

CAT405 Intelligent Computing Major Project

Initial Project Proposal

AUTOMATING FEEDBACK SUGGESTION IN TECHNICAL WRITTEN ASSIGNMENTS AT UNIVERSITY LEVEL

Intelligent Computing

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Abstract

It is a tedious work for instructors to provide timely feedback on open-ended technical written assignments, particularly for classes with many students. Many instructor will choose to give the final grades without any feedback, while those that gave feedback might not be consistent due to the massive numbers of submitted assignment. On the contrary, students could not improve better in their assignments when feedbacks are not given. Hence, this project aims to create a web application that can perform semi-automatic grading and generate or suggest feedback based on components in a grading rubric on technical written assignments submitted by university level students.

The objectives of this system are to provide a classroom where students can upload their digital assignments whilst instructors can review student's assignments and create grading rubric, perform text extraction and apply natural language processing for analysis, generate feedback at two different levels of analysis: lexical and rubric, and allow instructors to choose to edit the feedback and students to view the feedback. The expected outcomes of the project are a web application that can perform classroom management, text extraction and analysis, feedback generation, and grading and feedback review. The proposed solution offers several benefits to both instructors and students, including timely and effective feedback, reduced workload for instructors, consistent and fair grading, and improved academic outcomes for students.

Keywords: Semi-automatic Grading, Feedback Generation, Natural Language Processing, Lexical & Rubric Analysis, Timely & Effective Feedback, Web Application

1. Project Background

Over the past decade, the enrollment in higher education in Malaysia has seen a significant increase with over 400,000 new students enrolling in higher education institutions (HEIs) every year. The gross higher education enrollment rate in Malaysia reached 48% in 2012, representing a 70% increase in enrollment from 2004 to 2014, with 1.2 million students enrolled in both public and private HEIs. According to the Ministry of Education in Malaysia there are currently 20 public universities, 36 polytechnics, and 105 community colleges. (MUHAMMAD, 2023) The number of students enrolled stikes up to the highest at the year of 2016 with 1,346,858 students. In addition, the general statistic of students and instructor ratio at public universities was approximately 18.93 students for every instructor available in 2022. (Policy Planning and Research Division, 2022). However, the number of students in class can be more than few hundreds depends on courses.

With the massive number of students, it is challenging for instructor to provide quality feedback to each students due to the increasing workload and a growing demand for personalized feedback on technical written assignments. This leads to the results of dissatisfaction and limited engagement between instructor and students. (Nicol, 2010) Other than that, the grading process can be repetitive especially for open-ended technical written assignments, it is a tedious and time-consuming process for instructor to provide personalized feedback. As for students in university level, they usually do not get any feedbacks from the instructors on their assignments, which is not helpful for the improvement of students. According to Harvard Graduate School of Education, feedback should be given in a timely manner to help students understand what they are doing correctly and incorrectly, with the focus on what they are doing in their assignments. (Boudreau, 2022)

Therefore, this system aims to create a web application that can perform semi-automatic grading and generate or suggest feedback based on components in a grading rubric on technical written assignments submitted by university level students. On the contrary, students can upload their assignments in PDF or Word format and they can review the feedback from the instructors.

2. Problem Statements

The problem statement is that instructors face difficulties in providing timely feedback on technical written assignments, particularly when dealing with a large number of students. This is due to the increasing workload of the instructor, especially during the grading process. Grading technical written assignments is a tedious and time-consuming process for instructors, and providing personalized feedback for each student is even more challenging. Additionally, grading the same questions repeatedly can be monotonous for instructors, and they could have utilized this time to work on more meaningful tasks such as preparing lessons or conducting research.

The lack of timely feedback on technical written assignments can lead to several problems. Firstly, students do not receive feedback on their work, which means they cannot learn from their mistakes and improve their performance. This can lead to dissatisfaction for both instructors and students, as well as a lack of engagement and motivation for students to improve their work. (Nicol, 2010) Secondly, students may not be able to identify their weaknesses and strengths, which can hinder their learning progress.

3. Motivation

This project is driven by the need to overcome the challenges faced by the instructor in the current grading process. The motivation of this project is to create a web application that will encourage and help instructors to provide timely, effective and consistent feedback to students as well as reducing the workload for the instructors. Other than that, the desire of students to learn from their mistakes through receiving feedback for their assignments also motivates the creation of this project.

4. System Objectives

The objectives of this system are:

- To provide classroom that students can upload their technical written assignments whilst instructors can review student's assignments and create grading rubric
- To perform text extraction and apply natural language processing for analysis
- To generate feedback at two different levels of analysis: lexical & rubric.
- To allow instructors to choose to edit the feedback and students to view the feedback

5. Proposed Solutions

The proposed solution is to create a web application that can perform semi-automatic grading and suggest feedback based on components in a grading rubric on student's written assignments.

The system will have a classroom management feature, including the creation of classroom and grading rubrics. Students will upload and submit their digital assignments (PDF or Word) and the application will perform text extraction for further analysis using the natural language processing techniques. When instructor is reviewing the assignments, the system will then generate feedbacks at two different levels of analysis: lexical (number of spelling errors, number of grammatical errors, etc) and, rubric (suggested comments on student's assignment based on each grading rubric criteria). The feedback will be generated using a template-based or generative AI method. The instructors can choose to accept the suggested feedback as it is, edit or overwrite the suggested feedback when grading. The students can view the feedback through the application once the grading is completed.

| Modules | Features |
|---------------------------------------|---|
| Classroom Management | <ul style="list-style-type: none"> - Instructor can create classroom - Instructor can create grading rubrics - Students can upload their technical written assignments in PDF or Word |
| Text Extraction & Analysis | <ul style="list-style-type: none"> - Convert student's submission into digital text |
| Feedback Generation | <ul style="list-style-type: none"> - Lexical (number of spelling errors, number of grammatical errors, etc.) and, - Rubric (suggested comments on student's assignment based on each grading rubric criteria) |
| Grading Feedback Review | <ul style="list-style-type: none"> - Instructors can choose to accept the suggested feedback as it is, edit or overwrite the suggested feedback - Students can review the feedback |

Table 5.1: Project Modules

6. Benefits or Impact or Significance of Project Solutions

The proposed solution for the web application for semi-automatic grading and feedback generation offers several benefits to both instructors and students. Firstly, instructors can provide timely and effective feedback to students. This is particularly important in classes with many students, where providing feedback on written assignments can be a tedious task. With the proposed solution, instructors can save time on giving feedback for students' assignments, allowing them to focus on other important tasks.

Secondly, the workload for instructors can be reduced. By automating the grading and feedback generation process, instructors can spend less time grading assignments and more time on other important tasks, such as lesson planning and research. This can lead to increased job satisfaction and a better work-life balance for instructors.

Thirdly, students can receive feedback that is consistent, fair, and objective. With the use of grading rubrics and natural language processing techniques, the feedback generated by the system will be consistent and objective, ensuring that all students are graded fairly. This can help to improve student engagement and motivation, as they will be able to see how they are progressing and what they need to do to improve their work.

Finally, students can view their feedback through the application, which can help them improve their work. By providing students with access to their feedback through the application, they can review their work and identify areas for improvement. This can help to improve the overall quality of assignments and reports submitted by students, leading to better academic outcomes.

7. Uniqueness of the proposed solution

The proposed solution is unique because it combines the use of grading rubrics with natural language processing techniques to generate feedback at two different levels of analysis: lexical and rubric. The system also allows instructors to choose to accept the suggested feedback as it is, edit or overwrite the suggested feedback.

8. Expected Outcomes of the Proposed Solution

The expected outcomes of the project is a web application that can perform:

- a. A classroom where
 - i. Instructors can create classroom and grading rubrics
 - ii. Instructors can review students' assignment
 - iii. Students can upload their digital assignments
- b. Text extraction to enable natural language processing techniques to be applied for analysis
- c. Feedback generation that involves two different levels of analysis:
 - i. Lexical (number of spelling errors, number of grammatical errors, etc.) and,
 - ii. Rubric (suggested comments on student's assignment based on each grading rubric criteria)
- d. Grading and feedback review where
 - i. Instructors can choose to accept the suggested feedback as it is, edit or overwrite the suggested feedback
 - ii. Students can review the feedback

9. Status of the Project

This project is a new project that will be built from scratch and never been developed before.

10. SDG Alignment

The proposed solution aligns with SDG 4: Quality Education, as it aims to improve the quality of education by providing timely and effective feedback to students.

11. References

- Boudreau, E. (2022, January 21). *How teachers can help students receive and learn from comments and critiques*. Retrieved from Harvard Graduate School Of Education: <https://www.gse.harvard.edu/ideas/usable-knowledge/22/01/importance-feedback>
- MUHAMMAD, D. L. (2023). *Malaysia Educational Statistic - Quick Facts 2023*. Ministry of Education Malaysia, Educational Policy Planning and Research Division. Putrajaya: Educational Macro Data Planning Sector.
- Nicol, D. (2010). From monologue to dialogue: improving written feedback processes in mass higher education, . *Assessment & Evaluation in Higher Education*, 35, 17. doi:10.1080/02602931003786559
- Policy Planning and Research Division, M. o. (2022). *Higher Education Report: [MALAYSIA]*. Paris: UNESCO National Commission.

12. Appendix

| Milestone description | Start | Oct 2023 | | | Nov 2023 | | | | Dec 2023 | | | | Jan 2024 | | | | |
|---|------------|----------|----|----|----------|----|----|----|----------|----|-----|-----|----------|-----|-----|-----|-----|
| | | W1 | W2 | W3 | W4 | W5 | W6 | W7 | W8 | W9 | W10 | W11 | W12 | W13 | W14 | W15 | W16 |
| | | 16 | 23 | 30 | 6 | 13 | 20 | 27 | 4 | 11 | 18 | 25 | 1 | 8 | 15 | 22 | 29 |
| Proposal | | | | | | | | | | | | | | | | | |
| Research on Proposed Topic | 16/10/2023 | | | | | | | | | | | | | | | | |
| Define Project Scope | 30/10/2023 | | | | | | | | | | | | | | | | |
| Initial Proposal Preparation | 16/10/2023 | | | | | | | | | | | | | | | | |
| Initial Proposal Amendments | 6/11/2023 | | | | | | | | | | | | | | | | |
| Research on possible method | 1/11/2023 | | | | | | | | | | | | | | | | |
| Milestone 1: System Requirement and Design (SRD) | | | | | | | | | | | | | | | | | |
| Research on Data Source | 1/11/2023 | | | | | | | | | | | | | | | | |
| Research on Related Work | 1/11/2023 | | | | | | | | | | | | | | | | |
| Define Project Management and Development Methodology | 6/11/2023 | | | | | | | | | | | | | | | | |
| Define Functional and Non-Functional Requirements | 13/11/2023 | | | | | | | | | | | | | | | | |
| UML Modeling | 20/11/2023 | | | | | | | | | | | | | | | | |
| Define System Architecture | 20/11/2023 | | | | | | | | | | | | | | | | |
| SRD Report Preparation | 4/12/2023 | | | | | | | | | | | | | | | | |
| SRD Presentation | 18/12/2023 | | | | | | | | | | | | | | | | |
| Prototype Development Phase 1 (Module 1 & 2) | 1/1/2024 | | | | | | | | | | | | | | | | |
| Prototype Testing Phase 1 | 8/1/2024 | | | | | | | | | | | | | | | | |
| Prototype Development Phase 2 (Module 3 & 4) | 15/1/2024 | | | | | | | | | | | | | | | | |
| Prototype Testing Phase 2 | 22/1/2024 | | | | | | | | | | | | | | | | |

| Milestone description | Start | Jan 2024 | | | | | Feb 2024 | | | | | Mar 2024 | | | | | Apr 2024 | | | | | May 2024 | | | | | June 2024 | | | | |
|---|-----------|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|----------|-----|-----|-----|-----|-----------|--|--|--|--|
| | | W12 | W13 | W14 | W15 | W16 | W17 | W18 | W19 | W20 | W21 | W22 | W23 | W24 | W25 | W26 | W27 | W28 | W29 | W30 | W31 | W32 | W33 | W34 | W35 | W36 | W37 | | | | |
| | | 1 | 8 | 15 | 22 | 29 | 5 | 12 | 19 | 26 | 4 | 11 | 18 | 25 | 1 | 8 | 15 | 22 | 29 | 6 | 13 | 20 | 27 | 3 | 10 | 17 | 24 | | | | |
| Milestone 2: Project Progress Demo | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Development (Module 1) | 29/1/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Testing | 12/2/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Development (Module 2) | 19/2/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Testing | 4/3/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Development (Module 3) | 11/3/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Testing | 25/3/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Project Progress Demo | 1/4/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Project Progress Demo Presentation | 1/4/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Development (Module 4) | 8/4/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Testing | 22/4/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Integration | 29/4/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| System Testing | 13/5/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Milestone 3: Final report & System Demo | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Demo | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Final Report Preparation | 20/5/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Final Report Submission | 27/5/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Final System Presentation (System Demo) | 3/6/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PIXEL 2024 | 24/6/2024 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |