AI-assisted educational platform for Gastric Oncology

by
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NANYANG TECHNOLOGICAL UNIVERSITY

10, 2025

DECLEARATION

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in accordance with School requirements this report is under 10,000 words in length;

all presented work was performed within the official project time frame as stated below;

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ABSTRACT

This study responds to the current shortcomings and highly international attention trends of gastric cancer, a disease which just has insufficient data, teaching resources, and research consistency, and builds on the basis of A!HistoCloud gastric tissue annotation platform by expanding the educational capabilities, combining AI and LLM modeling capabilities and finally establishing an AI-assisted educational platform for Gastric Oncology.

The platform is designed for three roles: student, teacher, and master, which not only accomplishes the basic teacher-student interaction and teaching capabilities, including new courses, homework correction, and data viewing, etc., but also establishes a communication community for three identities, building a memo calendar to facilitate information communication and reminders of personal schedules, as well as integrates crawler capabilities to facilitate master's literature query. Most importantly, a local LLM and an online Multimodal-LLM are established as well. The local LLM talks with the teacher to help him/her generate courseware and summarize the teaching information, while the online Multimodal-LLM interprets the annotations and image data from the researcher to provide learning guidance to the users.

This platform not only has a very perfect communication channel between different roles, but also has an efficient integration of technological capabilities, a very convenient operation experience and partition expansion. At the same time, integration of AI, LLM, and crawling technologies provides great guidance for both research and teaching of Gastric Cancer. It is hoped that the establishment of this platform can solve some of the deficiencies which were encountered in the process of research on Gastric Cancer and contribute to the development of biomedical engineering in the future.

1 INTRODUCTION

1.1 Background

Gastric cancer is a highly lethal disease and gradually becomes a worldwide health challenge, whose death rate mainly results from an advanced stage diagnosis [1], which means a timely diagnosis as well as intervention is crucial to improve its prognosis [2]. However, a large number of barriers in the researches regarding Gastric Oncology remain unsolved.

Differentiation of diagnostic benchmarks, lack of high-quality data, and insufficient professional educational resources have hindered the development of Gastric Oncology research. Besides that, diagnosis often lacks standardization and accuracy due to the subjectivity as well as the complexity of physician judgment [2]. Furthermore, lack of finely labeled pathology datasets has hampered research progress, and the low efficiency of traditional medical education systems, especially in the ability of integrating and teaching cutting-edge digital healthcare technologies, is another key problem. Therefore, an accelerated curricular revolution needs to be sparked urgently so that the digital literacy and lifelong learning capabilities of healthcare professionals could be enhanced [3].

In order to address the healthcare challenges outlined above, researchers are increasingly integrating healthcare and clinical research with some novel technical tools, due to the existing proof of AI's potential for problem-solving models and algorithms. For example, a deep learning model showed its efficiency in classifying abnormal tissue in the stomach [4], enabling fully automated lesion labeling and improving the accuracy of early gastric cancer pathology slides. Researchers designed AI-driven fuzzy supervised tools to simulate multi-intelligence educational clinical scenarios [5]. Additionally, the development of cloud computing technology provides elastic and expandable IT resources, which provide capacity support for modern education technology by optimizing the learning process, enriching learning resources, and enabling flexible implementation of education models [6]. The technologies discussed above provide new opportunities for clinical assistance and professional education.

1.2 Research Problem

The lack of trained medical pathologists in the world, particularly in Gastric Oncology, has contributed to delays in diagnosis and treatment, impacting patient outcomes. Traditional educational pathways for pathologists are time-intensive and resource-heavy, making it difficult to scale training in regions with limited access to expert instruction. There is an urgent need for innovative, technology-driven solutions that can accelerate the training process.

The use of available AI-based systems like AIHistoCloud offers a rapid and scalable approach to developing specialized educational platforms for Gastric Oncology. These kinds of systems could significantly accelerate the training of medical pathologists in Gastric Oncology, thereby addressing workforce shortages within a shorter time frame.

1.3 Objective

This study aims to explore a combination of AI technologies to build an AI-assisted education platform on Gastric Oncology. The platform has three main objectives:

1. To comprehensively improve the quality and efficiency of education.
2. To enhance the accuracy and standardization of early clinical diagnosis.
3. To create an unprecedented and intelligent pathology learning resource.

The platform will be constructed to use the annotation label as the database and develop foundation.

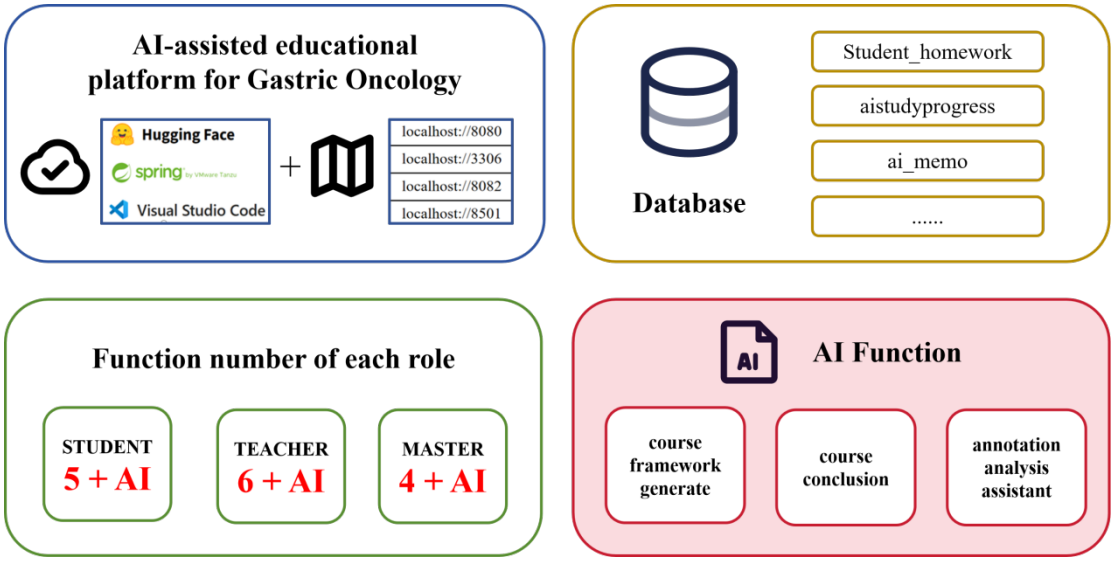


Figure 1. Overview diagram of the construction education platform

The establishment of the platform will focus on impacting targeted educational skills and cutting-edge knowledge specific to Gastric Oncology, ensuring that students can quickly gain knowledge and apply it to the clinic condition. The AI-assisted teaching system not only helps teachers in tasks before and after study, but also acts as an intelligent aid for students to study annotation and for masters to better understand morphological tissues. Such education technology can be integrated to reduce the redundancy of educators' work, improving work efficiency, and form a closed-loop education system. This initiative is of great significance in boosting the growth of medical professionals, promoting the training of compound talents, improving the teaching quality of gastric tumor diagnosis, accelerating the transformation of knowledge, and finally improving the prognosis of patients.

1.4 Scope

The A!HistoClouds platform is an in-house software solution developed by the iDMP team at the Bioinformatics Institute (A*STAR BII) to facilitate data management, annotation, and AI model integration for digital pathology applications. The platform has fundamental functions like user registration, login and data interaction. The roles involved in the platform are admin, staff, and user, which enable them to perform basic research tasks, such as making annotations of gastric cancer tissue images, driving AI-assisted annotations, generating reports and reviewing historical data.

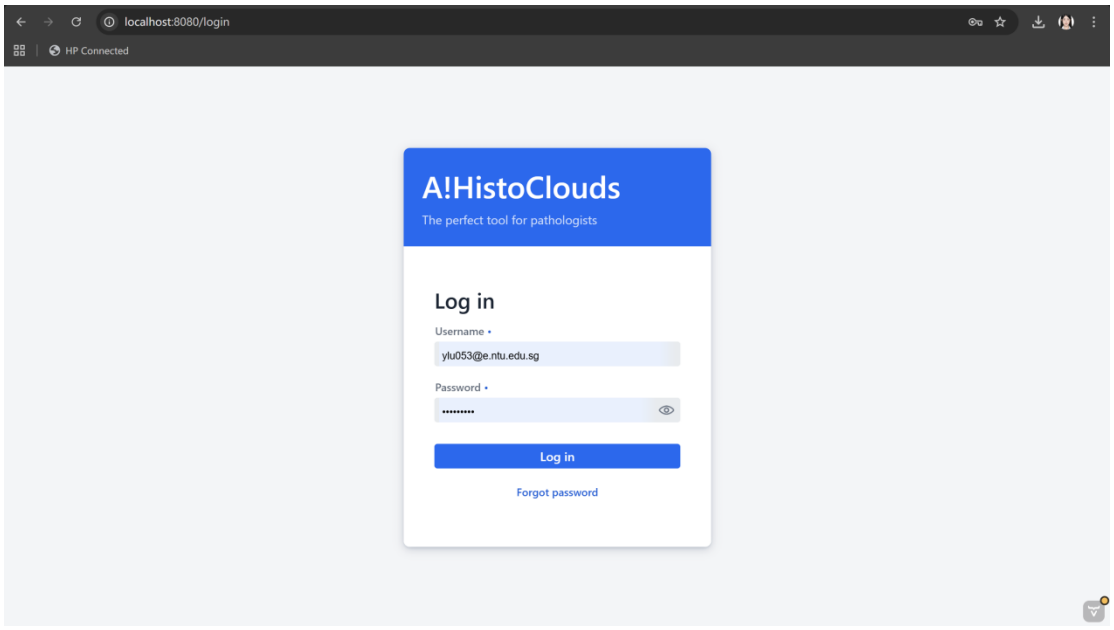


Figure 2. Main menu of A!HistoCloud research and education platform

The AI-assisted educational platform for Gastric Oncology is the expansion of the main functionality of A!HistoCloud by integrating special educational tools. These include features for course creation, homework assignment, grading, academic paper importing as well as multimedia integration. Additionally, the platform also provides extra functions such as calendar memos and implements web crawler technology for research resource acquisition. Moreover, the platform has two fully deployed large language models [7] to generalize cancer education contents and analyze Gastric Oncology labels. These LLMs are deployed locally and accessed through website. These features not only efficiently facilitate data gathering and information integration for teachers during the educational process, but also act like a professional clinical researcher, making it easier for all users to understand annotations of gastric tissue. All designs and functions of the platform play a crucial role in the advanced development of Gastric Oncology education and research work.

2 MATERIALS AND METHODS

2.1 Workstation and Environment

The main function framework of this AI-assisted educational platform is built on the Vaadin framework (Java programming language). It is being developed, deployed and communicated across multiple environments.

2.1.1 Workstation Specifications

The development and testing procedure were conducted on a local machine, which hosted most of the locally deployed functionalities and communication interfaces. This project uses one cloud-based model on Hugging Face open source website. The working hardware device is Lenovo Pro14GT.

Tab 1 Details of hardware development environment

Attributes	Descripcion
Processor	AMD Ryzen H-Series
Memory (RAM)	32 GB
Storage	1 TB Solid State Drive
GPU or CPU	CPU

2.1.2 Deployment Environment

In order to facilitate functionality testing and integration validation during the design and completion phases of the project, the core features of the AI-assisted educational platform for Gastric Oncology are deployed within a local environment. The AI function which understands automatically crops Gastric tissue images uses an open source VLM on the cloud.

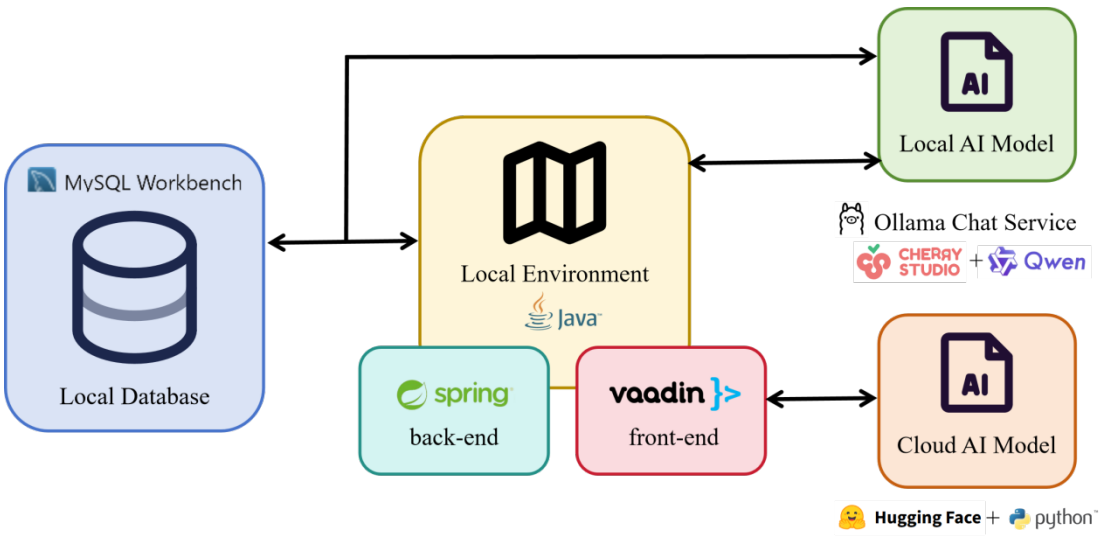


Figure 3. Development environment, code type and information flow diagram of the education platform, Bidirectional arrows mean the data information is continuously interacting.

The main development environment and IDE of the platform are shown in Figure 3. The database of the whole platform is built with SQL language, and managed using MySQL Workbench IDE for data visualization and editing. The front-end is primarily developed on Vaadin framework, and handles core functions that involve user authentication, course management, and teacher-student data interaction. The back-end is based on the Java Spring Boot framework, which incorporates these functions and handles the interaction with the front-end.

Additionally, the platform incorporates two LLM models. One of the LLMs invokes the local Qwen3 LLM service, which is deployed via Ollama, to act as an "AI Tool Box" to provide teaching assistance for teachers. Its IP endpoint is hosted by Cherry Studio. The Histo-LAB-AI feature of the platform connects to the SmolVLM-500M-Instruct model, hosted on the Hugging Face open-source website to provide users with professional insight into pathology image labeling. The invocation of this cloud model is realized by the communication between a local service and an independent Python website, called by a local service and a standalone Python interface communication built with the Streamlit module.

2.2 Implementation Overview

Based on the existing features of A!HistoCloud platform (shown in the blue rectangle in Figure 4), I have extended roles and finally established an education platform for roles named teachers, students and masters. This platform has the necessary education functions that match a typical teaching ecosystem, such as course creating, learning modules, homework grading, evaluation, community feature. The platform also adopts a real-time thesis acquisition tool through web crawler technology, that enables masters to collect scientific information faster.

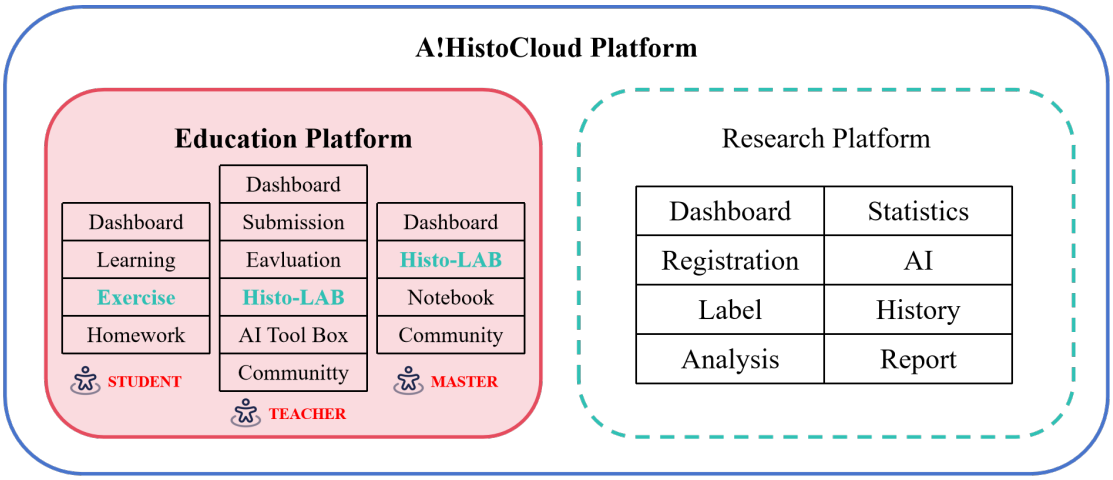


Figure 4. Function overview map of the whole A!HistoCloud platform. The green rectangle is the original functions and red rectangle shows added features. Blue color words in the red rectangle indicate education functions integrated with AI..

Additionally, I designed two AI-powered assistants in this platform. The first is an education assistant that helps teachers generate course lesson plans and teaching conclusion reports. The second is a research helper that provides professional and concise pathological interpretation based on annotated gastric tissue images. All the original functions and the newly developed educational feature (shown in the red rectangle in Figure 4) are shown in the figure above.

Table 2. Main roles, functions and realization technical path of education platform

Role	Responsibility	Vaadin Components
teacher	Create and design teaching resources, complete student assessments	Dialog, Upload , MessageList, Chart
student	Taking courses related to gastric cancer, learning cellular tissue labeling methods.	Upload, StreamResource , Anchor, Dialog, Chart
master	Self-research work, provide educational guidance to teacher and students.	RichTextEditor， Lumo, StreamResource, Anchor, DatePicker, TextArea

The educational module function is developed based on the Vaadin Flow framework, which provides extensive user experience, an easy-to-use interface and real-time data interaction for teachers, students and masters. Each role has its responsibility and the Vaadin components involved, which are shown in Table 2 in detail.

2.3 Main Modules

a) Basic Teaching Module and Forum

Teaching Module consists of course creation section and student evaluation section. Their data flows are shown in Figure 5 and Figure 6 respectively. In short, the data flow and working methodology of these functions are a collaborative workflow integrated by a 'Vaadin + Spring Boot + Database' code framework. The logic of data access and database integration is implemented in the 'table_nameRepository.java' files. The object-relational mapping which converts database entities into platform variables is declared in the file named 'table_name.java'.

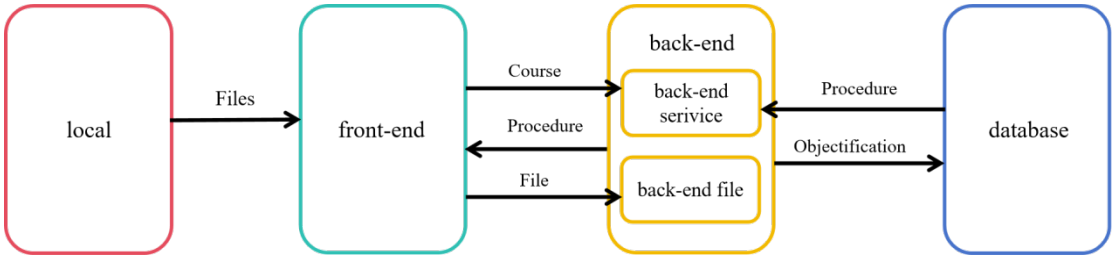


Figure 5. The main technical framework for course creating functionality, and data flow of it in Teaching Module

In the course creation section, a teacher creates a course by entering the course name and description, assigning students and selecting local course attachment files to upload. The back-end service stores the file streams to the file system of the server, creating new paths to files. The course information and its relationships with assigned students are written to the database. Moreover, a teacher can make a query to call the database to verify the query progress of a student in a particular course by executing a request that is responded to by the back-end istudyProgressRepository.java file.

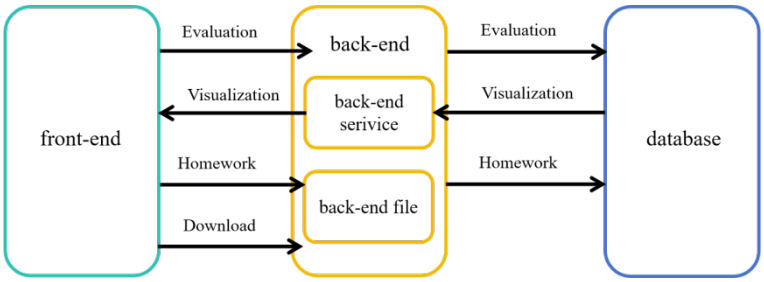


Figure 6. The main technical framework and data flow mode for student evaluation function in Teaching Module

In the student evaluation section, a teacher enters the assignment details like title, due date, assigning to certain students and uploading attachments. These files are stored in the back-end service, assignment is recorded in the database. Then, students can read their assignment details retrieved from database, and submit the assignments. After a student submits the assignment, the teacher can view and click on the evaluation button. The teacher can then enter the scores and rubrics through the designed window. Once the teacher has clicked on submit, then the back-end service updates the relevant student assignments attributes in the database. Lastly, a student can download homework through an Anchor component, hosting a component which points to the location of the file in the file system of the server.

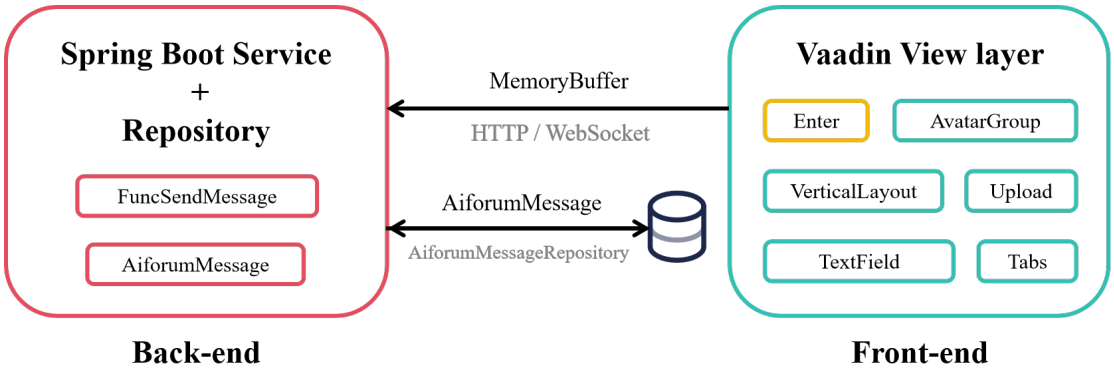


Figure 7. Forum's construction structure and data flow for community feature implementation,. The yellow rectangle indicates the start of data transformation and communication when the 'Enter' button is clicked.

Forum is constructed using the Vaadin Flow framework, and integrated into the community function. The front-end interface receives the user's input (both text and attachment) that is stored in local memory. The user will be able to store it in the computer's memory before sending it to the community. Upon clicking the enter button which the user uses to post, the message is passed to the back-end service through a communication on the server side.

The file stream will be written to a specific path configured to the file system of the server. Once a storage has been made, a URL is generated, and stored in the database. Forum messages will store message details such as content, sender ID, timestamp and the attachment URLs through an object named AiforumMessage. The new object is immediately transferred to the database by the service layer. The architecture allows the forum to query and display all historical messages immediately when the forum is loading.

b) AI-assisted Helper for the Pathologists Teaching

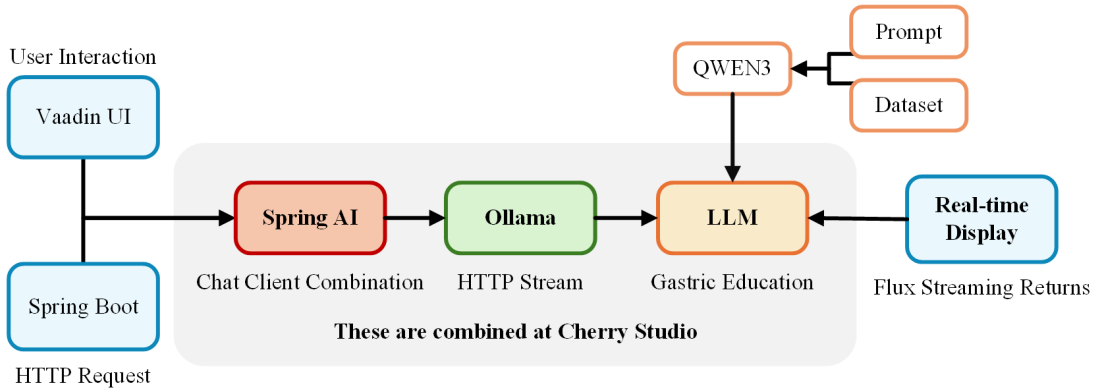


Figure 8. Combination pattern of the LLM Model on Gastric Oncology Education

The teacher AI-Tool Box function is built with Spring AI[1] which is recommended by Vaadin, Cherry Studio[2], Ollama[3][9] and a fine-trained Qwen3[4] LLM. The data communication and integration could achieve a real-time update and present a visualization interface. The above figure demonstrates the exact stack of technology and data interaction path. Cherry Studio in the front-end interacts with the user interface. Spring AI in the application layer integrates with business logic as well as the AI integration framework. Ollama in the service layer interacts with local LLM server, and Qwen 3 in the model layer is trained with prompt and datasets.

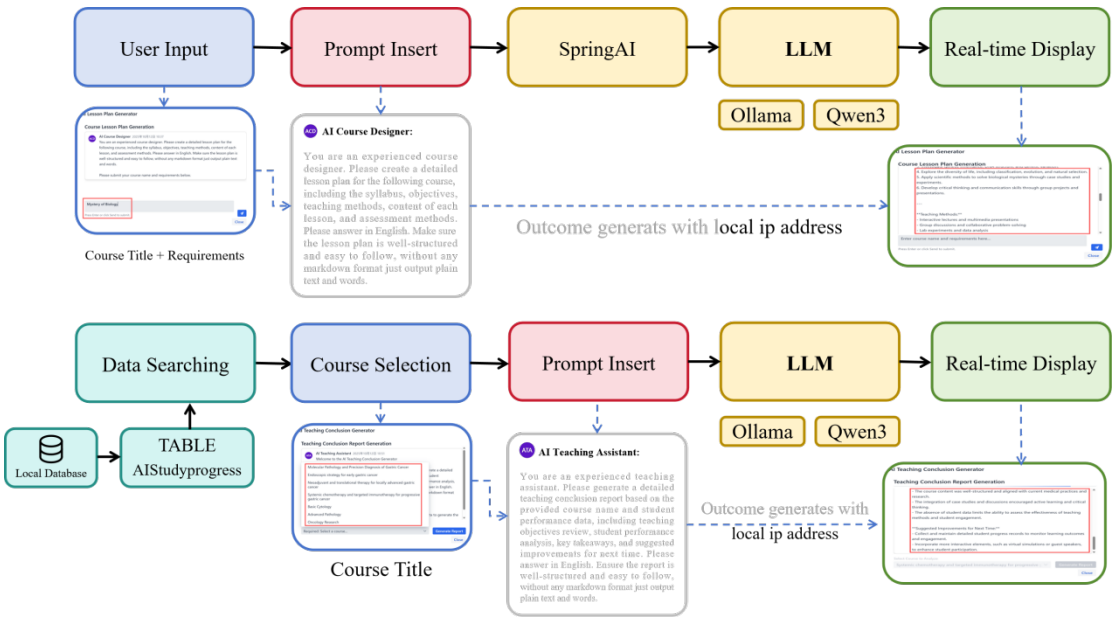


Figure 9. Full flow of two application scenarios of teacher-side LLM model, the flow above shows the detailed procedure of course framework generation functions, while the below flow shows how the course evaluation part works.

[1] https://spring.io/projects/spring-ai
[2] https://www.cherry-ai.com/
[3] https://ollama.com/
[4] https://qwen.ai/research/

The auto-generation of course planning framework starts when an input of course title is entered by a teacher. Spring AI will then construct a detailed prompt, and Ollama forwards the request to LLM. The LLM produces a detailed course and outputs a structured output with keywords, objectives, teaching methods, and content of lesson. This output is in the form of a starting syllabus.

In order to create a teaching conclusion report, a teacher selects one of the existing courses. The system reads the course ID and related information, including the learning process. The key information is extracted by Ollama and is analyzed with the help of LLM. The multi-dimensional conclusion report is produced by the LLM. Their data communication is done using HTTP REST APIs. These APIs are created by Cherry Studio and Spring AI to process requests such as the calls to the local IP address where Ollama is deployed. Ollama's local process communication with Qwen3 LLM is then handled locally. The specific flow is also shown in the figure above.

c) AI-assisted Histopathological Image Analyzer

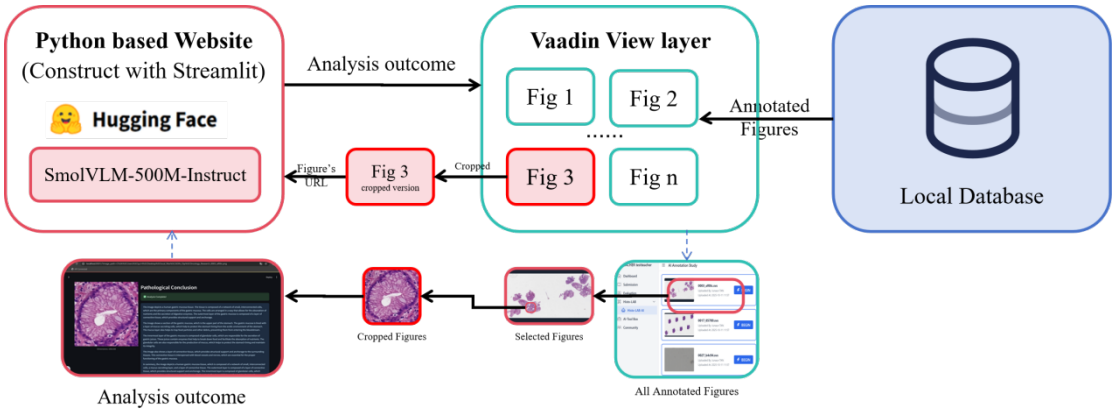


Figure 10. Full flow of AI-assisted Histopathological Image Analyzer

I constructed an intelligence named 'AI-assisted Pathology Image Analysis Tool', which consists of a Vaadin front-end with a back-end service written with Python (Streamlit module). When the function is launched, a list of labeled images will display in the interface. If the user selects a learning target, the platform will read the labeled file, crop specific regions for analysis and serve it automatically. The URL parameters will be generated to pass the cropped image path to an externally-run webpage through IP address and wait for inference learning and results presentation.

Table 3. Comparison outcome of three types of SmolVLM in tissue figure analysis

Model	Pre-Processing Time	Answer Time	Quality of Answer
SmolVLM-256M	18.17s	9.92s	Bad
SmolVLM-500M	8.91s	46.48s	Good
SmolVLM2-2.2B	65.75s	161.05s	Bad

Table 3 shows the comparison of the performance results of different models on the tissue figure analysis during my model selection process. Based on the performance I finally chose to use the SmolVLM-500M-Instruct VLM from HuggingFaceTB for deployment in the back-end. When called, the 64x64 images which are scaled to meet the model's input requirements are fed into the model for inference along with the pathology prompts.

3 RESULTES

3.1 Database Establishment

A novel hierarchical and highly structured databases which extend original A!HistoCloud database is built for facilitate the content organization of the educational platform, tracking students, assessment of teachers as well as the interaction between the three roles, which structure is shown in Figure 11.

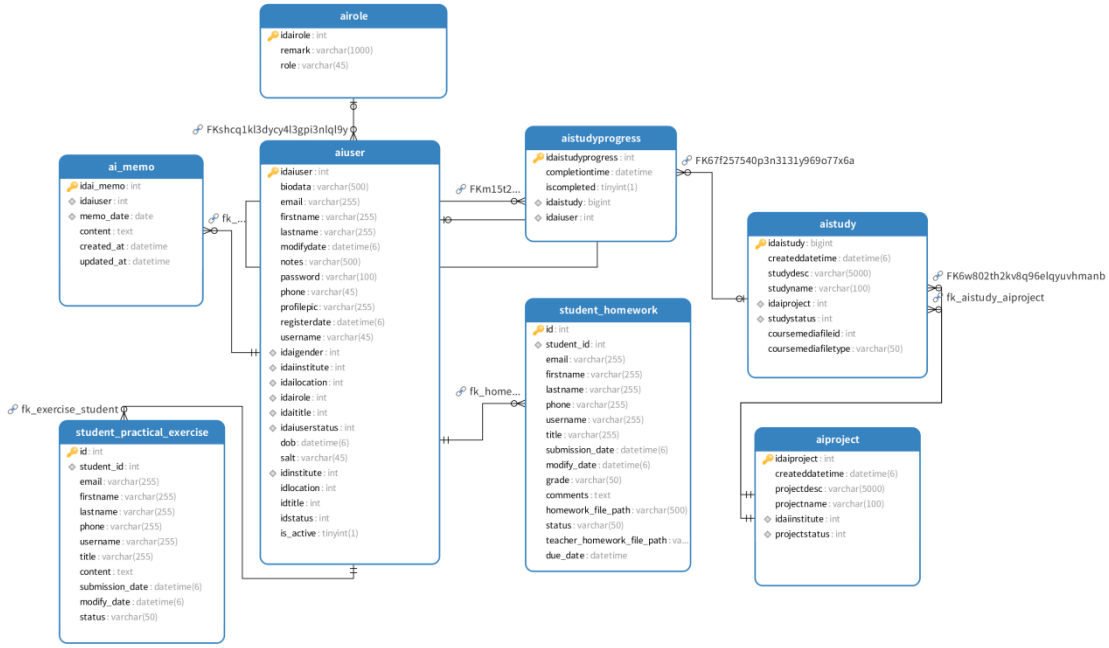


Figure 11. Structure and relationship of the main table established in education platform.

Table 4. Main table of the database used for education platform

.Table Name	Key Type	Key Attributes
aiuser	idaiuser (PK)	idairole, idaiinstitute
aiinstitute	idaiinstitute (PK)	institutename
aiproject	idaiproject (PK)	projectname, idaiinstitute (FK)
aistudy	idaistudy (PK)	studyname, idaiproject (FK)
aistudymedia	idaistudymedia (PK)	idaistudy (FK), rawimagefilepath
aistudyprogress	idaistudyprogress (PK)	idaistudy (FK), idaiuser (FK), iscompleted
student_homework	id (PK)	student_id (FK), submission_date, grade, status
ai_memo	idai_memo (PK)	idaiuser (FK), memo_date (Unique Key)

In summary, `aiuser` table provides the basis for linking learners to their specific `aiinstitute` and `airole`. On top of the original identities, roleid=4, 5, 6 (student, teacher, master) are created for the platform. All the login methods must gain accurate permissions and progress reports, which are tied to the correct user context. `Aistudyprogress` table is the main table for the education platform, which utilizes the composite primary key of `idaistudy` and `idaiuser` to enable accurate, de-duplicated recording and tracking of each student's course completion status. The table also serves for querying and calling of the LLM (see Section 3.3) generated course conclusion reports. The structure of the database is shown in Figure 12, and the main tables, including keys relationship, are shown in Table 4.

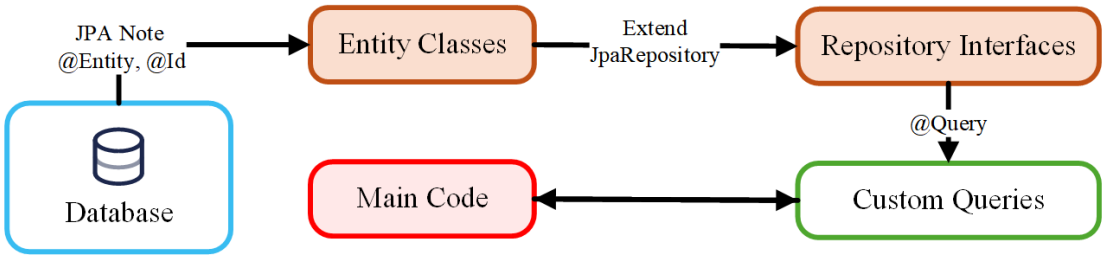


Figure 12. Methods of connection between database and educational platform

Link and update of database with education platform are integrated in an efficient, loosely coupled three-tier structure for database operations. Entity Classes are defined as the data model bridge (for example, Aidatastatus.java, Aigender.java, etc.). Java Classes are used as the direct mapping of the database tables to be connected through the JPA annotations. Repository Interfaces implement data access functions (take AidatastatusRepository.java, AigenderRepository.java, etc. as examples) and perform database operations by inheriting JpaRepository interface, automatically realizing operations such as save(), findAll() and so on. I also write some specific query methods linked to JDBC via “Conn” to generate complex SQL queries as well as transfer their logic annotated with @Query in string text to handle special conditions. The concrete implementation framework is shown in the following Figure.

3.2 Platform Deployment

3.2.1 Student Core Functions

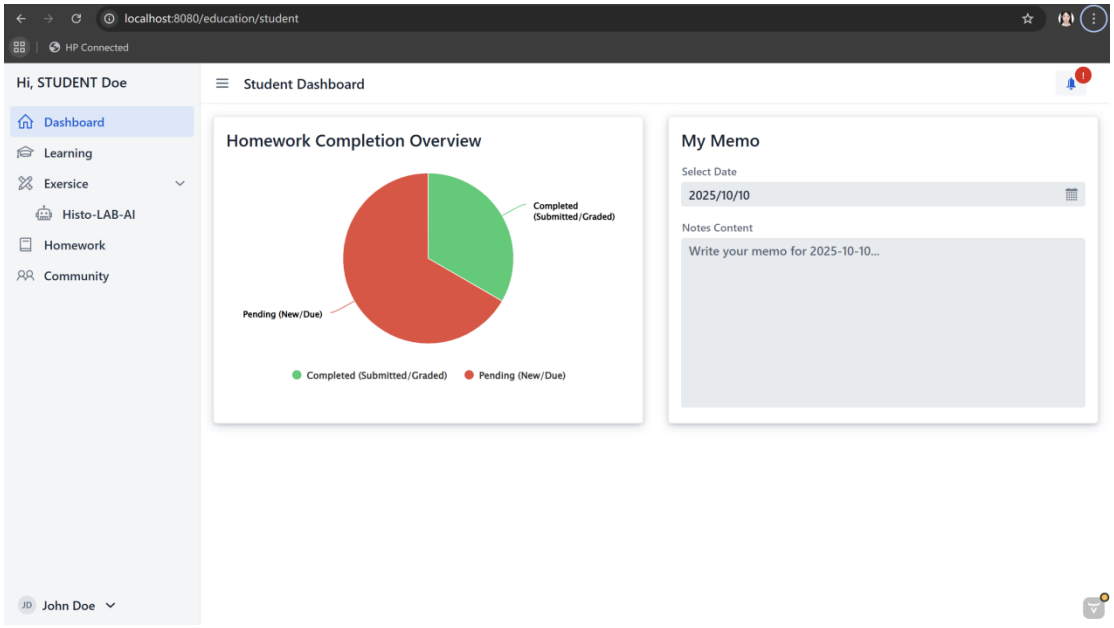
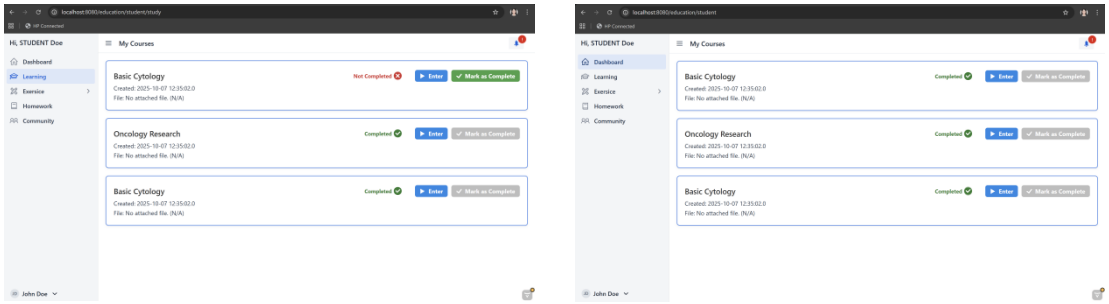


Figure 13. Rendered figure of student Dashboard function

The main functions of role student contain five sections: Dashboard, Learning, Exercise, Homework, and Community. When a student logs in, the Dashboard section displays all of the assignments and completion status, as shown throw a pie chart in Figure 13. A calendar and memo are available for student to jot down unaccomplished tasks.

When teacher assigns a course to student, the student can view the course information in the reading section. When the student clicks the ‘ENTER’ button on the learning panel, specific course information and media download links are displayed. The student can mark the learning as complete after study and the system will change the status from ‘Not Completed’ to ‘Completed’ as shown in Figure 14(b). The completion study information will be synchronized to the teacher, which is crucial to facilitate the follow-up of the learning procedure, which is shown in Figure 20.



(a) (b)

Figure 14. (a) Rendered figure of student Learning function (remain study)

(a) Rendered figure of student Learning function (finish study)

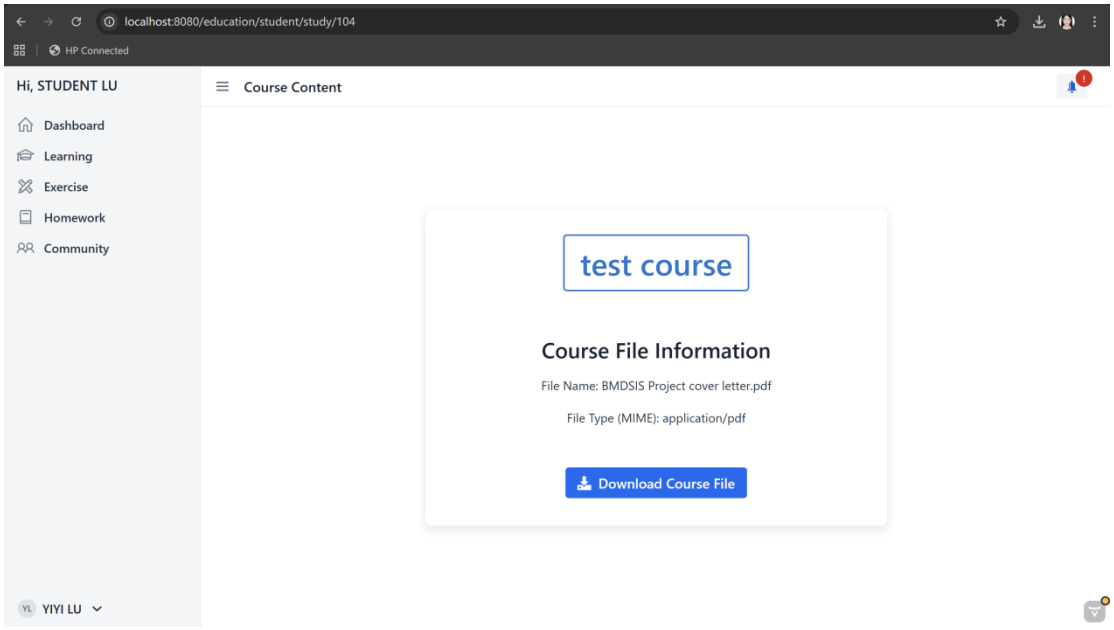


Figure 15 Rendered figure of student Learning visualization function

The Student's Exercise section is shown in Figure 15, which is similar to the Analysis section in the original A!HistoClouad platform. This is a cloud-based tool for Gastric Oncology labeling, where a link between the educational and research platforms is made. This section is important to facilitate students' clinical simulation and labeling practice as shown in Figure 16.

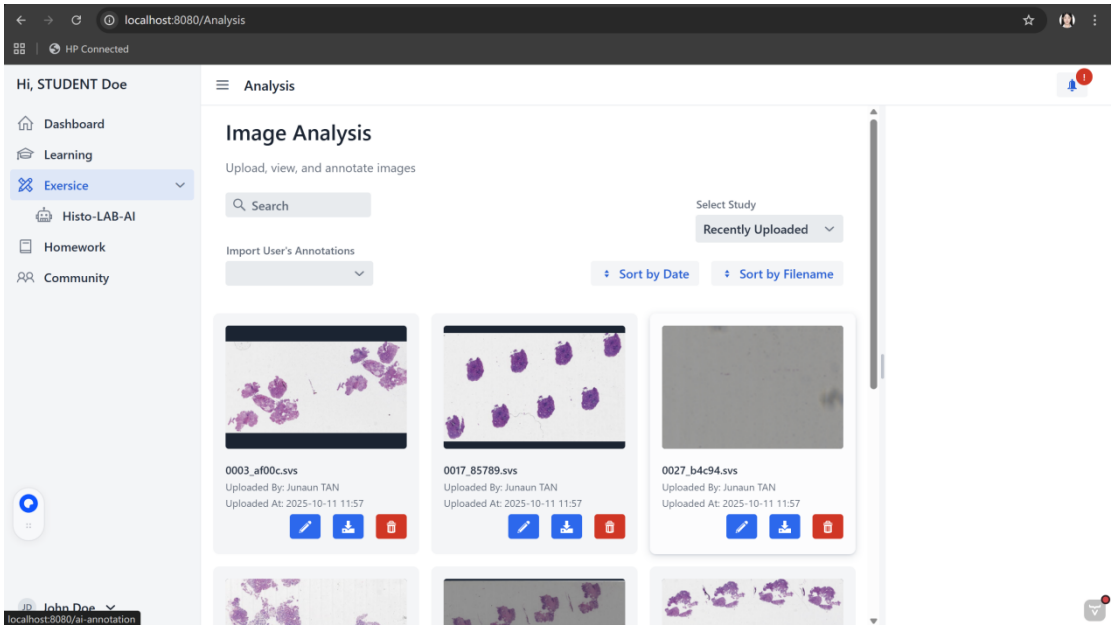
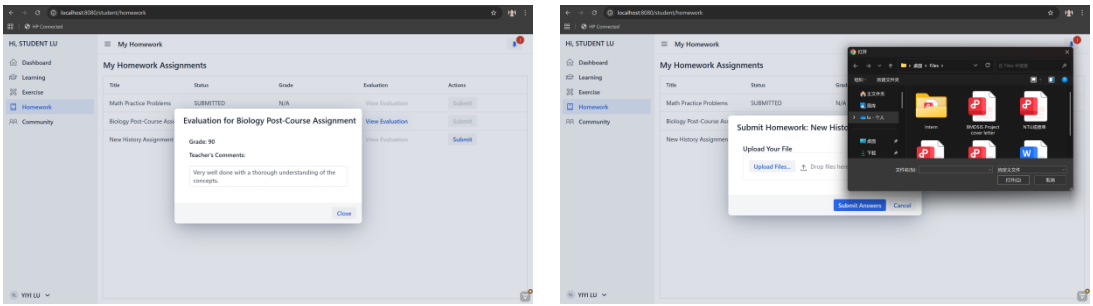


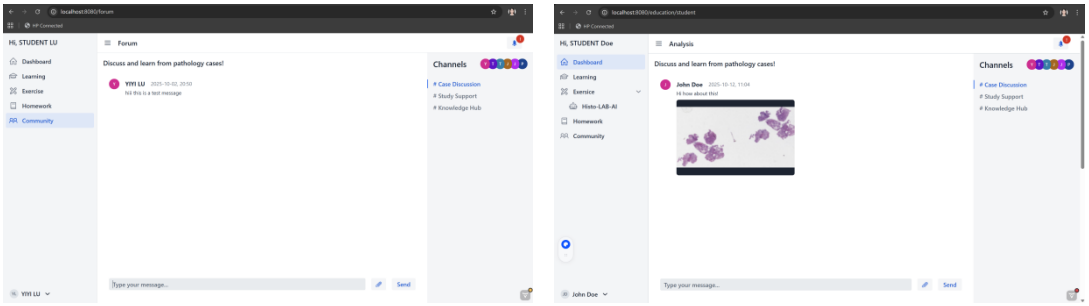
Figure 16. Rendered figure of student Exercise function



(a) (b)

Figure 17. Rendered figure of student Homework function

Homework interface is shown in Figure 17, which displays homework information in form of a table. This section allows student to upload local attachments for homework submission. Student can view the score and comments provided by teacher by clicking 'View Evaluation' button. All the data are sharing and synchronization between teacher and student.



(a) (b)

Figure 18. Rendered figure of student community function

Community function is designed as a sharing forum in which students, teachers as well as masters are allowed to share insights of their learning processes with each other. Media attachments and text-based messages are involved. This function facilitates the sharing of knowledge, fostering more detailed and comprehensive communication.

3.2.2 Teacher Core Functions

The Teacher Dashboard section visualizes course details, student learning progress as well as homework completion rate statistics, etc. The bar chart below visualizes the completion rate of students in each course. This visualization makes it easy for teachers to adjust course lesson plans and to keep up with the learning status of students.

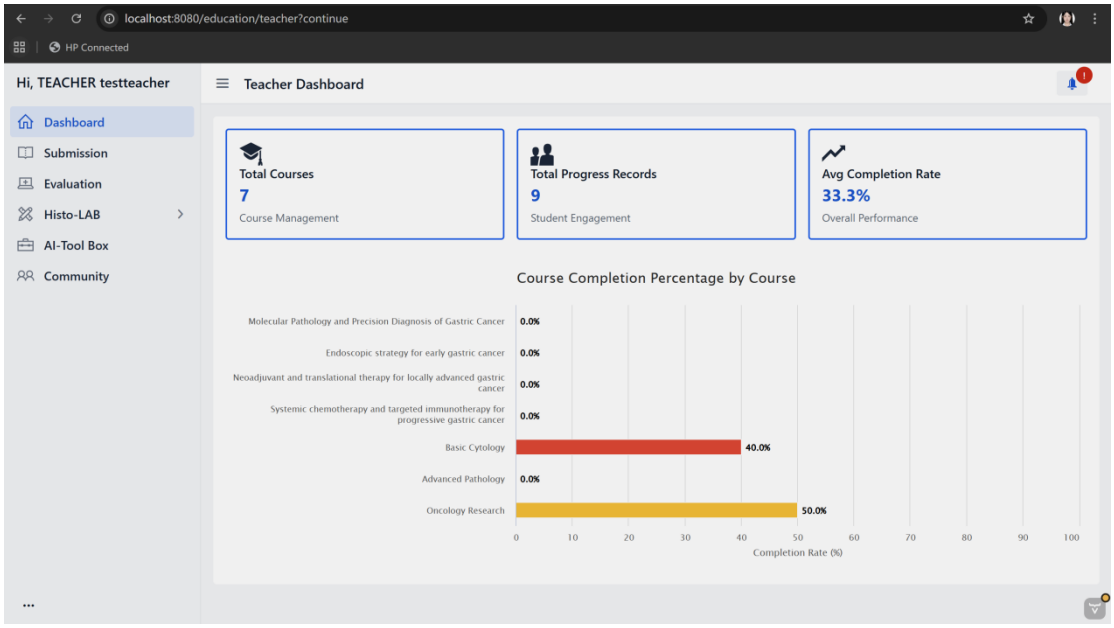
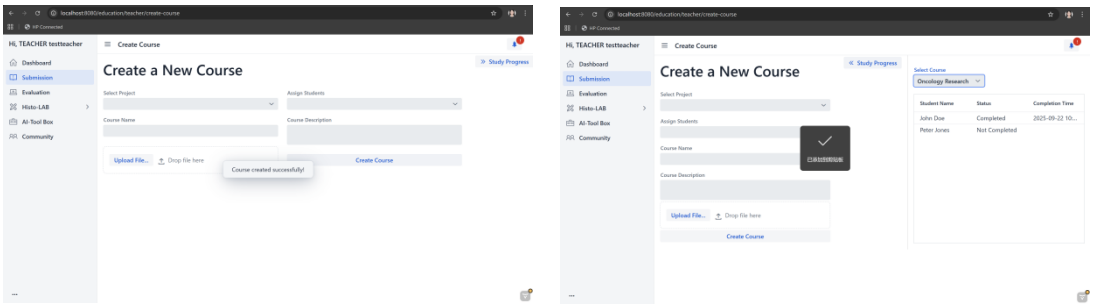


Figure 19. Rendered figure of Teacher Dashboard function

The course creating interface is designed to add course information by uploading attachments, selecting students, and entering course details. The uploaded course will be synchronized to students. The results of study completion will also be synchronized to teachers, as demonstrated in Figure 20(b). Figure 20 (a) shows the content for teachers' input during the process of course creation.



(s) (b)

Figure 20. Rendered figure of teacher Submission function the left one is brfore suspended and right one is after suspended

Teacher evaluation interface shows the completion status of the student's assignments as shown in Figure 21. Teacher can grade and comment on the assignments. Figure 22 shows that teacher can also upload the course work, set the completion deadline and assign students. The grade and assignments will be synchronized to students.

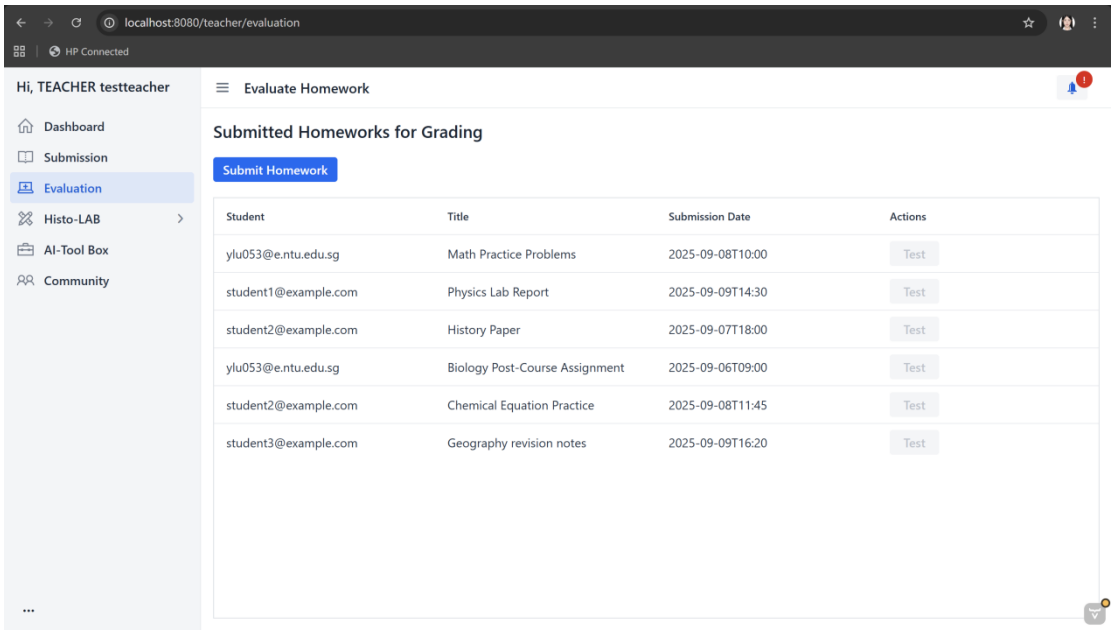


Figure 21. Rendered figure of teacher evaluation function (evaluation panel)

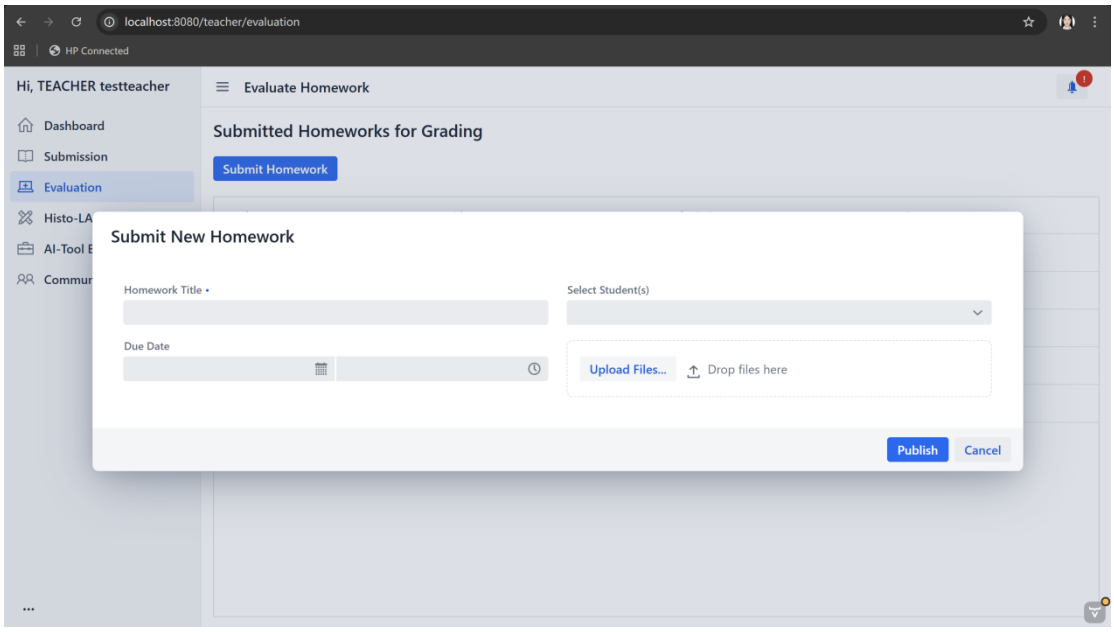


Figure 22. Rendered figure of teacher Evaluation function (assign panel)

Teacher AI-Tool Box was designed to generate a syllabus generation helper in Course Plan Generation and Course Teach Conclusion functions. Both parts use locally deployed LLMs, which generate responses matching teaching conditions based on cue words and task instructions, with automated conversations and questioning functions. The design concepts and results of the LLM Model on Gastric

Oncology Education will be discussed in Section 3.3.

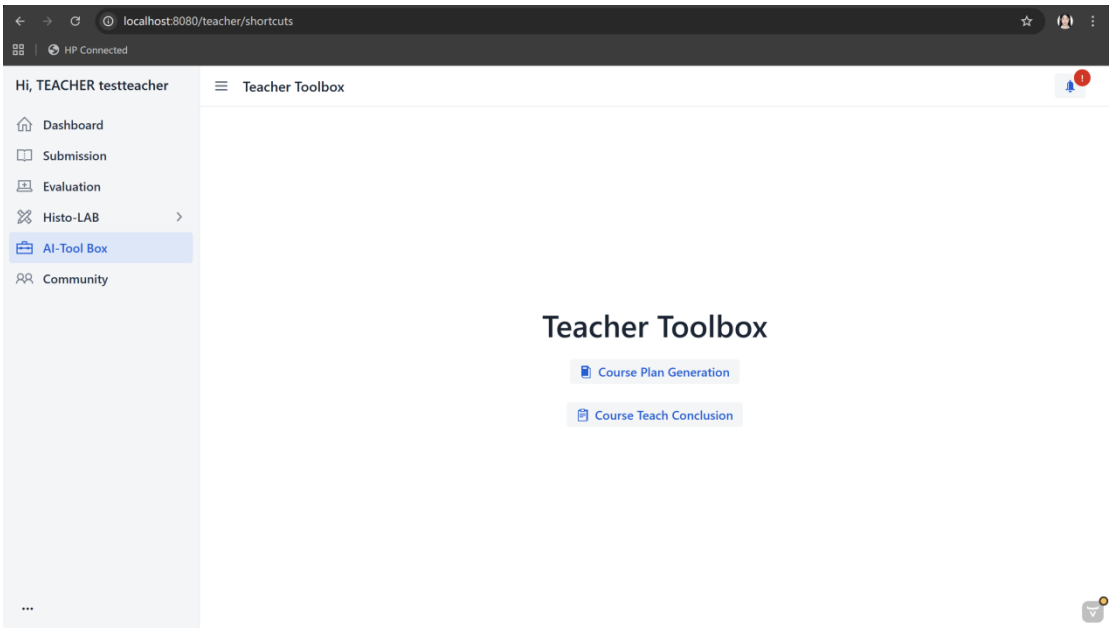
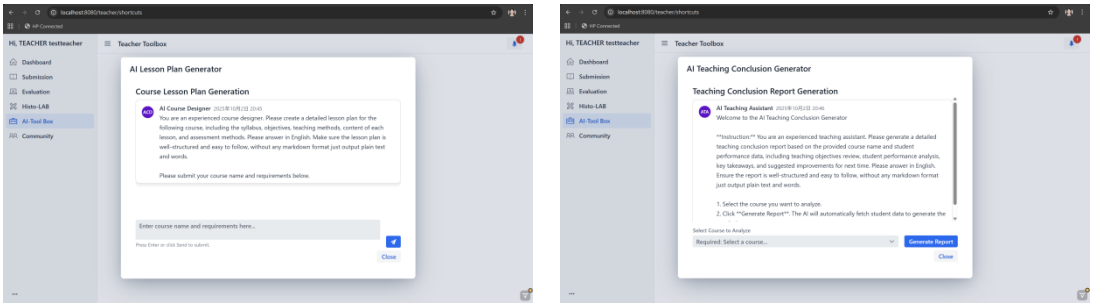


Figure 23. Rendered figure of teacher AI-Tool Box function 1

Figure 24(a) shows the Prompt for course plan generator: You are an experienced course designer. Please create a detailed lesson plan for the following course, including the syllabus, objectives, teaching methods, content of each lesson, and assessment methods. Please answer in English. Make sure the lesson plan is well-structured and easy to follow, without any markdown format just output plain text and words.

Figure 24(b) shows the Prompt for course conclusion generator: You are an experienced teaching assistant. Please generate a detailed teaching conclusion report based on the provided course name and student performance data, including teaching objectives review, student performance analysis, key takeaways, and suggested improvements for next time. Please answer in English. Ensure the report is well-structured and easy to follow, without any markdown format just output plain text and words.



(a) (b)

Figure 24. (a) Rendered figure of AI Lesson Plan Generator in teacher AI-Tool Box function

(b) Rendered figure of AI Lesson Teaching Conclusion Generator in teacher AI-Tool Box function

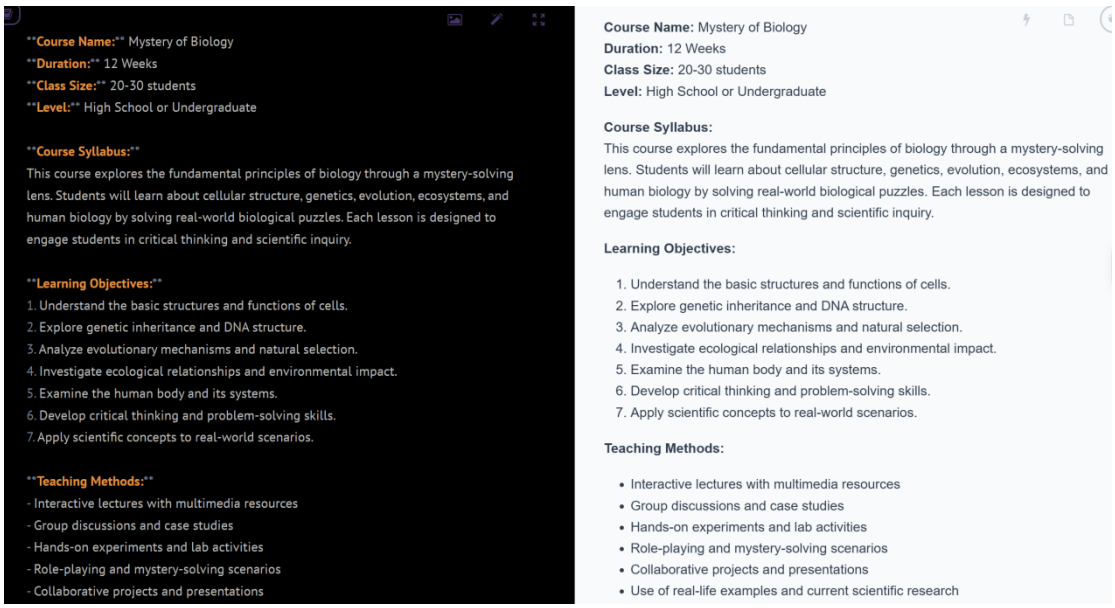


Figure 25. Emerging outcome of AI Lesson Plan Generator on course framework generation

The content and pattern of the answer generated by AI Lesson Plan Generator is shown in Figure 25. This LLM AI assistant plays a very important role in guiding and summarizing the procedure of Gastric Oncology education. It not only provides the teacher with more professional guidance in teaching, but also significantly improves the efficiency in the course planning process compared to the traditional human statistical methods.

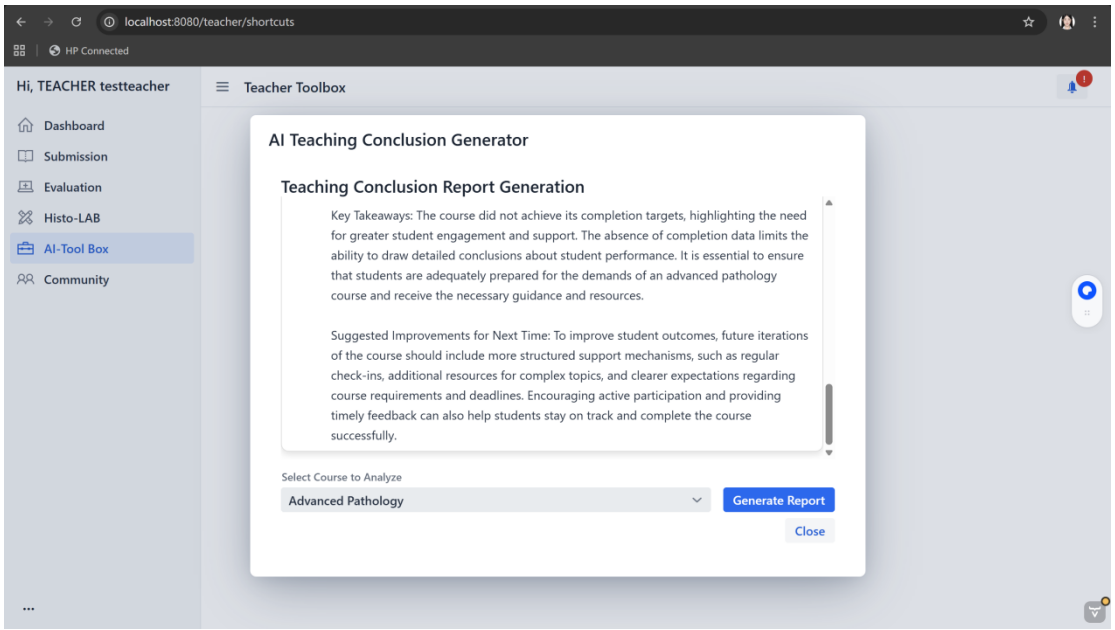


Figure 26. Emerging outcome of teacher-side LLM model on course summary generation

3.2.3 Master Core Functions

Master's Dashboard consists of a crawler interface on the left and a memo calendar on the right, as shown in Figure 27. The crawler will return relevant theses according to the input like the keyword and the number of links that are wanted. All the resources are crawled from PubMed[5], which allows masters to jump to visit relevant websites by just one-step clicking on the links. This makes it easier for them to view the relevant research resources in real time, getting first-hand scientific research information as well as providing a very convenient integrated platform.

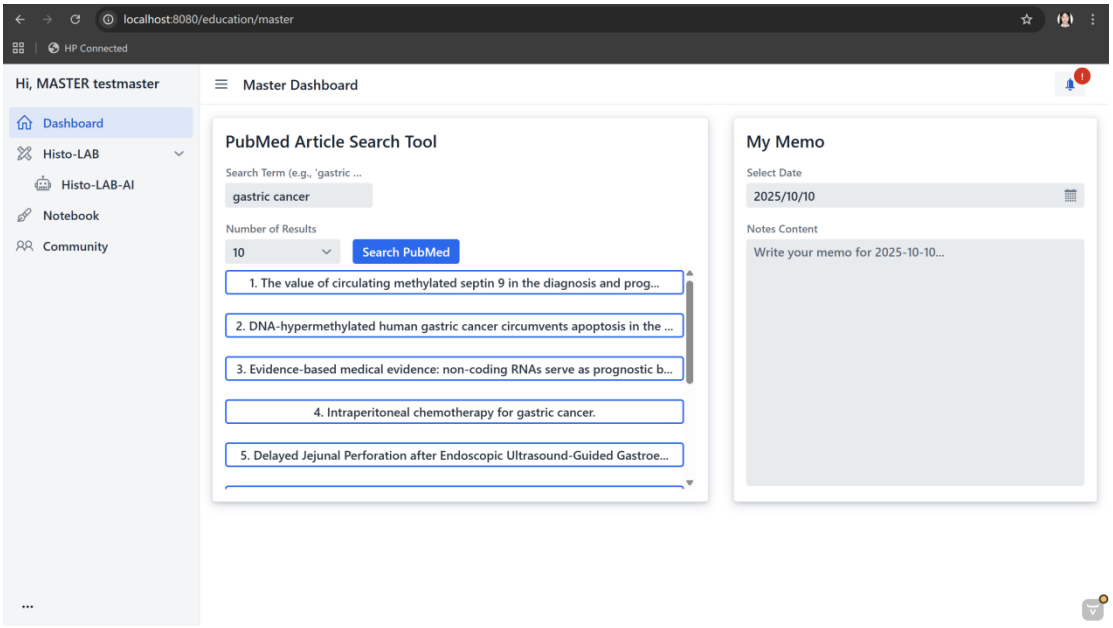
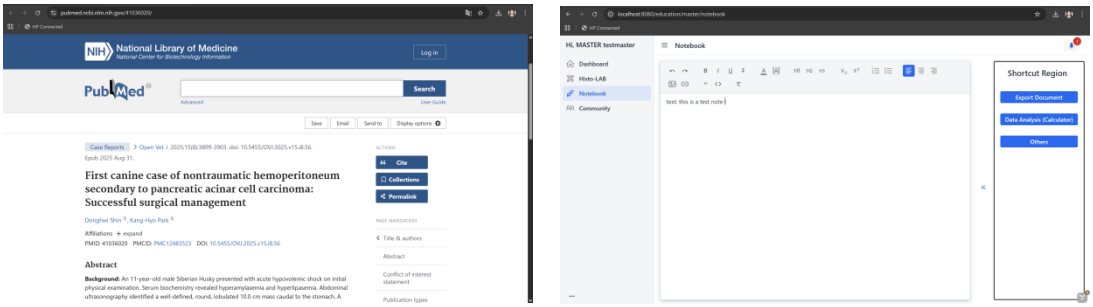


Figure 27.Rendered figure of master Dashboard function



(a) (b)

Figure 28. (a) Rendered figure of master's redirection of thesis link in Dashboard

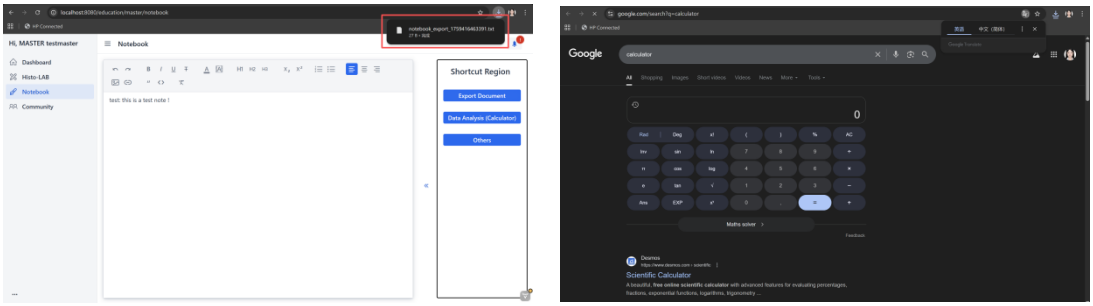
(b) Rendered figure of master's Notebook function

The procedure that the crawler works:

1. Use Jsoup to call E-Search APIto retrieve keywords and get a list of PMIDs of related articles.
2. System packages PMIDs and calls the E-Fetch API to get the XML metadata of each article.
3. Parsing and rendering XML data as a clickable button to direct user to each PubMed page link.

[5] https://pubmed.ncbi.nlm.nih.gov/

Figure 28(b) shows the Notebook section that is the same in the Memo in the master's Dashboard. It uses Vaadin's rich text editing function, so that the master can edit and export the text. This interface can facilitate masters' scientific and technological literature writing, in addition to providing auxiliary tools such as a calculator for data analysis. The 'Other' auxiliary tools can facilitate functionality expansion. Figure 29(a) shows the channel of automatic export of rich text, while Figure 29(b) shows the result of redirection.



(a) (b)

Figure 29. (a) Rendered figure of the file export mode of master's Notebook function

(b) Rendered figure of redirection of data analysis link (Calculator) in Notebook function

3.3 LLM Model on Annotation Analysis

When user opens the Histo-LAB-AI tool, the labeled annotation will be displayed on the page as shown in Figure 30. User can select the image that he/she wants to assist in analyzing, and start by clicking the BEGIN button.

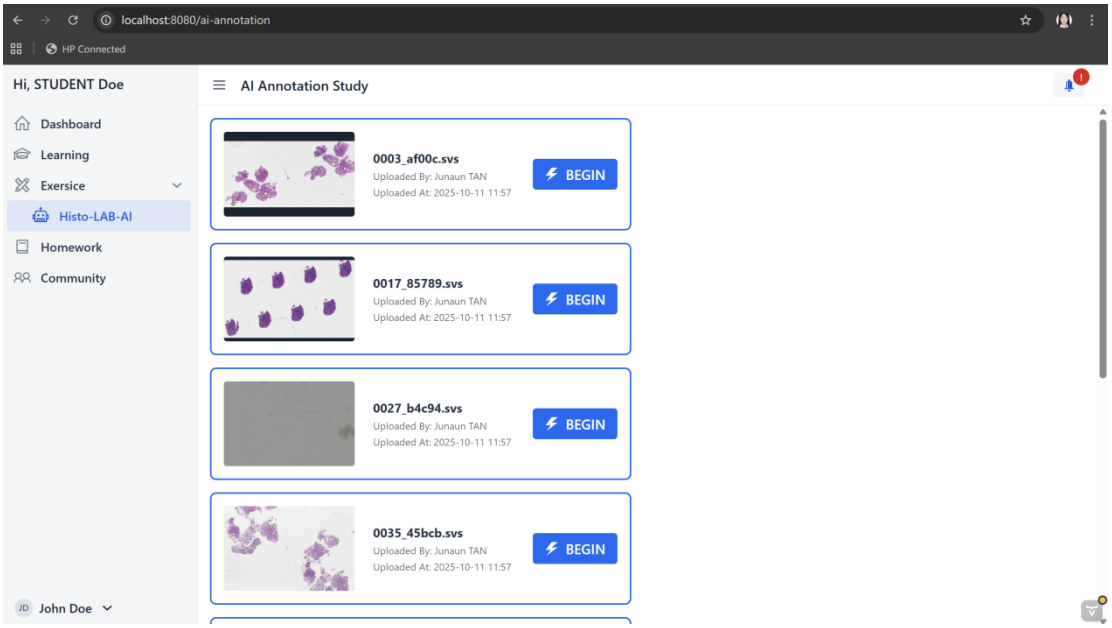


Figure 30. Rendered outcome of Histo-LAB-AI function

Figure 31 shows that the system will automatically open an IP address with the URL local address of the selected image to display the image information on the page. The page will ask the user to confirm, and click on the "START STUDY" button to start AI-assisted learning.

After analysis, the interface displays the results of the VLM model and prints them in a specific format for the user to study as shown in Figure 32.

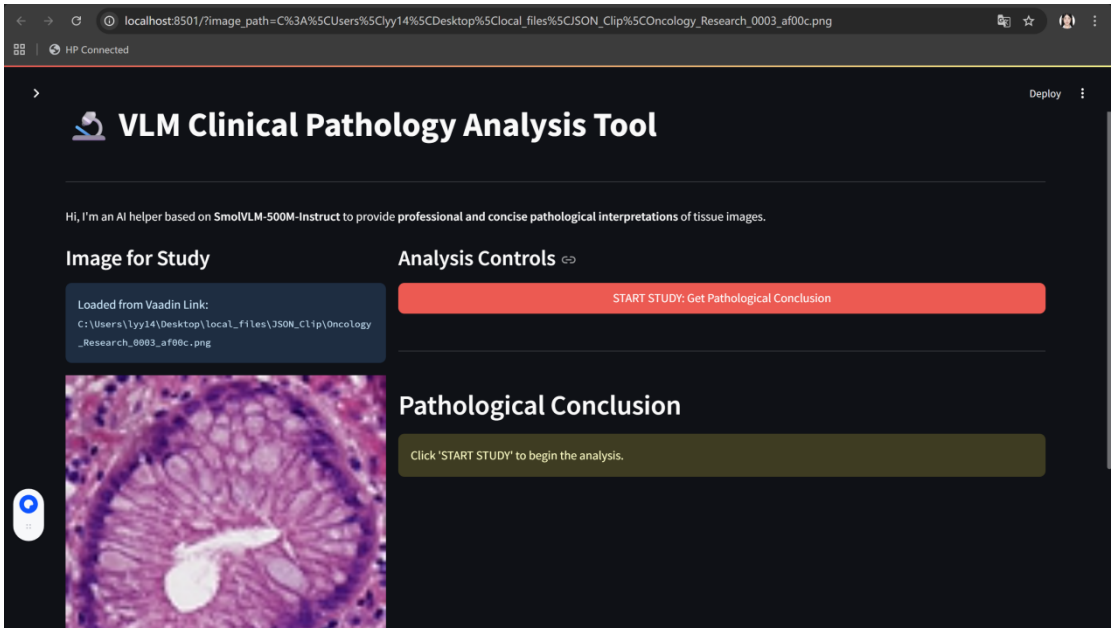


Figure 31. Rendered outcome of figure selected by user

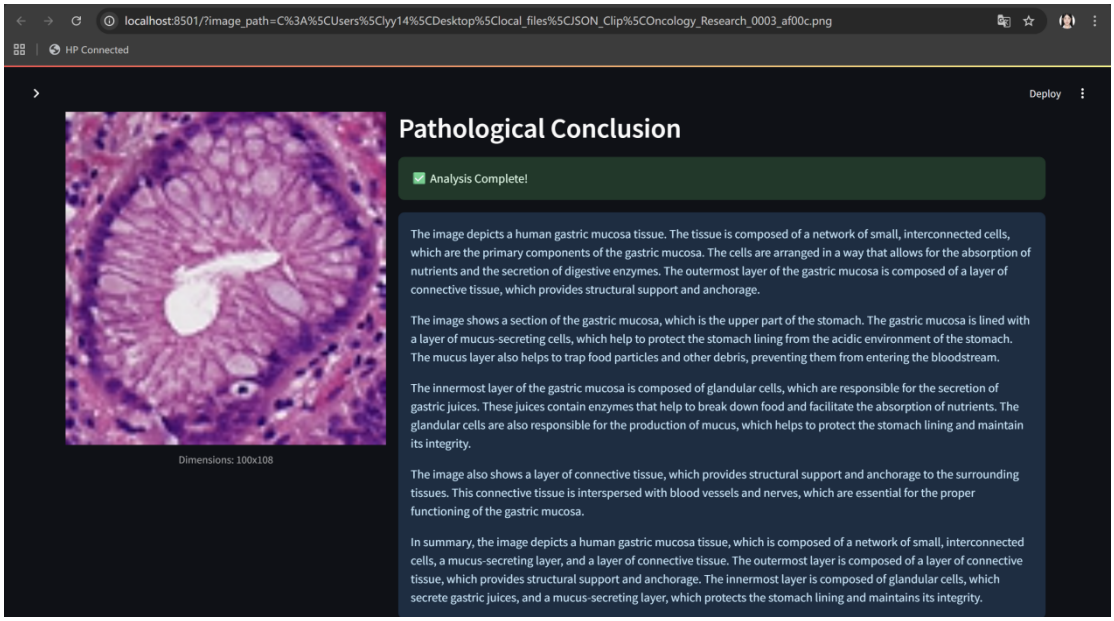


Figure 32. Analysis outcome of annotation by AI-assisted Histopathological Image Analyzer

4 DISCUSSION

4.1 Innovations and Advantages

4.1.1 Specialization in Gastric Oncology

Compared with traditional educational platforms, the Cloud-based Educational Platform for Gastric Oncology has more detailed medical education platform construction models. It not only combines basic functions such as assignments, evaluation, courses, but also integrates crawling capabilities and scientific research capabilities, serving more precise user groups, which are not only divided into graduate school users and medical users, but also provides a bridge to link students, teachers and masters. Secondly, from the data layer, it directly integrates and manages oncology image data, educational resources and clinical cases which are all specific to gastric. In addition, the platform integrates two deep learning models to assist image annotation and quantitative analysis. It also serves clinical simulations and practical exercises for students, training a locally deployed Qwen3 LLM model with expertise in Gastric Oncology education to ensure that the generated course framework as well as assessment reports are medically-specialized and context-aware.

4.1.2 Intelligent Teaching Assistant

The Cloud-based Educational Platform combines the LLM's streaming generation function. TEACHER can input course title to invoke LLM to generate standardized course framework, including teaching objectives and lesson time content, which reduces TEACHER's time spent on typing and planning course plan. At the same time, LLM can automatically extract student learning data from the local database, analyzing it and generate multi-dimensional teaching summary reports, which makes it easier for teachers to grasp student learning status and adjust teaching strategies.

In addition, the introduced AI-assisted Histopathological Image Analyzer gives full play to the advantages of the multimodal model on open-source platform, bringing technological development into the education process, facilitating three roles to be assisted in the knowledge of pathology which is contained in the professional annotation, and provides more feasible solutions to the subsequent platform development. It provides more feasible programs for subsequent platform development and function inheritance.

4.2 Limitation of Platform Design

It is generally acknowledged that the deployment and training of LLM models, as well as the performance optimization of WSI image, require high deployment and computational costs, especially when large-scale users are concurrent. This will lead to a serious limitation of efficiency as well as an increase in computational costs when the platform is formally put into application. Secondly, the variability of manual annotation results for gastric tissue, the scarcity of traditional vision models, and lack of research based on this case will limit the accuracy in model application of the platform. More high-precision models have yet to be developed and applied, which means the platform's generalization ability is insufficient as well.

4.3 Future Outlook

In the future, the Cloud-based Educational Platform for Gastric Oncology will evolve both open ecology and closed-loop learning, which can contribute specialized courses as well as tools for a large range of medical educators and researchers, in addition to serving teaching activities within a single institution. Additionally, optimization of the platform and functionality needs to be modified continuously. From the technical level, more Gastric Oncology deep learning models (e.g., prognostic prediction models [10], etc.) could be flexibly integrated into the master toolboxes, as they have more authoritative expertise and can make better use of AI capabilities to assist in diagnosis. We can also optimize the models and adaptively iterate through diagnostic results. From the functional level, the existing `aiforummessage` database can be utilized to enhance the case discussion module, which could be designed to support anonymous or real-name posting of non-sensitive real clinical cases, supporting multiple rounds of questioning, discussion, and labeling of specific cases, and utilize functions such as summarizing the discussion content with LLMs or providing evidence-based references, etc. Expansion of such functionality will be very meaningful to the establishment and development of such a platform.

5 CONCLUSION

Based on the function of the existing AI-HistoCloud research platform, this project successfully designs and implements an AI-assisted Educational Platform for Gastric Oncology serving three major users: student, teacher and master, integrating cloud computing, Java, Spring Boot and Vaadin as technology stack. The platform also combines advanced AI and LLM model to build a structured and functional medical education ecosystem with specialized architecture and database, which not only realizes basic teaching functions such as courses, homework assignments and evaluation, but also links with the original research platform's image annotation tools to provide students with clinical simulation and pathology practice exercises.

In addition, the design of real-time crawler and rich-text notes for the master promotes the efficiency of knowledge acquisition and organization for advanced medical researchers. Besides, this platform successfully deploys the localized Qwen3 LLM model for automatically generating professional frameworks and multi-dimensional teaching summaries, enhancing the teacher efficiency in lesson preparation and teaching analysis. Additionally, it combines Vaadin with Python Website and connects to Hugging Face open-source LLM platform, importing the SmolVLM-500M-Instruct model and finally establishing an AI-assisted Histopathological Image Analyzer named Histo-LAB-AI.

The successful establishment of this platform promotes research of Gastric Oncology and lays the foundation for the a priori prediction ability of medical workers, which also proves a great application potential of AI in the field of professional medical education. It is very useful in solving some core pain points of traditional medical education such as dispersal of resources, limited practice opportunities as well as inefficient teaching and evaluation. It truly provides a powerful digital tool for training highly qualified medical professionals for the Gastric Oncology field and cultivates some high-quality medical talents.

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