

Final Year Project Proposal

TU857

Automatic essay grader with AI generated feedback

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Declaration

I hereby declare that the work described in this dissertation is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree at this or any other university.

Signed:

Joseph Egan

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03/11/2024

# *Summary*

A machine learning algorithm that will receive an exam paper question or essay, grade it, and send it to an AI to generate advice on how to improve. The program will have the user import a document of an essay. The program using a machine learning model will grade the document, based off the grading system, and using an AI API will output advice, e.g. you get a grade of 95%, because you lost 5% for punctuation.

This can be used as an educational tool to help students with studying for exams, improving their continuous assessment work, or by lecturers to help grade students work. The end deliverable will be a program that takes in a document, grades it using machine learning, and offers advice based on AI to tell a student where they went wrong and to improve.

# *Background (and References)*

Ireland, universities and colleges have seen a steady rise in student enrolments over recent years. This increase has placed a strain on faculty resources, leading to one of the highest student-to-lecturer ratios in Europe. While the average ratio stands around 20 students per lecturer in Ireland, some disciplines and institutions face even higher numbers, far above the EU average of approximately 15:1. This widening ratio poses a challenge for lecturers who are now responsible for larger groups of students, especially when it comes to labour-intensive tasks like grading written assignments.

Detailed feedback on written work is crucial for students, as it supports their academic growth and development. Yet, with the added workload, lecturers struggle to provide the kind of individualized feedback that helps students improve essential skills, like writing and critical analysis. Research shows that frequent, specific feedback leads to stronger learning outcomes, but high student numbers make it difficult to sustain such a practice effectively.

An AI-supported essay grading and feedback tool could help bridge this gap. By automating parts of the grading process, such a tool can deliver timely, constructive feedback on areas like grammar, argument structure, and coherence. It allows lecturers to allocate their time to more complex, personalized teaching tasks while ensuring students receive consistent, relevant feedback. Implementing an AI-driven system in this context could enhance the learning experience for students and help educators better manage the demands of growing class sizes across Irish higher education.

(**Irish Universities Association (IUA),** n.d. *University Profiles: TU Dublin.* [online] Available at: <https://www.iua.ie/ouruniversities/university-profiles/tu-dublin/>)

# *Proposed Approach*

I plan to use an Agile developmental approach to complete my project. I will break down my project in 5 phases: Research, design, model development and training, system integration, and validation and verification.

* The research and requirement phase would consist of interviewing students and lecturers to see if there is any interest in my project and what would be their needs and expectations of my project.
* The design phase would consist of the system architecture and redesigning the user interface elements.
* The model development and training phase would consist of selecting the dataset and training the model to grade based on the academic rubrics.
* The system integration phase would consist of combining the model, the AI, and the other components together.
* The validation and verification phase would consist of evaluating the model’s grading accuracy and consistency results and the understanding of the AI’s interpretation of the grade and feedback.

# *Deliverables*

30 Nov 2024 Interim Submission

11 Apr 2024 Final Submission

# *Technical Requirements*

1. Hardware

• Computing Power: Moderate processing power to run the machine learning grading.

• Storage: Size of a small mobile application.

• Memory: High memory is essential for processing long documents or essays in real

time. 64GB RAM or higher would be beneficial for smooth model inference and

handling large document data.

2. Software

• Machine Learning Frameworks: a python program using tools like Jupyter to use

machine learning. Tools like Scikit-learn or NLTK for implementing scoring metrics,

e.g. BLEU, ROUGE, to evaluate essay structure, coherence, grammar, and content

quality.

• API Development Framework: Flask or FastAPI for creating a RESTful API that allows

users to upload essays, process them, and receive graded feedback.

• User Interface Components: HTML/CSS and UI/UX design tools to ensure a user

friendly design for students and educators alike.

3. Infrastructure

• Cloud Services: AWS, Google Cloud Platform, or Microsoft Azure to host the database.

* Online Database: Google Firebase for storing the machine learning algorithms and dataset.

# *Conclusion*

A machine learning algorithm that will receive an exam paper question or essay, grade it, and send it to an AI to generate advice on how to improve. The program will have the user import a document of an essay. The program using machine learning will grade the doc, based off the grading system, and using an AI API will output advice, e.g. you get a grade of 95%, because you lost 5% for punctuation.

This can be used as an educational tool to help students with studying for exams, improving their continuous assessment work, or by lecturers to help grade students work. The end deliverable will be a program that takes in a document, grades it using machine learning, and offers advice based on AI to tell a student where they went wrong and to improve.

# *References*

Hint:

Use Zotero to manage your references (see Brightspace resources).

Use the **Harvard** referencing style

<https://library.tudublin.ie/articles/5683278.6336/1.PDF>

<https://library.tudublin.ie/articles/5254577.5146/1.PDF>

[TU Dublin | Irish Universities Association](https://www.iua.ie/ouruniversities/university-profiles/tu-dublin/)

# *Appendix A: First Project Review*

Hint: review a past project from the library website that relates to your project idea.

Title: Generating expenditure tracking and analysis from hard copy receipts

Student: Cillian Keohane

Description (brief): A system to scan receipts and process them into an expenditure tracker

What is complex in this project: The use of a Wikimedia API and the machine learning algorithm to process the receipts.

What technical architecture was used: Model, View, and Controller architecture

Explain key strengths and weaknesses of this project, as you see it.

Strengths: the use of the scanner and photo processor, and the machine learning algorithm that adapts to the individual user and improves over time.

Weakness: It is not synchronized to other banking devices to automate the process of taking in receipts.

# *Appendix B: Second Project Review*

Hint: review a past project from the library website that relates to your project idea.

Title: Machine Learning for Predictive Analysis and Recommender System

Student: Glory Pierce Eguare

Description (brief): An application that generates a predictive algorithm for the fuel consumption efficiency of automotives

What is complex in this project: The

What technical architecture was used: Model template view architecture

Explain key strengths and weaknesses of this project, as you see it.

Strengths: The use of a detailed dataset auto-mpg, to train the machine learning algorithm.

Weaknesses: The normalisation of the ranges of his dataset to facilitate easier training, may have led to skewed data biases to his results. This would have disproportionally punished more specialised vehicles, i.e. an unusually heavy car would look like it would have unexpectedly terrible mpg, and raise the value of more average cars.