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Development of Multi-modal AI Teaching Assistant Agentic System

Introduction

- **The evolution of LLM and the effectiveness of new technologies**

In addition to improvements in LLM performance and the scaling up of LLM, methods such as Chain of Thought, ReAct, and Agent are being researched, and in particular, Agent and Multi-agent have shown high performance in HumanEval and ALFWorld.

- **Features and potential of multi-agent systems**

Multi-agent is an agent that specializes in multiple specific tasks and can handle complex tasks, and there is a possibility that it can carry out tasks that humans perform.

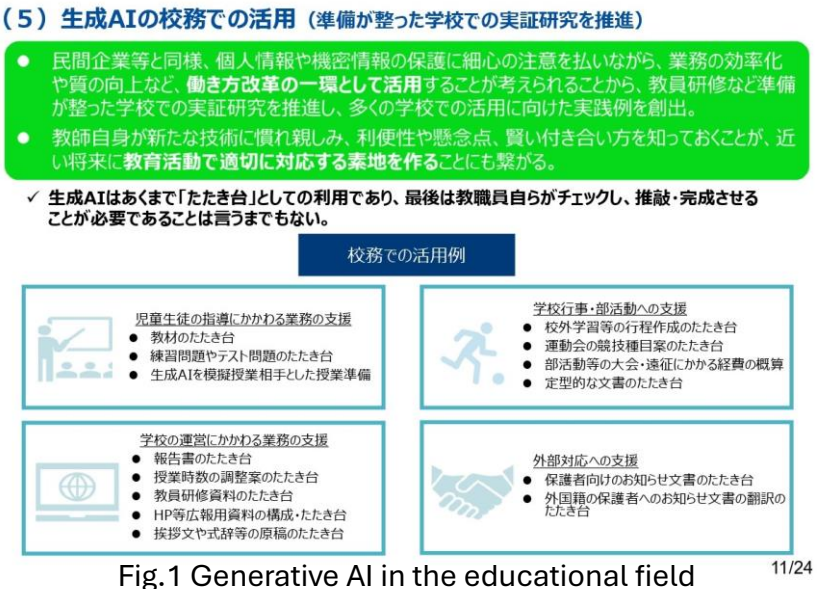


Fig.1 Generative AI in the educational field

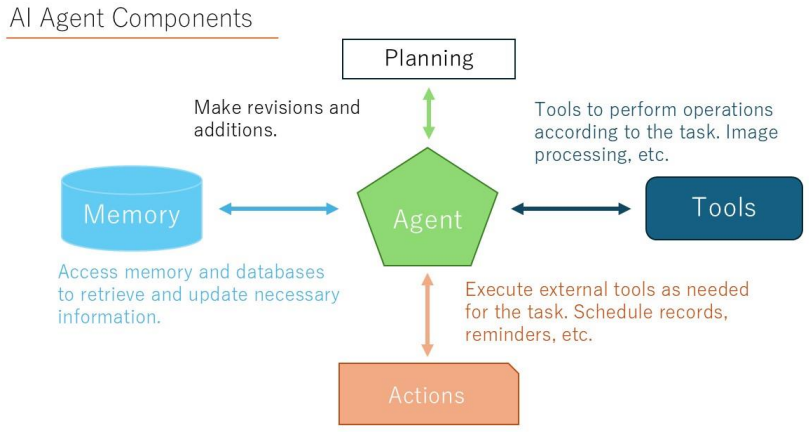


Fig.2 AI Agent System

- **Potential for educational support with AI**

As digitization progresses in the field of education, there is a lot of attention being paid to the potential for AI-based teaching assistants (TAs) to provide effective support to learners beyond the constraints of time and other factors.

- **Multi-agent solution of complex tasks**

As it is difficult to construct a TA with a single AI agent, we propose the idea of realizing a complex TA with a multi-agent system in which each task is assigned to a dedicated agent.

Goals

Research & Development of an AI Agents System for educational support with following capabilities :

- Multi-modal input and output including images such as photo, graph, figure, etc...
- Give correct answers to students' questions.
- Give advice on class assignments without direct answers.
- Grade class assignments and other problems.
- Provide additional problems related to the class and its assignments.
- Provide support such as attendance and scheduling for classes.

Teaching Assistant Agentic System

This system makes it possible to perform the complex task of TA by having multiple agents specialize in different tasks and then combining their responses. The following seven agents play a major role in the Teaching Assistant Agentic System. The following seven agents play a major role in the Teaching Assistant Agentic System.

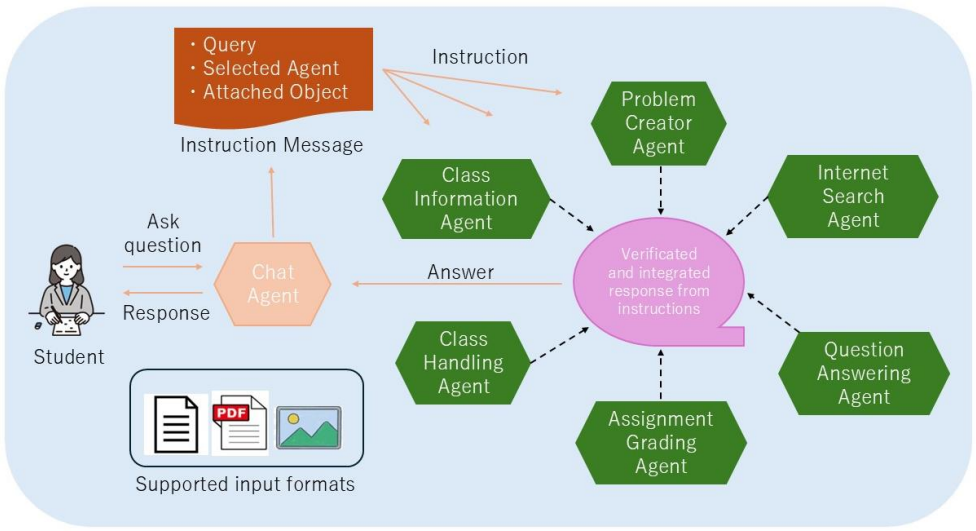


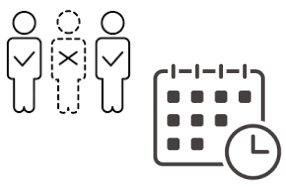
Fig.3 Teaching Assistant Agentic System Concept

• Chat Agent

The main task is to interact with the user, select the agent to be used, and create an instruction message for the selected agent.

• Class Information Agent

This agent answers questions related to the content of the lesson. It has the lesson content indexed, and its answers are always in line with the content.

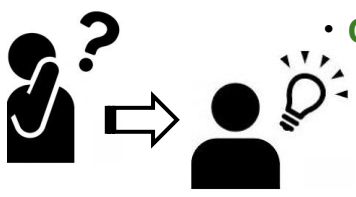


• Claas Handling Agent

This agent provides support for attendance and scheduling related to lessons. It can access calendars, spreadsheets, etc., and load and manipulate content.

• Internet Search Agent

This agent is an Internet searcher that performs searches corresponding to queries and returns the results.



• Question Answering Agent

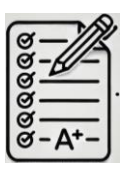
It will respond to the questions in the class. However, this response will not include a direct answer to the question, but will be designed to return advice.

• Problem Creator Agent

This agent generates similar problems that were not covered in class or in assignments, as sometimes these are not enough as practice.

• Assignment Grading Agent

This is an agent that grades assignments and problems.



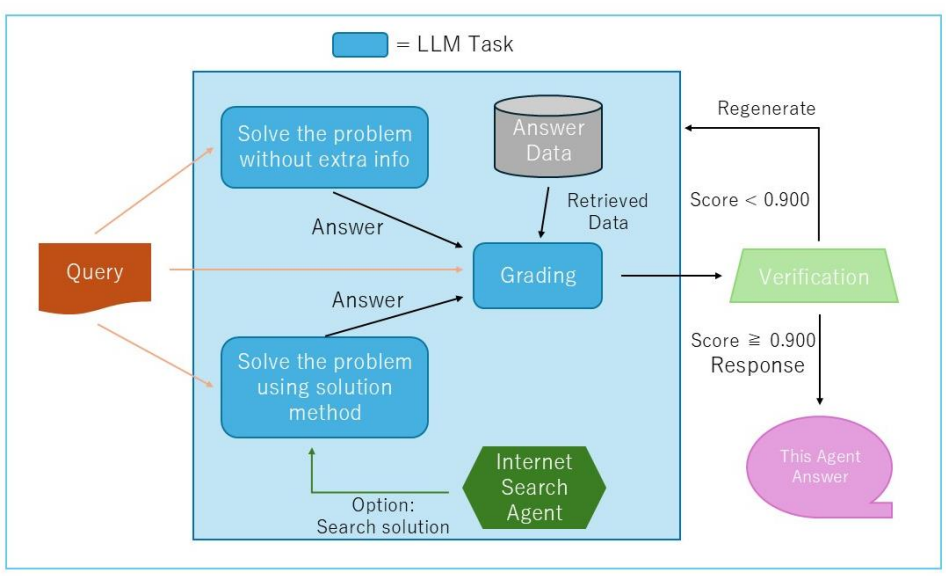


Fig.4 Assignment Handling Agent Diagram

Development Status

LlamaIndex LangChain OpenAI

The main system concept is ready and the actual construction of the system will be done. For the LLM model, we are considering using OpenAI 4o and 4V. In addition, we are using frameworks such as Llamaindex and LangChain to build the system and are experimenting with building Agents.

References

[1]文科省 「初等中等教育段階における生成AIの利用に関する暫定的なガイドライン」の作成について https://www.mext.go.jp/content/20230710-mxt_shuukyo02-000030823_004.pdf