptance and Satisfaction:**

In-depth surveys and interviews with educators, students, and educational institutions are crucial to understanding user acceptance and satisfaction regarding AES systems. Factors influencing user perceptions include the ease of use, reliability of scores, clarity of feedback, and overall user experience.

Educators appreciate the efficiency of AES systems in providing timely feedback and reducing grading workload, allowing them to focus on teaching. However, concerns about the system's ability to capture nuanced writing aspects and provide personalized feedback may affect initial acceptance.

Students generally value quick feedback and consistency in grading offered by AES systems. They appreciate the objectivity of automated scoring but may seek additional human feedback for qualitative aspects and improvement suggestions.

**6.Educational Impact:**

Automated essay grading has a significant educational impact by providing timely and detailed feedback that enhances student engagement, motivation, and writing skills. The systematic feedback loop encourages students to revise and improve their writing based on specific criteria, leading to measurable enhancements in writing proficiency and critical thinking abilities.

**7.Integration with Curriculum:**

Integrating AES systems into the curriculum requires strategic planning and training for educators to leverage these systems effectively. Best practices include incorporating AES-based assignments, promoting peer review activities facilitated by AES feedback, and aligning assessment criteria with learning objectives. Seamless integration with Learning Management Systems (LMS) streamlines grading workflows and enhances student-teacher interactions.

**8.Adaptive and Personalized Grading:**

AES systems can incorporate adaptive and personalized grading features by leveraging machine learning algorithms to analyze individual writing styles and learning needs. Personalized feedback mechanisms based on performance trends support targeted interventions and student progress tracking, contributing to personalized learning experiences.

9.Cross-Language Evaluation:

Challenges in cross-language evaluation include linguistic variations, idiomatic expressions, and cultural nuances that impact grading accuracy. Multilingual AES models, language translation tools, and cultural adaptation techniques are essential for ensuring consistent and fair evaluation across diverse linguistic contexts.

10.Longitudinal Studies:

Long-term studies are critical to assessing the sustained effectiveness and evolution of AES systems over time. Research methodologies should track changes in grading accuracy, student performance, and educator satisfaction, considering curriculum dynamics and technological advancements.

11.Collaborative Grading Models:

Collaborative grading models combining AES systems with human evaluation ensure comprehensive feedback while maintaining efficiency and consistency. Quality assurance measures, calibration processes, and inter-rater reliabilitychecks enhance grading accuracy and fairness in hybrid grading approaches.

12.Security and Data Privacy:

AES systems must adhere to stringent security protocols, data anonymization practices, and regulatory compliance to protect student information and ensure ethical use of data. Encryption methods, secure data transmission, and transparency in grading algorithms are essential for maintaining trust and privacy.

13.Industry Adoption and Best Practices:

Industry adoption of AES systems outside academia showcases diverse applications such as recruitment assessments, content evaluation, and language proficiency testing. Best practices include understanding industry-specific grading requirements, addressing regulatory challenges, and fostering innovation in automated assessment technologies. Collaborations between academia and industry can drive advancements and promote global adoption of AES systems in various sectors.

**14. Results and Discussion:**

In evaluating the performance of the Automated Essay Scoring (AES) system, various metrics such as accuracy, precision, and recall were employed to provide a comprehensive assessment. Accuracy measures the system's ability to correctly classify essays and assign appropriate scores, while precision reflects the system's precision in identifying relevant aspects of essays according to grading criteria. Recall, on the other hand, assesses the system's ability to capture all relevant information and not miss any important aspects of essays during scoring.

The results of the evaluation highlight the AES system's capability to consistently provide objective and reliable essay scores. Achieving high accuracy, precision, and recall metrics indicates that the system can effectively mimic human educators' scoring trends and provide fair evaluations of student essays. These results are particularly significant in educational assessment scenarios where consistent and unbiased grading is essential for promoting learning and academic progress among students.

**15.Conclusion and Future Work:**

Automated Essay Grading powered by Deep Learning and Natural Language Processing (NLP) represents a significant milestone in educational technology, offering a scalable and efficient solution for grading essays in educational settings. The successful implementation and evaluation of the AES system demonstrate its potential to revolutionize traditional grading methods and streamline the assessment process for educators and students alike.

Looking ahead, future work in this field could focus on refining the system's capabilities even further. This may involve fine-tuning deep learning models such as Long Short-Term Memory (LSTM) networks to better capture nuanced aspects of writing quality and style. Additionally, expanding the dataset used for training and testing the AES system could lead to improved generalization and performance across diverse writing styles and topics.

Furthermore, addressing ethical considerations in automated grading systems remains a crucial area for future research and development. Ensuring fairness, transparency, and accountability in automated grading processes is essential to maintain trust and integrity in educational assessments. Future work may explore techniques to mitigate biases, enhance explainability of grading decisions, and incorporate feedback mechanisms for continuous improvement of the AES system. Overall, continued advancements in AES hold the promise of enhancing educational outcomes and fostering a more efficient and equitable learning environment.

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