GMR-210 Cogni-Resource: AI-Driven Reflective Feedback Analysis for Enhanced Learning Insights and Resource Discovery

Abstract

Cogni-Resource synthesizes the features of Cogni-Reflect and Learning Resource Finder, leveraging AI technology to improve learning analytics and resource exploration in educational settings. Cogni-Reflect utilizes LLMs for analyzing student reflections, letting educators obtain immediate insights into learning outcomes and challenges, while Learning Resource Finder uses web scraping and OpenAI API integration to offer learners curated educational content. Together, these tools simplify the evaluation and finding of resources, aiding educators in making data-driven interventions and guiding students to find customized high-quality learning materials.

Introduction

In today's educational settings, teachers and learners encounter unique obstacles. Teachers need quick access to students' reflective thoughts, while students need easy access to relevant learning materials in the midst of a large amount of resources. Cogni-Reflect was created to automate the process of identifying main themes in student reflections, making it easier to provide immediate feedback using a dynamic dashboard. At the same time, the Learning Resource Finder tackles the issue of information overload by collecting, condensing, and displaying educational URLs in response to user searches, improving availability of top-notch learning materials. The combination of these tools in Cogni-Resource creates a seamless environment for learning analytics and resource discovery, promoting holistic education engagement and advancement.

Methodology

Cogni-Reflect utilizes memory tuning based on LLM, specifically the LLaMA 3.1 model, to evaluate narrative reflections and classify learning outcomes and challenges at class-wide and individual levels. The tool's continuous adjustments help maintain high accuracy in topic extraction, with feedback data gathered from reflective writing prompts in a college environment. The interactive dashboard combines weekly and student-specific information, enabling educators to monitor learning advancement in a detailed manner.

The Learning Resource Finder utilizes the Scrapy framework to scrape the web and incorporates the Google Search library to gather educational material from trusted websites like Coursera, W3Schools, and GeeksforGeeks. The OpenAI API creates concise summaries for each result, improving the relevance and readability of the links shown. Flask, a Python web framework, enables users to interact by displaying search results with informative descriptions.

Cogni-Resource combines reflection analysis with resource curation to offer a comprehensive solution that gives learning insights and personalized educational materials.

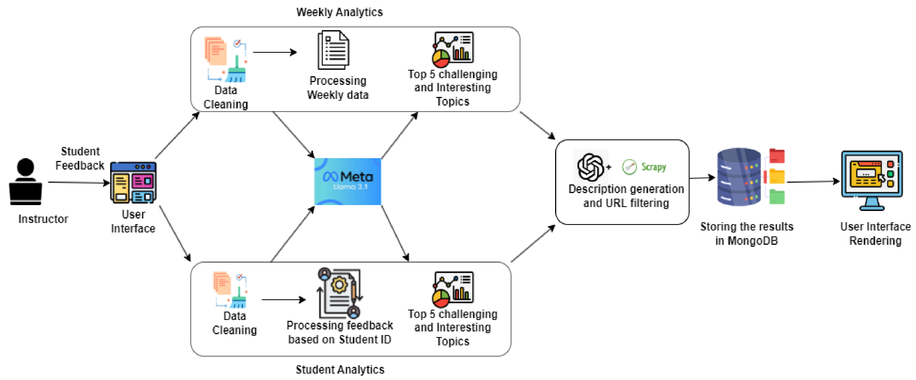
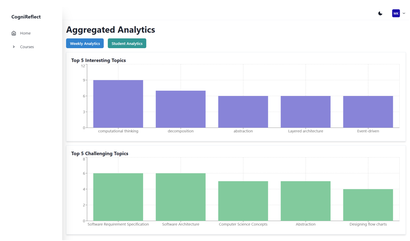
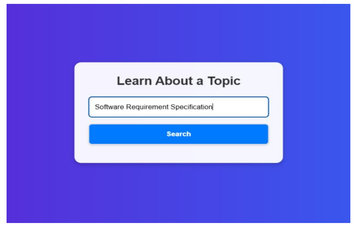


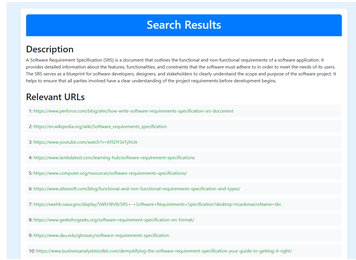
Fig 1. Cogni-Resource System Architecture

Results

Cogni-Reflect demonstrated strong performance in topic extraction, achieving a Percent Valid Topic Extraction accuracy of over 95% and a Percent Correct Empty Responses accuracy of 87% after multiple rounds of fine-tuning. This step-by-step refinement process helped minimize errors, such as hallucinations, while improving the model's adaptability to diverse feedback types.The Learning Resource Finder effectively gathered and summarized educational materials, providing users with accurate, high-quality search results. By leveraging web scraping and the Google Search library, the tool ensured access to a broad range of content. OpenAI-generated summaries enhanced comprehension, allowing users to quickly identify essential resources.Together, the Cogni-Resource framework offers educators a comprehensive view of student challenges and preferences, guiding them to top-notch educational resources. This integration ultimately enhances engagement, accessibility, and targeted learning experiences.







Conclusions

Cogni-Resource is a thorough AI-driven method for educational analytics and finding resources, blending reflective feedback analysis with recommended educational content curation. By analyzing student reflections, Cogni-Reflect helps educators in making informed interventions, while Learning Resource Finder supports students' learning journeys by giving access to relevant materials. Future work will include enhancing the scraping algorithm for more personalized results, incorporating adaptive learning characteristics, and examining the scalability of the framework in various educational environments.

Acknowledgments

College of Computing and Software Engineering at Kennesaw State University

AIET LAB (Artificial Intelligence in Educational Technology)

Contact Information

AIET Lab website : https://aiet.kennesaw.edu/

Director: Dr. Nasrin Dehbozorgi dnasrin@Kennesaw.edu

Ashrith Kumar Devara : adevara3@students.Kennesaw.edu

References

1.Alrashidi, H., Almujally, N., Kadhum, M., Ullmann, T. D., & Joy, M. (2022). Evaluating an automated analysis using machine learning and natural language processing approaches to classify computer science students' reflective writing. Pervasive Computing and Social Networking: Proceedings of ICPCSN 2022, Springer, pp. 463–477.

2.Schön, D. A. (2010). Educating the reflective practitioner: Toward a new design for teaching and learning in the professions. Australian Journal of Adult Learning, 50(2), 448–451.

3.Fekete, A., Kay, J., Kingston, J., & Wimalaratne, K. (2000). Supporting reflection in introductory computer science. ACM SIGCSE Bulletin, 32(1), 144–148.

4.Chng, S. I. (2018). Incorporating reflection into computing classes: Models and challenges. Reflective Practice, 19(3), 358–375.

5.Ullmann, T. D. (2019). Automated analysis of reflection in writing: Validating machine learning approaches. International Journal of Artificial Intelligence in Education, 29(2), 217–257.

6.Devlin, J., Chang, M.-W., Lee, K., & Toutanova, K. (2018). BERT: Pre-training of deep bidirectional transformers for language understanding. arXiv preprint arXiv:1810.04805.

KENNESAW STATE UNIVERSITY
COLLEGE OF COMPUTING AND SOFTWARE ENGINEERING

Author: Ashrith Kumar Devara

Advisor: Dr. Nasrin Dehbozorgi