

Project ID:

R24-088

1. Topic (12 words max)

Autonomous grading system for Sinhala Language tests using Natural Language Processing

2. Research group the project belongs to

Knowledge Inspired Computing (KIC)

3. Research area the project belongs to

Natural Language Processing (NLP)

4. If a continuation of a previous project:

| | |
|------------|--|
| Project ID | |
| Year | |

5. Brief description of the research problem including references (200 – 500 words max) – references not included in word count.

As technology continues to advance rapidly, the realm of education is not immune to its transformative effects. One area that has seen significant progress is exam evaluation. Traditionally, grading exams has been a time-consuming and subjective process, prone to human error and bias. However, with the emergence of automated grading systems powered by Artificial Intelligence (AI), the landscape of exam evaluation is undergoing a revolutionary change.[1]

Setting up an automatic grading system is one of the advantages of using an online examination system. This way of grading is much more convenient than the traditional approach. The expansion of technology in e-learning and the rising number of participants need the development of an error-free scoring process that lightens the load of the instructors, saves time, and guarantees impartiality.[2]

The research problem at hand is the development of an autonomous grading system tailored for Sinhala language tests, leveraging the capabilities of Natural Language Processing (NLP). With the increasing integration of technology in education, there is a growing need for automated assessment tools that can handle the nuances of languages beyond English, particularly in regions where diverse languages are predominant.

The motivation for this research stems from the unique linguistic characteristics of the Sinhala language, spoken by the majority of the population in Sri Lanka. Sinhala possesses a rich morphology and syntax, presenting distinct challenges for automated language processing. Existing autonomous grading systems primarily designed for English may not effectively capture the intricacies of Sinhala, limiting their applicability in educational contexts where Sinhala is the medium of instruction.[3],[4]

The significance of this problem is underscored by the potential impact on education in Sri Lanka. By developing an autonomous grading system that understands and analyzes Sinhala language nuances, users can benefit from more efficient and accurate assessments, ultimately improving the learning experience for students.

In summary, this research addresses the need for a specialized autonomous grading system that caters to the linguistic intricacies of the Sinhala language, utilizing the power of NLP. The expected outcomes include advancements in Sinhala language processing technology, contributing to the broader field of educational technology and fostering more inclusive and effective assessment practices in Sinhala.

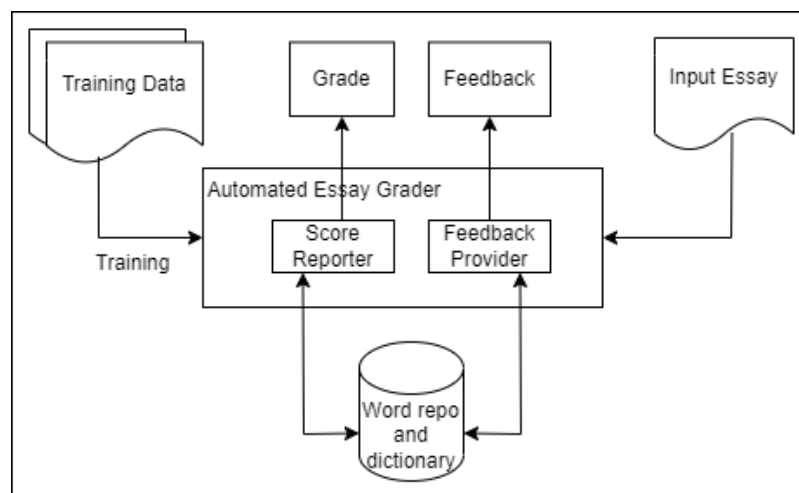
References

- [1] “Automated Grading Systems: How AI is Revolutionizing Exam Evaluation” Erika Balla, May 31, 2023 at 9:26 am [Online] Available: <https://www.datasciencecentral.com/automated-grading-systems-how-ai-is-revolutionizing-exam-evaluation/> [Accessed 2024]
- [2] “WHY MARKING ONLINE EXAMS IS EASIER” Sep 22, 2022 [Online] Available: <https://blog.edexams.com/why-marking-online-exams-is-easier/> [Accessed 2024]
- [3] Hewagamage, K. (2019). "Challenges in Automated Sinhala Language Processing: A Review." International Journal of Computational Linguistics and Sinhala Language Processing, 5(2), 14-25.
- [4] Perera, S., & Rajapakse, P. (2020). "Machine Learning Approaches for Sinhala Language Understanding." Journal of Artificial Intelligence in Education, 30(4), 587-605.

6. Brief description of the nature of the solution including a conceptual diagram (250 words max)

The proposed solution involves the development of an autonomous grading system for Sinhala language tests using Natural Language Processing (NLP). The system aims to overcome the challenges posed by the linguistic complexities of Sinhala, ensuring accurate and culturally sensitive grading of exam responses.

The solution comprises several key components. They are Sinhala Text Preprocessing and Understanding, Sinhala Meaning Recognition and Semantic Analysis, Sinhala Named Entity Recognition (NER) and Keyword Extraction and Sinhala Grading and Feedback Generation. The conceptual diagram illustrates the flow of the autonomous grading system. Sinhala exam responses undergo preprocessing, where specialized NLP techniques are applied. The system then proceeds to semantic analysis, named entity recognition, and keyword extraction. The grading component employs Sinhala-specific scoring mechanisms, and the feedback generation module produces feedback in Sinhala. The solution aims to provide an efficient and accurate tool for grading Sinhala language tests, contributing to the enhancement of educational assessment practices in Sinhala.



7. Brief description of specialized domain expertise, knowledge, and data requirements (300 words max)

The implementation of an autonomous grading system for Sinhala language tests using Natural Language Processing (NLP), requires specialized domain expertise, knowledge and specific data requirements to address the linguistic nuances and cultural context of Sinhala.

Expertise in Sinhala linguistics is crucial for understanding the unique morphological, syntactical, and semantic aspects of the language. Linguistic experts can contribute to the development of custom NLP models tailored for Sinhala language constructs. Domain experts in Sinhala language education are essential to ensure that the grading system aligns with the curriculum, grading standards, and educational goals. Further, cultural sensitivity helps in avoiding misunderstandings and ensures the appropriateness of the feedback provided.

As for the knowledge requirements, a comprehensive corpus of Sinhala text is necessary for training and fine-tuning NLP models. This corpus covers various domains and contexts, including educational materials and exam papers. Moreover, an annotated dataset of Sinhala exam responses with labeled correct and incorrect answers is essential for training and evaluating the grading system. This dataset captures the diversity of student responses.

By means of data requirements, diverse collections of Sinhala texts, including literature, academic writings, and online content, are required to build language models that understand the broader context of Sinhala language use. Access to educational materials in Sinhala, including textbooks, question papers, and instructional content, is crucial for training the system to recognize and evaluate academic language.

In summary, specialized domain expertise in Sinhala linguistics, education, and cultural nuances, coupled with access to comprehensive Sinhala language corpora and annotated datasets, is essential for the development of an effective autonomous grading system. Collaboration between linguists, educators, and NLP experts is crucial to ensure the system's accuracy and relevance in the Sinhala language context.

8. Objectives and Novelty

| Main Objective: The main objective of the research is to develop and implement an autonomous grading system for Sinhala language tests using Natural Language Processing (NLP), by advancing the field of educational technology by providing a tailored solution that addresses the specific linguistic and cultural challenges posed by Sinhala language assessments. This system seeks to enhance the overall educational experience by offering accurate, efficient, and culturally sensitive evaluation of Sinhala language proficiency. | | | |
|---|--|--|--|
| Member Name | Sub Objective | Tasks | Novelty |
| Maddumage P.W. | Investigate methods for effectively extracting and representing features from essays (Sinhala) that requires identifying relevant linguistic, syntactic, and semantic features that contribute to the overall quality of an essay. | Explore algorithms for tokenization, part-of-speech tagging, and syntactic analysis (NLTK) Research techniques for capturing and representing vocabulary richness and coherence in essays (TF-IDF) Develop methods for extracting features that reflect the structure and organization of written content. | Examine ways to dynamically modify text cleaning procedures according to the particular contexts of various topic areas or inquiry kinds. Explore ways to optimize cleaning techniques for various linguistic contexts to enhance the accuracy of downstream NLP tasks. |

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| Wijesinghe W.M.C.I. | Enhance the system's ability to understand the contextual nuances of essays, relating leveraging NLP techniques to capture semantic meaning, sentiment, and overall context within the written content. | <p>Implement advanced NLP models, such as BERT, for contextual understanding.</p> <p>Incorporate sentiment analysis algorithms (VADER) to identify emotional tones in essays.</p> <p>Explore and use Named Entity Recognition and Text Summarization methods for identifying and understanding rhetorical devices and stylistic elements</p> | <p>Examine the potential effects on grading that come from using emotional context in semantic analysis.</p> <p>Investigate the development of models that consider the emotional tone of student responses and assess how sentiment analysis can contribute to a more nuanced understanding of the content, leading to personalized feedback.</p> |
| Amarasena J.H.T. | Develop machine learning models capable of autonomously grading essays based on extracted features that involves training and fine-tuning models to make accurate and context-aware grading decisions. | <p>Implement supervised learning algorithms for initial model training using annotated essay data.</p> <p>Explore reinforcement learning approaches to enable continuous learning and improvement.</p> | <p>Look on ways to improve the explain ability and transparency of grading systems.</p> <p>Investigate how these relationships evolve over time or across different domains, contributing to</p> |

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| | | Investigate ensemble learning techniques to combine the strengths of multiple grading models. | more adaptive and context-aware NER |
| Pindeniya P.C.M. | Address ethical concerns related to bias and fairness in autonomous essay grading. This involves identifying and mitigating biases in the system to ensure fair and unbiased evaluation of essays | <p>Implement algorithms for bias detection in the grading system.</p> <p>Explore fairness-aware machine learning techniques to mitigate biases.</p> <p>Develop strategies for transparent and explainable AI to provide insights into the grading decisions and identify potential biases</p> | Explore how to generate human-understandable justifications for automated grading decisions, ensuring that students and educators can comprehend and trust the AI-generated scores and feedback. |

a) Does the chosen research topic possess a comprehensive scope suitable for a final-year project?

| | | | |
|-----|-------------------------------------|----|--------------------------|
| Yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> |
|-----|-------------------------------------|----|--------------------------|

b) Does the proposed topic exhibit novelty?

| | | | |
|-----|-------------------------------------|----|--------------------------|
| Yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> |
|-----|-------------------------------------|----|--------------------------|

c) Do you believe they have the capability to successfully execute the proposed project?

| | | | |
|-----|-------------------------------------|----|--------------------------|
| Yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> |
|-----|-------------------------------------|----|--------------------------|



d) Do the proposed sub-objectives reflect the students' areas of specialization?

| | | | |
|-----|-------------------------------------|----|--------------------------|
| Yes | <input checked="" type="checkbox"/> | No | <input type="checkbox"/> |
|-----|-------------------------------------|----|--------------------------|

e) Supervisor's Evaluation and Recommendation for the Research topic:

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|------------------------------------|
| <p>Approved with minor changes</p> |
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10. Supervisor details

| | Title | First Name | Last Name | Signature |
|--|-------|------------|-----------|---|
| Supervisor | Ms. | Jenny | Krishara |  2024/01/11 |
| Co-Supervisor | Ms. | Wishalya | Tissera |  11/01/2024 |
| External Supervisor | | | | |
| Summary of external supervisor's (if any) experience and expertise | | | | |

This part is to be filled by the Topic Screening Panel members.

Acceptable: Mark/Select as necessary

| | |
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| Topic Assessment Accepted | |
| Topic Assessment Accepted with minor changes (should be followed up by the supervisor)* | |
| Topic Assessment to be Resubmitted with major changes* | |
| Topic Assessment Rejected. Topic must be changed | |

* Detailed comments given below

Comments

The Review Panel Details

| Member's Name | Signature |
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***Important:**

1. According to the comments given by the panel, make the necessary modifications and get the approval by the **Supervisor** or the **Same Panel**.
2. If the project topic is rejected, identify a new topic, and request the RP Team for a new topic assessment.
3. The form approved by the panel must be attached to the **Project Charter Form**.