



**The Hong Kong University of Science and Technology**

**Department of Mathematics**

**MPhil THESIS EXAMINATION**

**Classification of Assessment Points in Calculus Exercise Problems  
using Large Language Models**

*By*

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**ABSTRACT**

Recommendation systems have gained significant popularity, particularly in commercial applications such as shopping and movie platforms, in the past ten years. However, the field of education, specifically in the domain of question recommendation systems, has seen limited development. This can be attributed to the insufficient data regarding the association between questions and different kinds of students, as well as the difficulty of learning this association through simple recommendation models. To address these challenges, we might need to investigate the relationship between questions and students by understanding the required knowledge points for solving questions and identifying the areas where students are weak. This study aims to infer assessment points for exercise, by utilizing the classifications on 8300 Calculus exercises authored by Prof. HU Jishan as the dataset. My approach involves leveraging the power of RoBERTa, a relatively small language model, and deepseek-math-7b-rl, a state-of-art language specially enhanced in mathematics, to comprehend the questions and employ a fully connected network enhanced with cross-attention mechanisms for inference. Experimental results demonstrate that the fusion of a language model and a classifier with an attention mechanism outperforms the accuracy of the language model's inherent classifier. However, this effect is not favorable in situations where the data is imbalanced, that is some tags appear too many times. When combining language models and classifiers, even large language models seem to excessively depend on the training data during the fine-tuning phase, leading to overfitting. Furthermore, experiments indicate that deepseek-math-7b-rl does not exhibit remarkable advantages in process-free pure classification tasks.

**Date : 9 August 2024, Friday**

**Time : 10:00 a.m.**

**Venue : Room 4472 (Lifts 25/26)**

**Thesis Examination Committee**

**Chairman : Prof. Can YANG, MATH /HKUST**

**Thesis Supervisor : Prof. Jishan HU, MATH/HKUST**

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*(Open to all faculty and students)*

The student's thesis is now being displayed on the reception counter in the General Administration Office (Room 3461).