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Key Technology and Application Research of Smart Education from the Perspective of Brain Science

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Abstract

The construction and sustainable development of smart education is inseparable from the innovation and application of smart technology. Edge computing technology expands the sharing of educational resources and educational services. Internet of Things technology enhances the perception of educational environment and teaching activities. Big data technology improves the intelligence of education management, decision-making and evaluation. Positioning technology perceives location information to improve targeted

educational services. Virtual reality and augmented reality enhance the teaching interaction and experience of virtual space. Artificial intelligence technology, especially knowledge graph can improve the visualization of educational resources and achieve personalized recommendation. Semantic network and ontology, can let the machine read educational resources with the service. The paper focuses on cloud computing, Internet of Things, big data, positioning, virtual reality and augmented reality, semantic web and ontology, knowledge graph and other smart education technologies and describes the specific application of these technologies in smart education.

Keywords : Internet of Things•Big data•Positioning•Knowledge map•Smart education
•Artificial intelligence

1. Introduction

With the rapid development of science and technology, the technical means of the brain researching are becoming more and more diversified. As a young discipline, modern brain science has flourished in a short period of time. Experts have said that the cross-integration between brain science and artificial intelligence will inevitably lead to a new scientific and technological revolution and industrial revolution. It will profoundly affect human thinking paradigms and lifestyles in the foreseeable future and become a new perspective for human beings to understand the world. Baoxian JIA.et al. (2018) designed intelligent retrieval system based on brain science for personalized study recommendation service which improved the accuracy and efficiency.

At present, the wide application of artificial intelligence technology relies mainly on large closed-loop optimization, deep learning and big data. It is also possible to combine the successful experience of artificial intelligence with the research ideas of brain science.

Artificial intelligence technology has the advantages of instant, personalized and massive data storage operations, and has advantages in context-aware resource recommendation,

automatic acquisition, and learning path planning. Brain science research helps to design and implement new learning mechanisms and topologies in artificial neural network technology, which will strongly promote the further development of artificial intelligence. The construction of smart education and sustainable development are inseparable from the innovative application of advanced technologies such as cloud computing, Internet of Things, big data, augmented reality, positioning technology, and semantic network. Among them, the Internet of Things and the Semantic Web are the key to the construction of smart education infrastructure. technology.

Artificial intelligence can provide simulation tools, systems and platforms for brain science, support the verification of scientific hypotheses, and provide broad application prospects. The further integration of brain science and artificial intelligence is expected to make breakthroughs in a number of characteristic directions. It has important research value and application prospects for exploring the intelligent nature of human beings, improving human intelligence limits, and promoting the level of intelligence in society. The rational interpretation and prudent application of the results of brain science research in the field of education will become an important basis for understanding learning and reforming traditional teaching.

2. Edge computing: expanding the sharing of educational resources and educational services

Cloud computing is considered to be the third IT wave after personal computers and the Internet. Simply, cloud computing is a collection of many computer resources and services. It will be easy and convenient to access a variety of cloud-based application information, eliminate the need to install and maintain. When the transition of individuals or groups in the education process depends on cloud computing, there will be a phenomenon in which various data processing hopes to go to the cloud, resulting in reduced efficiency and increased delay. Many scenarios cannot be used. So mobile Edge computing, which uses the wireless access network to provide the services and cloud computing functions, is required by users to

create a carrier-class service environment with high performance, low latency and high bandwidth. Edge computing is effective for cloud computing. In addition, it can be safely used in educational blockchain scenarios.

Cloud computing can bring a lot of computing power to users with zero input. In the next 30 years, cloud-based mobile computing will be applied to all areas of the education industry. The development of cloud computing technology in colleges and universities has entered the practical application stage. The application of cloud computing in the smart education system mainly focuses on the sharing of educational resources (hardware, platform, software, learning resources), which can effectively solve the education informationization. In the process of advancing, there are persistent investments such as repetitive investment and information silos. In addition, cloud computing can also be used to create a cloud-based learning environment. Students can enjoy various learning services in the cloud at any time through terminals such as e-books. The learner's learning process data will also be stored in the cloud in time to ensure that the learning data will never be lost, providing data support for learning analysis.

Smart education cloud has five key technical features: service situation recognition, intelligent information extraction, intelligent information processing, intelligent information retrieval, and intelligent information push. The use of semantic Web technology and ubiquitous technology to develop a smart learning space can provide context-aware services to learners, such as intelligently pushing personalized learning resources to learners by perceiving the learner's location and learning activities. It is important for smart education to promote communication between learners and share learning resources in real time.

3. Internet of Things technology: improving the perception of educational environment and teaching activities

The cooperation between the three technologies of Internet of Things, data analysis, and artificial intelligence will create a huge network of intelligent machines in the world, enabling massive commercial transactions without human intervention, including education.

But while the Internet of Things will increase efficiency, it will also increase concerns about network security and personal privacy.

In addition to being used to build an intelligent teaching environment, enrich experimental teaching, and assist energy management, the Internet of Things technology can also monitor student health. (Monitor physical health, blood pressure, pulse and other vital signs data); learning situation data collection, through sensor combined with positioning technology, real-time capture of learner's learning location, time, content, status, environmental information and other learning context information, for adaptation Sex push resources, activities and tools, visual monitoring, and understand the students' every move. It can expand extracurricular teaching activities, students experience and explore various natural phenomena and cultivate their inquiry spirit and innovation ability by Mashal I, et al.(2018). It is efficient for education security monitoring and rapid response to crisis.

In the future, a large number of IOT application platforms will integrate machine learning, image recognition, augmented reality and blockchain technology. The integration of these technologies will promote the healthy and rapid development of smart education. For example, brush face access can be applied to classroom attendance.

4. Big Data and Data Mining: Improving the Wisdom of Education

Management, Decision Making and Evaluation

We are in the era of big data and digital transformation and data is everywhere. The use of data-driven ideas and strategies has gradually become a consensus in practice, and the value of data has been successfully reflected in education. Big data technology is a collection of collection, storage, management, processing, analysis, sharing, and visualization technologies. Big data captures, stores, and analyzes entire databases, discovering the relationships between known variables, and enabling effective science to make prediction. The core technology used by big data in education is education data mining and learning analysis. Based on the scientific research of big data, it can dynamically collect the data needed for scientific research, analyze and process large-scale scientific research information, find its

internal relevance, predict the development trend of scientific research, improve the efficiency of scientific research and the credibility of scientific research results. The analysis of educational big data has changed the traditional data questionnaire method. Education big data belongs to natural data and the credibility is larger than traditional data. At the same time, it focuses on mining. Of course, the education of big data is safer with the help of blockchain technology.

Educational big data refers to a collection of data generated throughout the educational activity that is collected according to educational needs and used to develop education and create great potential value. Education big data is definitely not only the data of the education classroom, the data of the scores, but also the information data of the students' family background, economic status, etc., emphasizing the relevance and cross-cutting of the data. There are two main sources of education big data, one is from teaching activities and the other is from management activities. The big data collection in the field of education presents a high degree of complexity. The collection of educational big data is different from the collection of big data of e-commerce. E-commerce can collect a lot of data through the actions of payment and operation. But for the data in education field, it is difficult to collect data, especially in the field of informal learning. If you don't use the Internet, how do you collect his learning data without using a mobile phone? The basic characteristics of smart management are reflected in many aspects. The smart management of education must first realize the comprehensive digitization of the education business. Smart management emphasizes the individualized intelligent service in the aspect of personalization, using massive data resources and years of behavioral scientific analysis to accurately find suitable and feasible educational opportunities for users. Big data will become a catalyst for new research models, artificial intelligence, and data open processes.

5. Virtual Reality and Augmented Reality: Enhance the Teaching Interaction and the Experience of Virtual Space

Augmented reality is a kind of information generated by calculations added to the real scene in a visually fused manner. The core technologies of augmented reality include display technology, spatial positioning and tracking technology, computer graphics and image technology, etc. It has core features such as virtual integration, real-time interaction, and 3D orientation. Many colleges and universities explore the combination of augmented reality in experimental teaching to promote students' practical interest, share teaching equipment, and save teaching resources. Augmented reality technology is developed from virtual reality technology. In the past few years, the market has had some over-expansion expectations for VR and AR. Today's ultra-high definition displays, low-cost pose and position detectors and high-definition video content have laid a solid foundation for mixed reality.

Virtual reality technology uses computers to create a virtual space. It uses virtual reality glasses to immerse users in a virtual synthetic environment that doesn't see the real environment. It utilizes the binocular vision principle to make the virtual world appear in a 3D stereoscopic state in the glasses. Wearable devices connected by the Internet of Things will bring real-time information directly into our senses.

In the future, virtual reality will not only involve vision, hearing, but also smell, touch, and taste. It constructs a world similar to the real environment. Augmented reality technology can fuse virtual information (objects, pictures, videos, sounds, etc.) into the real world. It enriches the real world and builds a more comprehensive and better world. In the future, the glasses or contact lenses we wear will revolutionize our communications, office, entertainment and more. In the future, we no longer need computers, mobile phones and other entities, just cast the image of the screen in both eyes, you can create a floating screen and a 3D stereo interface. In the future, friends thousands of kilometers away can immediately appear in front of you to talk face to face with you. You will also touch any object in the Unreal World. In the future, humans can easily be completely immersed in another virtual world.

6.Positioning technology: perceive location information and improve the pertinence of educational services

The Location Based Service provides the user's related services by locating the technology location information. In addition to location navigation, emergency assistance, information query and other functions, it can also be adaptively pushed in learning resources. It can recommend potential learning needs based on recorded information, and then recommend more suitable personalized learning resources.

Simultaneous positioning technology can promote collaborative learning. When learners encounter problems and are puzzling, they can immediately use the help information to release help information in time through learning partners and subject experts near LBS technology. Positioning technology can respond in a timely manner and conduct learning guidance.

Positioning technology can guarantee the personal safety of students. In recent years, there have been many incidents of injuries to students around the world. LBS can not only provide emergency rescue services within the school, but also conduct real-time location tracking and conduct safety monitoring for teachers, students and researchers who conduct teaching and research activities outside the school. In addition, mobile navigation, WeChat sharing location, etc. are all conducive to the recommendation of personalized learning services.

7.Semantic Network and Ontology: Let Machines Read Educational Resources and Services

The core idea of the semantic web is to attach the semantics that can be understood by the machine to the existing World Wide Web, making the Internet a universal information exchange medium. The Semantic Web is an extension of the current network. Information is given a clear meaning. It can make people and computers work better together. Due to the advantages of semantic network technology in knowledge representation, information sharing, and intelligent reasoning, many researchers in the field of e-learning have begun to have a great interest in the Semantic Web. Ontology technology is the most widely used in the Semantic Web. For semantic learning resources, ontology is the basis for knowledge sharing and reuse. Scholars such as R. Studer et al.(1998) of Karlsruhe University in Germany have

conducted in-depth research on the basis of previous studies, and believe that ontology is a clear formal specification of shared conceptual models. It focuses on adaptive system development, learning resource management and sharing, adaptive resource distribution and personalized learning content recommendation, semantic retrieval, and intelligent Q&A.

There are many ways to express knowledge. The ontology expresses the structure of the concept, the relationship between the concepts, and the attributes inherent in the concept. In the era of rapid development of science and technology, the introduction of smart education has brought education informatization to a new height. The ontology has been widely used at home and abroad. The application of ontology information integration, knowledge organization and reasoning in smart education enables education to realize the new concept of smart education at the technical and method level.

Smart education is a new education order and new form in the information age built on the basis of informationization. It is the inevitable result of "Internet + education." It is the integration of fragmented resources and the reconstruction of education. The mapping between heterogeneous ontology enables the interworking between multiple domains. It associates concepts with terms and provides definitions or examples related to them. It also correlates the concepts of different presentations across disciplines and languages. What is important in education is the transfer and sharing of knowledge. The description language of ontology is OWL, and OWL is based on XML. This formal description is the component that knowledge is reused and shared in the software system. Therefore, the ontology not only integrates concepts into one, but also bridges connecting the three worlds, with advanced sharing capabilities of intelligent information integration.

In a society where information is rapidly developing, the introduction of smart education makes the content directly taught by education wisdom. That is to say, the educational content directly received by the educated person is wisdom. As a way of knowledge organization, ontology can not only store some unnatural language, but also store natural language. The ontology also plays a key role in the tacit knowledge that exists in the real world and in the human brain. The formalization of tacit knowledge makes the semantic learning resources in the e-book package appear as higher-level knowledge, and the existing

knowledge or information presentation becomes the transmission of wisdom knowledge.

In the process of learning, we can use the ontology to record learners' learning based on knowledge and experience such as education, educational psychology, and teaching systems. We can use the inference function of the ontology to automatically introduce a route suitable for learners to learn and implement a personalized learning method suitable for learners. Compared with other data organization methods, the integration of massive learning resources and related knowledge of ontology is more conducive to achieving multiple learning methods. As an important component of the Semantic Web, ontology intelligently realizes the integration of information. In the continuous development of smart education, it not only realizes the wisdom education concept of technological innovation, but also provides certain support to the smart education method. Therefore, the ontology promotes the development of smart education, and the ontology will gradually mature in the development of smart education.

8. Artificial intelligence technology: providing personalized recommendation service based on knowledge graph

At present, the concept of smart education has become the focus of educational researchers. Behind the "smart", in addition to the need for advanced education and teaching concepts, it is inseparable from the support of artificial intelligence technology. In today's era of educational information overload, how to effectively and timely select and recommend information that meets user needs, has become one of the key issues of personalized learning services. Artificial intelligence technology has the advantages of instant, personalized and massive data storage operations. It has advantages in context-aware resource recommendation, automatic acquisition, and learning path planning. Artificial intelligence will present new features such as deep learning, cross-border integration, and human-machine collaboration. The algorithm for deep learning neural networks has lacked fundamental breakthroughs for decades. In the fields of general artificial intelligence, brain-like intelligence, cognitive intelligence, etc., the existing artificial intelligence

technology is far from achieving substantial progress in basic theory.

In the early 21st century, foreign researchers began to realize the significance of personalized recommendation of learning resources. In October 2012, the US Department of Education released the Education Big Data Report on Promoting Teaching and Learning through Educational Data Mining and Learning Analytics. The report provides a detailed introduction to the areas and cases of big data education applications in the United States and the challenges they face. In order to illustrate the educational application of educational big data, the report uses the application of big data in the adaptive learning system as an example. Saleh et al. (2014) created a learning material recommendation system framework, which can not only recommend based on the user's multiple preferences and multi-dimensional attributes of learning materials, but also can be related to multiple materials based on association rules. The goal-oriented online learning recommendation system proposed by Chughtai et al. (2015) focuses on solving the cold start problem in online learning personalized recommendation. The system divides the cold start problem into new user recommendations and low frequency learning user recommendations. The former combines a collaborative filtering algorithm with a content filtering based algorithm. The latter is solved by combining the neighbor algorithm. Méndez et al. (2018) designed a CBR(Case-based Reasoning) personal recommendation system. It can be designed to support the user's selection of educational materials from the library of learning objects according to the needs and preferences of the user, and to improve the recommended learning materials for each particular student by using the relevance of the previous interview results of students with similar characteristics. Jia, B. X.et al. (2018) designed semantic similarity calculation algorithm based on knowledge graph for personalized study recommendation service which improved the accuracy and efficiency of recommendation.

The most valuable of the school is the teaching resources and the experience of the teachers. Traditional teaching focuses on the teaching hardware itself and lacks efficient application of teaching resources. Through artificial intelligence technology, we can build a massive and digital resource library to help teachers develop personalized lesson plans, reduce burdens and improve efficiency.

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