

Based on Artificial Intelligence Technology: A Comprehensive Learning System

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Abstract: With the flourishing development of artificial intelligence technology, the author has observed its successful applications in various fields and believes in its vast potential in the field of education. The author suggests that integrating the end-to-end learning system born out of this technology can address several industry pain points, such as significant individual differences among students, uneven distribution of educational resources, and limitations in assessment methods. This article provides a detailed introduction to the architecture and main functions of the system, including user interface and interactivity, as well as intelligent recommendation and customized learning paths. The core functionalities of intelligent recommendation and customization paths are highlighted, aiming to significantly enhance students' learning experiences and efficiency. The article also delves into the process of data integration and analysis, covering data collection and processing, as well as learning behavior analysis and model optimization. Furthermore, the article presents a preliminary simulation of the usage process, focusing on language learning, and discusses potential risks that may arise during the application, such as privacy protection, ownership of intellectual property rights, and the relationship between artificial intelligence and humans.

1. Introduction

In November 2022, OpenAI launched the large-scale language model ChatGPT, sparking immediate public interest and discussions. ChatGPT, essentially an intelligent conversational robot, can answer a wide range of questions and provide reasonable solutions, from simple tasks like instructing how to boil an egg to complex assignments such as completing a history paper. The success of ChatGPT signifies breakthroughs in key technologies like natural language processing and deep learning. Globally, AI technology has made significant strides in various directions. In the medical field, AI-generated efficient and multifunctional databases, along with intelligent image recognition based on computer vision technology, can assist doctors in diagnosis, reducing the likelihood of misdiagnosis. In the transportation sector, AI's auxiliary computation and decision-making can be utilized to optimize traffic control, reducing road congestion. Meanwhile, numerous products have emerged in the field of education and teaching. Squirrel AI is an AI-based educational system focused on primary to high school levels. It utilizes algorithms to identify students' learning needs and tailor personalized teaching plans. Dreambox Learning, a company specializing in adaptive learning for mathematics courses, utilizes AI technology to offer personalized math courses for students. The adaptive teaching platform Smart Sparrow assists teachers in designing instructional content based on the varying levels of acceptance and changes among different students. From these products, it is evident that artificial intelligence

technology holds vast potential and a promising future in the field of education.^[1]

2. Challenges and Dilemmas in the Field of Education

2.1. Challenge of Individual Differences in Students

Traditional classroom teaching is teacher-centered, using uniform textbooks and established lesson plans. Dozens of students with different learning backgrounds, speeds, and habits follow the same learning pattern. This one-size-fits-all teaching method has many drawbacks. Students with a strong foundation and quick learning may find the course unattractive, having to do a lot of repetitive exercises. On the other hand, students with weak foundations and slow learning may not have clarified some basic concepts before being forced into the next chapter of learning. In addition, students have varied learning methods. Some prefer to gain and consolidate knowledge through discussions, some excel in reading and summarizing knowledge, some prefer visual stimuli like charts, drawings, and videos, and others prefer hands-on practice through experiments and field investigations. Students' learning situations and methods within the same subject vary, and the same student may perform differently in different subjects. It is evident that traditional teaching methods have limitations in meeting the diverse learning needs of different students for various subjects.

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2.2. Unequal Distribution of Teaching Resources

Broadly speaking, teaching resources refer to all elements that can be utilized in the teaching process, including teachers, teaching materials, infrastructure, and more. Unequal distribution of teaching resources is a serious challenge in today's education field. Disparities exist between different countries, different regions and cities, economically and technologically advanced areas and relatively underdeveloped areas, and even among schools within the same city, and among different families. The quality of teaching staff directly influences the teaching quality. Economically developed areas can attract higher-level education professionals with high salaries, good benefits, and a favorable working environment, while economically underdeveloped areas face the opposite situation. According to relevant data from China's Ministry of Education in 2023, urban primary schools have an average of only 24 students per class, while rural primary schools have an average of 30 students per class. In urban areas, there are 42 high school teachers per thousand students, while in rural areas, there are 30 teachers per thousand students.^[2] Meanwhile, teaching materials and infrastructure directly impact students' learning experiences. Some schools, due to a lack of experimental equipment and library resources, limit the development of students' practical abilities and the improvement of comprehensive literacy.

2.3. Limitations of Assessment Methods

In current teaching, assessment methods have certain limitations, hindering a comprehensive understanding and accurate evaluation of students' learning situations. Traditional teaching assessment involves organizing an exam at the end of a stage of learning, usually in the form of a paper, allowing students a set time to complete it, and determining their performance through scoring. This judgment method lacks examination of practical and innovative aspects. It fails to provide directional guidance and encouragement for students' later learning. Moreover, excessive reliance on exam assessment may lead to the singularity of teaching content and methods. Teachers may invest a significant amount of energy into the process of solving and explaining problems, causing the classroom to lose its interest and appeal, thereby reducing student participation and enthusiasm.

3. Risks and Limitations of Applying AI Technology in the Field of Education

3.1. Privacy Protection

It should be noted that almost all internet products face this issue upon deployment, and applications based on artificial intelligence technology are no exception. Various AI models require large amounts of data during training, and whether the authorized use and proper protection of information such as gender, age, school, and family data collected by AI products during user interaction are crucial issues. If this information is stolen and exploited by

malicious individuals and organizations, it could lead to crimes such as child trafficking, kidnapping, and fraud targeting minors. Additionally, the legal regulations regarding privacy protection for AI-based products are still in a gray area in many countries, potentially increasing the harm caused by privacy breaches.

3.2. Ownership of Intellectual Property

This involves two aspects: first, whether the content students obtain from AI educational products infringes on others' intellectual property, and the ownership and usage rights of this content are crucial. Especially in cases of cross-border data flow, the international intellectual property system faces significant challenges. As users, if a student uses AI products to complete their literature homework, they need to trace the intellectual property provided by the AI product and annotate the owner when publishing the work. Second, there is no clear legal provision on how to define the intellectual property of works created by users inspired by AI products or works co-created by users and AI products. Currently, intellectual property laws in various countries primarily protect the creations of one or more natural persons. Therefore, content created by users in the process of interacting with AI products currently lacks protection, posing risks to subsequent knowledge production.^[3]

3.3. Relationship between Artificial Intelligence and Humans

The relationship between artificial intelligence and humans is one of the most discussed topics in the contemporary field of technology. Firstly, the development of artificial intelligence technology has brought innovation and opportunities to many fields and industries. However, with every innovation comes a flip side, leading to various issues and debates. Artificial intelligence is a humanoid technology, so where is the upper limit of this technology, and will its development one day surpass humans, becoming uncontrollable and ultimately enslaving and destroying humanity, as depicted in many science fiction movies? Secondly, there is the issue of technological dependence. If students rely on artificial intelligence to provide answers for an extended period and lack independent thinking and exploration, does it violate the essence of education, turning artificial intelligence from an aid into the main force? There is also a potential risk here – prolonged use of electronic devices carrying AI products by students may lead to visual fatigue, decreased eyesight, and other issues. Lastly, there is the issue of substitutability. The application of artificial intelligence technology in many industries may lead to the unemployment of many traditional occupations, triggering deeper social conflicts.

4.Design of the Whole Process Learning System

4.1.System Architecture and Function Design

4.1.1 User Interface and Interactivity

Firstly, an attractive user interface should be simple and fun. The aesthetics of the pages should not be overlooked. The main page can use bright and visually stimulating colors such as red, yellow, orange, while learning pages can use alternating colors in different sections to enhance memory, such as blue, yellow, green, and red. Different design elements can be added for students of different age groups. Learning content linked through animated characters and stories may be more appealing to younger students, while learning processes resembling game levels and challenges may attract older students. Secondly, social interaction is also an important trend in AI education products, building platforms for collaboration and learning between teachers and students, as well as among students through online discussions, games, and cooperation.^[4]

4.1.2 Intelligent Recommendation and Customized Learning Paths

First, the system can import students' past learning data, including previous exam papers, teacher evaluations, and self-assessments. The AI intelligent system analyzes these data, and then recommends learning content suitable for the student's level and capable of sparking their interest. Secondly, personalized learning paths are an extension of intelligent recommendations. The system can adjust learning speed and difficulty based on the student's learning progress. For example, if a student with a weak foundation and lack of interest in a subject has not mastered core content after completing a unit, the system can slow down the learning pace, reinforce learning in that area until the student is satisfied, and then move on to the next unit. Conversely, a student who excels in a subject and quickly grasps its content can have the learning pace accelerated to meet their learning needs.

4.2.Data Integration and Analysis

4.2.1 Data Collection and Processing

This process involves the collection, analysis, and utilization of a large amount of learning data. The first step is data collection.^[5] Students can upload test papers and questions from both school and online learning applications. They can invite teachers to provide evaluations of their performance in a specific subject. Students can also describe their strengths, weaknesses, and areas they want to improve based on their past performance in a subject. The intelligent system consolidates this information, obtaining details such as students' learning duration, subject preferences, answering patterns, and error modes. The second step is data processing, a crucial aspect to ensure the effectiveness of

this data. Using machine learning and data mining techniques, AI learning products can identify patterns, establish correlations, and gain deep insights into students' learning behaviors.

4.2.2 Learning Behavior Analysis and Model Optimization

The intelligent system extracts patterns and rules from the mined information, continuously adjusting learning models to better adapt to the diverse learning needs of students. Model optimization may involve various aspects, including but not limited to improving recommendation algorithms, adjusting learning paths, and personalizing the difficulty of questions.^[6] For example, the system may adjust recommended learning content based on students' learning history and performance, offering materials that align with their level and interests. Alternatively, it may adapt learning paths based on students' learning speed and mastery, ensuring the appropriateness and effectiveness of the learning progress. This model optimization is an ongoing iterative process. The system follows students' learning progress, continuously optimizing learning models, resembling a personalized learning assistant accompanying them.

5.Whole Process Learning System Simulation

Below is an example of the use process and content of the whole process learning system, taking language learning as an example.

5.1.Preview Stage

Based on the previously collected student learning data, analyze and determine whether the learning path is foundational, improvement-oriented, or advanced. Different types of students have different tasks in the preview stage.^[7] Foundational students focus on school textbooks, using animations and songs to introduce the unit, making it easy to increase interest and familiarize them with core words through games.^[8] Improvement-oriented students, with a stronger foundation, can have a shorter preview. Advanced students, who have mastered current school content, can access test questions from the learning library through an intelligent system. After testing, their learning level is determined, and a suitable learning path and content are arranged based on their proficiency.

5.2.Learning Process

After the preview stage, formal learning content begins, divided into different modules. Tailor personalized learning paths according to the diverse needs of different students. For example, students in mainland China aiming for various academic exams will focus on content that improves exam scores. Students in many other countries, with less academic pressure, learn a language for reasons such as interest, allowing for more flexible and interesting

content design. Language learning typically involves modules like listening, speaking, reading, writing, and grammar, which can be freely combined based on student needs. AI's assistive learning functions persist throughout the learning process.^[9]

Reading Guidance and Monitoring: Traditional reading lacks long-term motivation and lacks guidance in pronunciation. AI learning tools provide real-time pronunciation correction and daily reminders, encouraging students to develop a habit of consistent reading and cultivating a sense of the target language.

Mistake Database Function: Students primarily focused on exams benefit significantly from this function. The mistake database collects errors from school exercises and AI learning applications, analyzes them, explains them to students, and pushes more similar questions until students can correctly complete them, progressing to the next learning stage.

Q&A Function: Students can ask any questions related to any subject to AI learning assistance tools, like having a 24/7 private tutor. It's crucial that AI tools provide explanations but not direct answers to uphold the original purpose of learning; otherwise, the tool shifts from being an aid to the main source of learning.

5.3.Review Stage

In the review stage, the AI intelligent learning system generates a learning report for this stage, showcasing learning achievements, identified errors, and areas needing improvement.^[10] Students can choose to proceed to the next stage or reinforce their learning in the current stage until they are satisfied with the results before moving on.

6.Conclusion

The intelligent learning system is an innovative educational tool based on artificial intelligence technology, aiming to enhance students' learning experience and performance through personalized and adaptive approaches. This paper delves into various aspects of AI intelligent learning systems, including system architecture and functionality design, data integration, and analysis. However, to better harness its potential, there are still challenges that need further addressing, including technical, privacy, ethical, and accessibility issues.

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