Journal of International Education and Development
2024, VOL. 8, NO. 4, 32-41
DOI: 10.47297/wspiedWSP2516-250003.20240804

# Research on the Application of Artificial Intelligence in Higher Education Scenario

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**ABSTRACT**
In order to promote the transformation and innovation of higher education, this paper studies the application of artificial intelligence in higher education scenario, and points out that the application of artificial intelligence (AI) technology is becoming increasingly widespread, especially in optimizing educational management, improving teaching quality, promoting educational equity, and meeting personalized learning needs. Research has found that expert systems and machine learning technologies achieve personalized guidance through user profiles, online course marketing systems improve course promotion effectiveness, and intelligent classroom note taking system and teaching quality dynamic evaluation system promote the intelligence and precision of the teaching process. The application of these technologies is not only an inevitable trend in technological development, but also an urgent need for educational reform. Future education will be more intelligent and efficient.

**KEYWORDS**
Artificial intelligence; Higher education; Application in scenario

With the rapid development of information technology, the application of artificial intelligence (AI) in various fields is becoming increasingly popular and has become an important force driving social progress. Higher education, as an important battlefield for talent cultivation and scientific research, is undergoing profound changes and innovations.

According to the Notice of the State Council on Issuing the Development Plan for the New Generation of Artificial Intelligence, the Chinese government attaches great importance to the development and application of AI technology, and proposes to actively promote the research and application of AI technology in the field of education to improve the level and quality of education [1].

Authoritative data shows that the global AI market has continued to expand in recent years, and is expected to reach $190 billion by 2025, with an average annual growth rate of over 20%. In this context, the application of AI in the education industry is also growing rapidly. Higher education institutions leverage AI technology to optimize educational management, improve teaching quality, promote educational equity, and meet personalized learning needs.

The specific applications of AI technology in higher education include: prediction, planning, and monitoring user profiles to achieve accurate analysis and personalized guidance of students' learning status; The online course marketing expert system utilizes big data and machine learning technology to optimize course promotion and student feedback analysis;

The intelligent classroom note taking system and teaching quality dynamic evaluation system are based on speech recognition and image recognition technology, promoting the intelligence and

precision of the teaching process.

The application of AI in higher education is not only an inevitable trend in technological development, but also an urgent need for educational reform and innovation.

## 1 The application of expert systems in higher education scenario

### 1.1 Expert system integrating prediction, planning, and monitoring based on user profiles

User profiles integrate multidimensional data such as personal attributes, preferences, lifestyle, and behavior patterns to form a labeled user model, which facilitates in-depth analysis and computer processing. In marketing, this method is used for precision marketing, predicting demand through user historical consumption behavior, and providing personalized products and services. This paper explores the application of student profiling technology in higher education to achieve personalized teaching. Creating user profiles relies on advanced algorithms or machine learning techniques, and although machine learning systems are often seen as "black boxes", they perform well in handling complex problems.

The interpreter in expert systems elucidates the reasoning process, helping users track decision paths, especially when data is incomplete, to avoid profiles' bias affecting prediction accuracy [2].

The study explores the application of three types of expert systems in education: predictive expert systems analyze historical data to predict future trends, such as employment counseling websites; Planning expert systems to identify action sequences to achieve goals, such as course selection assistance websites; Monitoring expert systems monitor expected and actual behavior, early identify and warn of anomalies, such as educational management websites. These applications demonstrate the diversity and practicality of expert systems in the field of education.

#### 1.1.1 Overall design

Comprehensively analyze multidimensional data such as academic performance, frequency of recreational and sports activities, and consumption habits through student user profiles, and construct a model that reflects student characteristics. This paper uses data dimensions such as exam scores and consumer behavior to create detailed student profiles.

Through expert systems, these profiles can be matched with career paths to predict suitable careers for students. For example, junior students can access career prediction services through employment counseling websites to view career matching results and the reasoning process behind them. The predictive expert system can also compare the current profiles of students with their target career profiles, identify areas that need improvement, and help students plan their learning and development paths. For example, law students who wish to enter the investment banking industry can use course selection assistance websites to plan courses.

The system recommends necessary courses based on career goals, which is a typical application of planning expert systems. When there is a significant change in the student profile, especially a negative change, the system can automatically send monitoring alerts to the tutoring teacher and provide preliminary diagnosis to distinguish between group or individual problems [3].

Tutoring teachers can view changes in student behavior and performance through the education management platform, provide targeted assistance, and show the functions of the monitoring expert system.

This integrated system covers prediction, planning, and monitoring functions, effectively integrating various information and tools to support students' academic and career development.

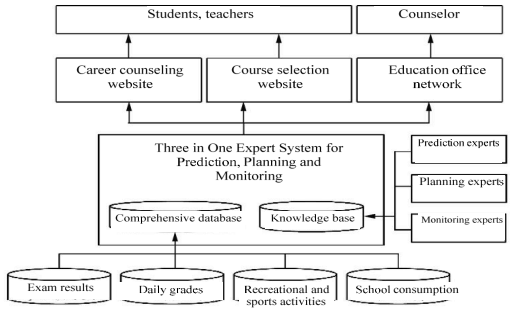


Figure 1 Overall design of the three in one expert system for prediction, planning and monitoring

### 1.1.2 Specific design

1) Systematically store exam scores

Exam scores represent students' academic performance and course mastery, providing key data for the career planning expert system. By analyzing the absolute value, relative position, and deviation between subjects of grades, students' career development potential can be predicted. Grade fluctuations are important warning signals for monitoring system, indicating learning problems or psychological stress.

2) Continuously update daily grades

Daily grades records reveal students' learning attitudes and psychological states. The difference of grades to reveal students' exam strategies and learning consistency is a key indicator of prediction systems. By monitoring these performances, tutoring teachers can promptly identify changes in students' status and achieve effective intervention and support.

3) Recreational and sports activities rating system

Evaluating students' performance in recreational and sports activities requires detailed quantitative standards. These activities show individual talents and teamwork skills, and improve the prediction expert system [4]. Design science grading rules that reflect students' influence and participation in the team.

4) Manage school consumption by classification

Assess behavioral tendencies through consumption habits, especially for students in the finance field. Analyze basic, improvement, pleasure-oriented and investment-oriented consumption habits and identify investment styles. Faced with the limitations of data collection, data authority should be treated with caution. Interpreter capabilities enhance transparency and trust in decision making.

5) Update daily comprehensive database

Synchronize exam scores, daily grades, recreational and sports activities, and school consumption data to a comprehensive database for in-depth processing and analysis. By aggregating and deconstructing data, generate detailed student profiles to more accurately understand and predict student behavior and development potential.

6) Systematize the input of expert knowledge

In the knowledge acquisition stage, expert knowledge is transformed into quantifiable indicators and calculation formulas, which are then entered into the knowledge base. Predictive experts provide career development models, planning experts recommend career paths, and monitoring experts design alert logic and thresholds for future queries and applications.

## 1.2 Online course marketing expert system

With the development of digital technology and the impact of the global pandemic, distance

education has rapidly emerged, and the knowledge payment model has also entered an outbreak period. Although paid viewing through video platforms can be profitable, online courses still face challenges such as limited target audiences and immature promotion mechanisms [5]. Famous schools in big cities are recognized for their online courses, but high-quality courses in other regions are often unknown due to a lack of promotion methods. Short videos have become an effective marketing tool. We can extract exciting clips of no more than one minute from complete course videos for promotion, and evaluate course quality through interactive functions such as likes, favorites, and comments. This study proposes an innovative approach to open online course videos to test users, collect viewing popularity data, and then use marketing expert systems to select the most attractive segments to create short videos, thereby improving the conversion rate from free viewers to paying users.

### 1.2.1 Overall design

The online course marketing expert system adopts a hierarchical structure, which is divided into two parts: front-end interactive interface and back-end server processing. The front-end mainly consists of an embedded Web video player that supports interactive elements such as bullet comments and buried dots in videos. It not only plays teaching content, but also captures and records user interaction data. These data are transmitted in real-time to the backend through JavaScript scripts on the frontend. The back-end architecture is divided into three core components: data collection server, video storage server, and marketing analysis system. The data collection server is responsible for receiving front-end data and providing Web services, while the video server handles the storage of video content and streaming media playback services. The marketing expert systems run in the background, using preset analysis rules to process the collected data, identify high-quality short video content, and push it to the video server to optimize content recommendations and marketing strategies. The overall design diagram of the system clearly shows the data flow and functional relationships between each component.

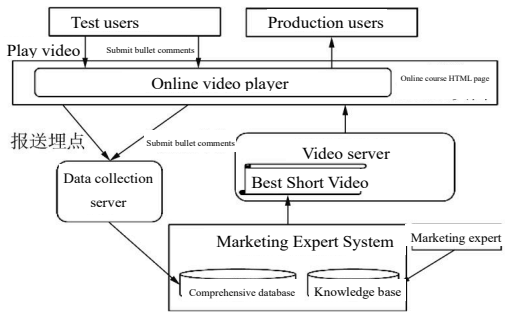


Figure 2 Overall design of online course marketing expert system

### 1.2.2 Detailed design and key technology demonstration

1) Video buried points

Video buried points technology is the core of online education marketing, which monitors user viewing behavior by dividing videos into fixed duration segments and setting buried points. These buried points are activated as the video progresses, capturing playback data and generating a heat map. This technology relies on video players, front-end JavaScript, and back-end data processing. For example, the buried point's frequency of Alibaba Cloud Player is 4 times per second, allowing data callbacks to be triggered every 0.25 seconds. Front-end developers summarize data every 40

callbacks to reduce network and server load [6]. These data are ultimately pushed to the server and integrated into the marketing database to optimize marketing strategies.

2) Open bullet comments

The bullet comments function enhances video interactivity as an indicator of the popularity of video clips. Each bullet comment comes with a timestamp to locate a specific video clip. Collect the total number of bullet comments for each segment and evaluate the viewing popularity. This technology relies on the Internet player interface, which is customized and developed by Web developers to ensure that the bullet comment information is effectively captured and transmitted to the server, and finally integrated into the marketing database for analysis, providing insight for audience behavior and preferences.

3) Test users

To obtain representative test user data, we will integrate real user groups into the test and attract participation through limited time free access. Evaluate the product in a real usage environment and analyze user interaction frequency and behavior patterns, such as playback frequency and bullet comment interaction, to optimize the experience. After the official launch, continue to collect and analyze user data, monitor and adjust the popularity of video content. This method is more reflective of market reactions than traditional internal testing, although it requires sacrificing some potential revenue in the early stages.

4) Data integration platform

Each video content will be reconstructed into a comprehensive information table containing time nodes, views, and bullet comment interaction through an advanced data conversion process. These data tables will be stored in an advanced database designed specifically for expert systems, ensuring effective integration and fast retrieval of information.

5) Build an intelligent knowledge base

By utilizing the in-depth analysis and experience of market experts, we will configure a dynamic marketing knowledge base. For example, the system may recognize video rankings based on popularity to select the most promising video segments, such as the third ranked video, or choose the previous related segment of a video with the highest popularity ranking. In addition, more complex parameter combinations may be used to optimize the selection. These marketing strategies and parameters will be based on data analysis of historical marketing activities, gradually enriching and improving the content of the knowledge base.

6) Operation process of automated expert system

On the operating platform, online course content managers first calibrate the long video resources they need to convert. Subsequently, they set the desired length of the short video and clicked the "start" button to begin processing. The inference engine of the system will use programming logic to parse the marketing strategies stored in the knowledge base and automatically generate corresponding Structured Query Language (SQL). This query not only accurately locates the best video clip, but also automatically performs video editing, extracts clips of specified length, and completes the output and saving of the video. This fully automated process greatly improves the efficiency and accuracy of video content processing.

## 2 The application of machine learning in higher education scenario

At present, machine learning is mainly applied in basic scenarios such as speech recognition, speech synthesis, image recognition, natural language processing, and their derivative scenarios. This paper explores the combination of speech recognition and image recognition with educational scenarios.

## 2.1 Intelligent classroom note taking system based on speech recognition

The popularization of speech recognition technology has profoundly changed daily life, from smartphones' unlocking to smart speakers. Its working principle is to segment the speech signal into small segments, recognize the phonemes in each segment, and combine them into words and sentences. This depends on acoustic feature extraction and acoustic model application. Linear Predictive Cepstral Coefficients (LPCC) and Mel Frequency Cepstral Coefficients (MFCC) are commonly used for feature extraction. The traditional Gaussian Mixture Model (GMM) is gradually being replaced by advanced technologies such as Recurrent Neural Networks (RNN) and Long Short Term Memory Networks (LSTM), which have improved recognition accuracy and efficiency. Pronunciation dictionaries and language models play a key role in speech recognition, constructing sentences by evaluating the probability distribution between words. Model types include N-gram models, Markov models, exponential models, and decision tree models. In the decoding search stage, the text sequence with the highest score is selected as the recognition result by integrating the scores of acoustic and language models. The research on speech recognition technology can be divided into two aspects: basic research to develop efficient and accurate systems and provide API interfaces for use in research; Apply research to integrate advanced technologies into specific business scenarios and promote commercial implementation. Basic researchers are responsible for initial training and opening up secondary training interfaces to support application researchers in customizing systems according to their needs.

### 2.1.1 Overall design

In modern university education, students face the challenge of memorizing and understanding a large number of knowledge points, while also needing to apply the theories they have learned to solve practical problems. The traditional handwritten note taking method is prone to information omission when dealing with fast-paced lectures or personal thinking. To improve the efficiency of this learning process, a system based on speech recognition technology can be implemented in the classroom. This system instantly converts the teacher's speech into text and automatically generates detailed classroom notes. This not only helps students concentrate better in class, but also facilitates their review and consolidation after class, greatly optimizing the learning experience and outcomes.

1) During the course, the recording device captures the voice in the classroom according to the set automatic or manual mode, and uploads these recordings along with their recorded time and location information to the NAS server.

2) These recording files are then sent to a speech recognition service for processing, converted into text information, and stored in a database along with the recording time and location for future retrieval and use.

3) Students and faculty can search for specific course names through a specially designed note search website. The system quickly provides detailed notes of relevant classes by executing joint queries, enabling users to easily access the required information.

### 2.1.2 Detailed design and key technology demonstration

1) Configure sound collection devices in classrooms and conference rooms to capture speech content.

2) Build two types of servers: one for storing voice files, responsible for storing classroom recordings and supporting subsequent voice transcription and backtracking analysis; Another text database server is used to store transcribed text, recording relevant information such as recording

time, location, and completion time of transcription.

3) Speech recognition technology plays a core role in the system, and it is recommended to use existing commercial services such as iFlytek and Baidu. IFlytek provides functions such as voice dictation and transcription, supporting Mandarin, English, 51 languages, and 24 dialects, including one ethnic language. Its technology can process and provide real-time feedback on results, achieving recognition while speaking. IFlytek also provides a self-training platform where users can upload voice data to customize and optimize models. At present, Huawei, ByteDance, Meituan and other enterprises have adopted the technology of iFLYTEK to provide public cloud and private deployment solutions.

4) Build a usage record platform and its database for classrooms and conference rooms, in order to perform joint queries with the note text database. This platform enables each note to be linked to a relevant course or project, allowing users to search and retrieve from multiple perspectives.

5) Establish a classroom note query website and assign specific roles to different users (such as teachers, students, administrators, etc.). Each role has different permission levels on the website. For example, students can search and comment on notes; Teachers have the authority to search, comment, and edit notes; Administrators can assign specific access permissions to different users. In addition, the website should also support version control, allowing users to track the editing history of notes and roll back to older versions if necessary. Implement branch management function, enabling students to create personal branches based on the main branch and perform personalized note editing on this branch, ensuring independence between branches. Students can submit a request to merge their personal branch changes back into the main branch, which will take effect after being approved by the teacher.

## 2.2 Dynamic evaluation system for classroom teaching quality based on image recognition

Image recognition technology utilizes computer vision to analyze images, identify targets and objects, and is widely used in fields such as license plate recognition, autonomous driving, military target tracking, geological exploration, and biometric recognition. This technology relies on feature data in the image, such as object contours and shapes. Through advanced methods such as Convolutional Neural Networks (CNN), image recognition technology can effectively extract and classify key information. The core steps include convolution and pooling operations. The convolution kernel is applied to the image matrix to calculate the feature matrix, while the pooling operation simplifies the feature matrix and preserves key information. Subsequently, the classification process uses the Softmax function to calculate the probabilities of each category and identify the category with the highest probability. The initial CNN model needs to be trained and optimized in order to work effectively. Image recognition research can be divided into two categories: basic research formalizes image recognition problems into mathematical models, optimizes parameters to improve accuracy and efficiency; Application research involves developing APIs that meet various business needs and realizing the commercialization of technology applications.

### 2.2.1 Overall design

In modern educational environments, student attendance and facial expressions are important indicators for measuring classroom teaching effectiveness. Through image recognition technology, it is possible to analyze the occupancy of students' seats and students' eye status as a binary classification problem: to determine whether the seat is occupied and whether the student is paying

attention to the course. General image recognition technology can determine seat occupancy status, while facial recognition technology can recognize and analyze students' eye status and expressions, providing important feedback on student engagement and classroom interaction. Although image recognition technology can evaluate classroom participation, its results are not sufficient to fully reflect the quality of the course. The correct evaluation of attendance rate should be based on the number of vacant seats and the actual number of applicants. At the same time, students' facial expressions and body postures should be comprehensively interpreted according to different types of classes (such as lecture, discussion, self-study). Therefore, it is necessary to introduce expert systems or machine learning classification models for in-depth analysis. By integrating multidimensional technologies, we can more accurately evaluate and improve the quality of classroom teaching, analyze student behavior patterns, and provide educators with precise teaching feedback and adjustment basis.

1) Automatic cameras are deployed inside the classroom to capture panoramic images of students at regular intervals and automatically upload them to the Network Attached Storage (NAS) system.

2) Start the image analysis program to automatically analyze and record data such as the rate of vacant seats in the classroom, student attention distribution (such as eye activity), head and body posture from the images, and store them in a dedicated data analysis library.

3) After the end of each day, the teaching quality analysis system starts running and calculates the teaching effectiveness score for each class based on the captured data. The system integrates course scheduling information and applies data aggregation technology to comprehensively evaluate teaching quality from three dimensions: course, teacher, and class, and stores the evaluation results.

4) School administrators can access and analyze the teaching quality evaluation results of each classroom through a specialized teaching quality assessment platform, in order to optimize teaching resources and methods.

### 2.2.2 Detailed design and key technology demonstration

1) To obtain real-time classroom information, the classroom is equipped with high-resolution photography equipment that meets the technical specifications of the image processing server. The requirements are as follows: the classroom image resolution shall not exceed 4096 × 4096 pixels; The facial image should be close to a square, with a side length of at least 1/48 of the shortest side of the classroom image, and a resolution of not less than 48 pixels. For large lecture halls, multiple camera systems need to be deployed to collaborate and ensure data integrity and accuracy. Due to the dynamic changes of students, the photography equipment needs to be set to dynamic capture mode, using a fast shutter speed of no more than 1/60 second to ensure image clarity, and additional requirements are placed on the aperture and sensitivity of the equipment.

2) Build a Network Attached Storage (NAS) system specifically designed for secure storage of image data. The storage capacity of a NAS system needs to be determined based on the size of each image, the frequency of shooting, and the duration of data retention.

3) Building an efficient image recognition service system is a key technical support. We recommend using mature commercial image recognition services such as Yitu Technology, SenseTime Technology, and Megvii Technology, which are widely used in the financial and medical fields, such as Orient Securities and Ruijin Hospital. In this project, identifying multiple faces in classroom photos is a technical challenge. The multi face recognition technologies provided by these suppliers have been commercialized and have developer interfaces for easy secondary development and integration. Taking Megvii Technology as an example, its free version API supports

up to 50 facial recognition images, while the commercial version provides unlimited recognition capabilities. In practical applications, server performance and specific usage scenarios need to be evaluated to ensure performance. Megvii's facial recognition service can recognize 16 facial features, including smile detection, emotion analysis, eye status, and head position monitoring. In the test, the accuracy of eye status recognition reached 99.985%, but it may slightly decrease in dynamic classroom environments.

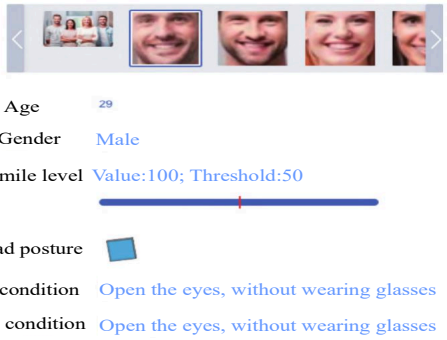


Figure 3 Multi face recognition test based on Megvii Technology API

4) The course will be divided into various scenarios, such as standard lectures, open discussions, self-study time, exams, and interactive activities. These scenario classifications will be used to construct subsequent classroom quality assessment algorithms.

5) In order to link the evaluation results of classroom teaching quality with specific courses, the school will implement electronic management of course scheduling. This involves establishing the correspondence between teachers and classrooms, as well as courses and classrooms, in the database system, and providing query services for these data. If there is a change of professor in the course, the relevant data needs to be updated in the scheduling system in a timely manner to ensure the correct attribution of classroom quality evaluation.

6) A dedicated classroom teaching quality analysis server will be established to evaluate teaching quality by integrating image recognition technology and classroom type data. This system can be implemented using rule-based expert systems or machine learning models. If machine learning methods are chosen, the model must be fully pre trained [7].

## 3 Conclusion

In summary, the application of artificial intelligence in higher education is flourishing like mushrooms after rain, not only bringing about big changes in teaching management, but also providing new opportunities for educational equity and personalized learning. The deep integration of expert systems, machine learning, and image recognition technologies is like adding icing on the cake, greatly improving the efficiency and quality of education. In the future, we will continue to uphold the spirit of exploration and innovation, keep pace with the times, constantly improve and promote these intelligent means, and make education smarter and more efficient. Learning is like sailing against the current, if you don't advance, you will fall behind. On this path of continuous educational innovation, we will surely ride the wind and waves, move forward bravely, and create a better future.

## References

[1] Liu Jiahao, Zeng Haijun, Jin Wanying, Li Zhisheng, Qi Binbin. Empowering Higher Education with Artificial

Intelligence: Logical Path, Typical Scenarios, and Practical Approaches [J]. Journal of Xi'an Jiaotong University (Social Sciences Edition), 2024, 44 (03): 11-20.

[2] Ji Kai. Research on the Transformation of Higher Education Driven by Artificial Intelligence in the Era of Digital Intelligence [D]. Nanjing University of Posts and Telecommunications, 2023.

[3] Wan Li, Gong Liying, Wu Qing, Mu Dechao. The Application Prospects of Artificial Intelligence in Higher Medical Education [J]. China Medical Education Technology, 2018, 32 (06): 607-610.

[4] Liu Jiaxin. Research on the Application of Artificial Intelligence in Student Evaluation of Higher Education in the United States [D]. Sichuan International Studies University, 2023.

[5] Huang Yutong. The Application of Artificial Intelligence in Higher Education Scenarios [J]. Journal of Harbin Engineering University, 2022, 43 (07): 1066-1072.

[6] Shen Xiaoteng, Cui Jinqi. 5G Supports the Application of Artificial Intelligence Technology in Higher Education [J]. Future and Development, 2021, 45 (03): 5-9.

[7] Liu Yawen, Zhu Linlong. The Application and Development of Artificial Intelligence in Higher Education [J]. Course Education Research, 2018, (08): 234.

## About the Author

Yimeng Zhang, Master, Education Policy/Higher Education.