A Research on Distance Education System Based on Artificial Intelligence Technology

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Abstract: This paper points out that applying artificial intelligence technology to distance education system can identify and classify massive data captured from the Internet at high speed, so as to realize unified management of educational resources, and provide accurate positioning and personalized learning services for learners. By analyzing and comparing the methods of machine learning and deep learning, the logical structure of distance education system based on artificial intelligence technology is designed. The system's working process is described gradually from data layer, logical layer to performance layer, and the main functions of the system are analyzed and explained from the perspectives of learners, teachers and managers, thus providing a theoretical basis for the concrete implementation of the system.

1. Introduction

China is vast in territory, with a large population, unbalanced economic development, the talents and resources of which are highly concentrated in the southeast coast, and its education are relatively deficient in in the vast northwest region. The number of key universities focusing on high-quality resource is rare. The majority of learners hope to share the famous teachers and classes in these universities, the market for distance education is huge. In recent years, with the rise of the sharing economy, universities and research institutions around the world are increasingly sharing high-quality resources on the Internet. Besides university resources, there are also a large number of diversified data on the Internet, which can be obtained from enterprise information networks, various campus networks, distance learning networks, various social networks and other sources, including numbers, texts, sounds, images, videos and so on. How to design a good distance education system and efficiently use these data resources for teaching is the first goal of our research.

In the meanwhile, with the development of information technology, more and more people have entered mobile learning, and are gradually accustomed to using fragmented time for distance learning to obtain knowledge sources from diverse spaces. The learning platform that is intelligent, personalized and mobile is more and more popular with the public. With the rapid development of artificial intelligence, big data, cloud computing and other technologies, it is possible to obtain useful data from the vast Internet, identify and classify these data at a high speed, and build a personalized environment and accurate services that are accurately customized for learners. As a result, designing a distance education system based on artificial intelligence technology, which can provide personalized and independent services, is another goal of our research.

2. Advantages and characteristics of distance education system based on artificial intelligence

2.1 The advantages of distance education system based on artificial intelligence

The distance education system based on artificial intelligence can give full play to the advantages of artificial intelligence technology, classify and grade massive teaching resources, and carry out unified management, giving priority to providing high-quality resources to students, thus ensuring the quality of distance education. The distance education system based on artificial

intelligence technology will also capture and analyze each learner's state data and environment data, offer different learning resources in accordance with their learning preferences, learning habits, learning progress, learning time and learning level, and actively propose appropriate learning plans and learning suggestions to learners. It not only has the high-speed intelligent identification function, but also has the ability of precise positioning and personalized service.

2.2 The technical characteristics of distance education system based on artificial intelligence

The distance education system based on artificial intelligence technology designed in this paper integrates the data digging and analysis processing technology of big data, utilizes the deep learning and machine learning of artificial intelligence and cloud storage technology, classifies and layers the massive data captured from the Internet through feature generation, automatic identification and pattern matching, and provides personalized learning services for students. This distance education system can measure and collect learners' learning environment data, analyze the data generated in the two-way teaching process by using statistical analysis, strategy analysis, predictive recommendation and other techniques, and understand and optimize the learning process and learning situation. Students' learning can be tracked and fed back in time, reflecting the "learner-oriented" educational concept and realizing large-scale self-adaptive personalized teaching and precise service.

3. Design of distance education system based on artificial intelligence technology

3.1 A comparative analysis of traditional machine learning and deep learning

At present, the two main methods in Artificial Intelligence (AI) technology are traditional Machine Learning (ML, hereinafter referred to as machine learning) and Deep Learning (DL). The origin of machine learning is earlier. It decomposes the problem into several parts to solve them one by one, uses algorithms to analyze data and learn from them, and then makes decisions and forecasts on events. It relies on traditional algorithms such as decision tree, clustering and Bayesian classification. In Machine Learning, in order to reduce the complexity of data, it is necessary to enter the Feature of the object in advance, which is designated by experts or manually completed in accordance with previous experience and requires a large amount of domain expertise. The performance of Machine Learning depends on the accuracy of identifying and extracting these features[1].

The process of Machine Learning is like this. First pf all, the training data is selected to build a model using relevant features, and the model is repeatedly optimized through training data. Then, validation data is input into the model to form a more accurate model. In the end, real data can be input and the trained model can be used to predict new data and output processing results. If a learner's learning needs are predicted, the needs will be affected by many factors, such as learning progress, learning preferences, personal status, geographical location, time and so on. By inputting some labeled learning data into the existing model, and constantly setting weights and adjusting and optimizing each feature, a model that can accurately predict learning needs can eventually be formed.

The concept of Deep Learning originates from the research of artificial Neural Network, which simulates the human brain to establish a Neural Network for analysis and learning, and interprets data by imitating the mechanism of the human brain. There are many layers and parameters in the artificial neural network, and Deep Learning provides a set of techniques and algorithms for parameterizing the structure of the deep neural network. Deep Learning usually combines simple models and transfers data from one layer to another to build more complex models[2], without manual feature extraction. Each neuron in the neural network assigns weights to its inputs, and the final output is determined by the comparison of these weights. Taking a picture of an English test paper captured from the Internet as an example. The system breaks all elements of a picture, and then "checks" them with neurons. If all of them are English letters and do not have Chinese, there are a lot of blank brackets and underscores, the words "test" or "exam" can be found, as well as the

characteristics of title and number. The system may give such a result: 80% may be an English test paper. 15% may be an English manual and 5% may be an English poster. The neural network will give a guess with the greatest probability - English test paper according to all weights. Deep Learning can automatically train models and learn optimization, and form high-accuracy recognition models after constant adjustment and optimization. The more feature training times of its neural network, the more accurate it will be in the future. Deep learning has achieved very high accuracy in natural language processing, machine vision and other fields.

When the amount of data is small, the performance of Deep Learning is not good, and the analysis and identification of small amount of data is more suitable for Machine Learning. Machine learning can be run only by manually constructing features before use, and the workload in the early stage is small. In terms of prediction and recommendation functions of known features, Machine Learning is simple and fast, and can completely meet the requirements. Deep Learning requires a lot of computation and requires very high hardware requirements, especially a high-performance multi-core GPU matrix, otherwise it will not give full play to an advantage. Moreover, because of many parameters, Deep Learning requires a large amount of pre-training time, and only in the environment of big data can the performance advantage be reflected after the training is completed.

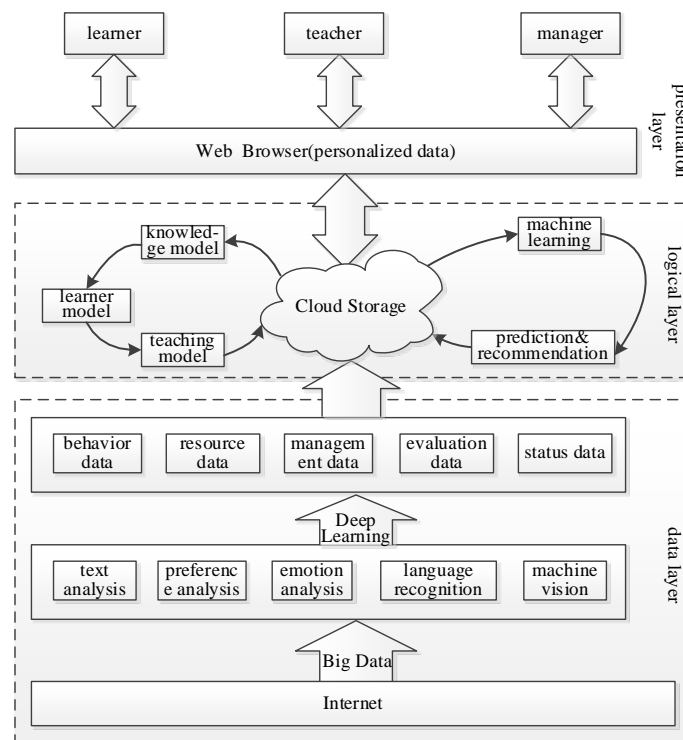## 3.2 The logical structure design of the system

Figure 1 Logical structure of distance education system based on artificial intelligence.

The logical structure of the distance education system based on artificial intelligence is designed into three layers, as shown in Figure 1, which are data layer, logic layer and presentation layer from bottom to top. The data layer first acquires massive data, and uses big data technologies such as crawler, regular expression, Xpath method and so on to efficiently grab data from the Internet. The captured data includes text, audio, graphics, images, video and other formats. For these huge amounts of data, the Deep Learning technology of artificial intelligence is used to automatically generate features to form neural networks or confrontation networks, etc. After a certain period of training, various data are subjected to text analysis, preference analysis, emotion analysis, language recognition processing and machine vision processing, classified into behavior data, resource data, management data, evaluation data and status data, and then uploaded to the cloud storage subsystem in accordance with the principle of close-by visit.

The logical layer is centered on the cloud storage subsystem, and the data stored here has been preliminarily processed by the data layer. The data in cloud storage is designed as a dynamic

two-cycle system. The first cycle revolves around three models, namely, teaching model, knowledge model and learner model. The teaching model is used to deeply simulate teachers' teaching process, skills, strategies and effective methods[3]; The knowledge model constructs the knowledge content that students should master under ideal circumstances, including the professional knowledge system of the subject they are studying. The learner model includes knowledge level, metacognitive ability, cognitive characteristics, emotional characteristics, etc. It is used to understand students' personality characteristics in cognitive and emotional aspects. The learner model can feed back the learning situation according to the learning behavior of specific learners, while the teaching model and the knowledge model infer the progress of learners through the feedback of the learner model and adjust the knowledge system and teaching methods in the model[3]. These adjusted data are stored in cloud storage and can be used repeatedly by choice to adapt to the learning of different learners. The three models are dynamic and continuously updated and enhanced.

The data in cloud storage is also designed with a second cycle, that is, Machine Learning to prediction recommendation cycle. On the basis of the data previously classified, this cycle further uses artificial intelligence technology to optimize classification. For the data that have been preliminarily identified and classified, the amount of data in each category is relatively small, and it is suitable for processing special features with Machine Learning technology. These special features are constructed by experts or managers, using clustering algorithm and Bayesian algorithm to derive rules or processes through data analysis to accurately match the recommended features, so as to predict and recommend the resources required by learners and finally form personalized data for different learners. The data in cloud storage can also be upgraded or downgraded by using decision tree and other technologies from the indicators of learners' visiting rate and good evaluation rate to form a complete hierarchy of resources and give priority to providing high-quality resources.

The data in the presentation layer flows in both directions. It not only gets customized data from cloud storage and offers it to learners, but also writes the captured learner data into cloud storage and adds it to the cycle of cloud storage subsystem to further enrich the data in cloud storage. No matter when and where, as long as the Internet is connected, students can use mobile devices or computers to log in the teaching system for learning, and can enjoy all system resources at one time and automatically receive evaluation and credits for learning. In addition to capturing learners' learning process, learning content and interactive data, the system also needs to use cameras, smart watches and other sensors to obtain learners' state and environment data. By analyzing the captured texts, sounds, pictures, expressions and logs, the system finds learners' current emotions, interest points, personality types, style preferences, learning content and progress, and judges learners' academic level, cognitive characteristics, emotional characteristics and so on, which are stored in cloud storage and used as learners' characteristic data. Teachers' online teaching data will also be captured in the presentation layer, analyzed and processed, and then stored in cloud storage. The system will also evaluate teachers' teaching status and performance level, list the excellent, good, medium and poor grades, and recommend teachers with excellent scores to students first. The presentation layer can be realized in dynamic interactive languages such as PHP, ASP.NET, JSP, etc.
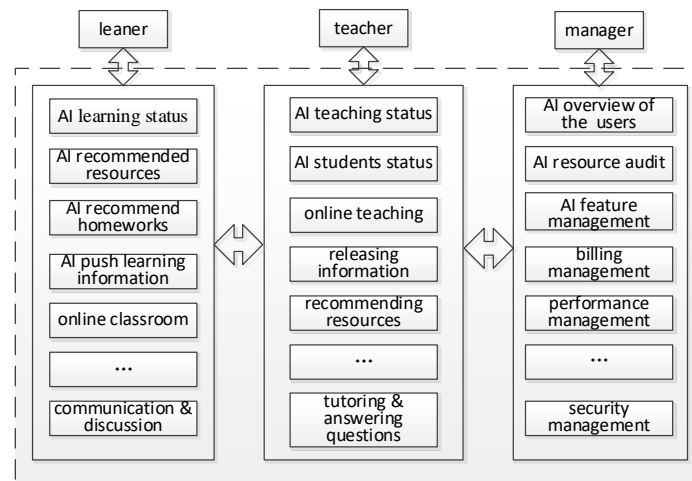
4. Design of system function

Figure 2 A functional diagram of a distance education system based on artificial intelligence.

As for the function of the system, as shown in Figure 2, after the learner logs into the system, there will be a personal learning status pushed by AI, telling the students about their current learning progress, homework completion, test results, performance evaluation level, and a summary report: according to the specific situation, praise will be given to those in good learning status, criticism will be given to those in poor status, encouragement will be given to those in progress, and early warning will be given to those in retrogression. AI also customized the ranking of recommended resources for students, and students can choose to use it. AI will also recommend appropriate assignments to students, which is in line with their academic level and progress of study, and even take into account students' preferences, they will appear in the forms that students like, such as game passing, competition, interaction, animation, voice, etc. AI also filters out clutter and useless interference information on the Internet and offers learning information related to students. As for the traditional online classroom and communication and discussion functions, students can choose to use them when they need them.

The system mainly uses Internet resources for independent teaching, but online teachers can further enhance the system's functions and promote the system's attractiveness to learners. Online teachers can provide specialized teacher classes, which is an effective supplement to independent teaching. Students can also be organized into small classes to provide teaching services that are guided by the teacher to some students and enrich the system of service forms. After the online teacher logs in, the system will actively offer the teaching status to him, including teaching plan arrangement, teaching task completion, teaching and student information, student feedback information, and so on, and also calculate the current teaching performance, attendance and other management data of the teacher. AI will also offer the status information of students to teachers, including students' learning progress, homework completion, exam results, recent learning time distribution, and even students' mood fluctuation state and learning form preferences analyzed by AI, helping teachers to carry out targeted teaching: choosing students' favorite time and selecting students' favorite resource forms to provide customized personalized services. Of course, teachers can also use the functions of systematic counseling and answering questions, releasing information, recommending resources, correcting homework, testing exams and so on to complete regular teaching tasks.

The manager refers to a team, it is not limited to an office space, and team members can log in the system from anywhere and at any time using a browser for management. The system collects the team's management data uniformly and informs each other to prevent management conflicts. After the manager enters the background of the system, AI will offer the manager an overview of the system's users, including how many teachers, how many learners and how many resources are in use online … so that the manager can have an overall understanding of the system's usage. AI also reviews and ranks resources, lists some resources with lower ranks, and suggests ways to deal

with them to managers. It will also filter out sensitive resources and put forward suggestions for batch processing. It will not operate beyond its authority without authorization, but also provide convenience for managers' management. The AI feature management function allows managers or experts to enter the system to manually build some key features for improving the efficiency of system AI Machine Learning. Administrators can also use the system for some routine management such as performance management, security management, billing management, and so on.

5. Conclusion

The distance education system based on artificial intelligence gives full play to the advantages of Deep Learning and Machine Learning, and can efficiently handle all kinds of resources grabbed from the Internet, classify and layer them, thus providing accurate personalized services for learners. It can reach the goal required by the research project. This system collects massive data on the Internet in a virtuous and dynamic cycle, dynamically improves the knowledge model, learner model and teaching model, and completes the customization of resources and services. The disadvantage is that artificial intelligence technology, especially Deep Learning, requires a lot of training to demonstrate performance, and this training process requires technicians to spend a lot of time managing it. In the meanwhile, Deep Learning technology relies on a large number of calculations and requires strong computing power. Machine Learning depends on the quality of manually constructed feature libraries, and requires many tests to meet the requirements. The following study is how to build a high-quality feature library to provide a strong guarantee for the high-speed operation of artificial intelligence and the specific realization method of the system.

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