The Construction and Application of Intelligent Learning Environment

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Abstract

Intelligent teaching environment is a pan technical environment and a technology enhanced classroom. With the support of various intelligent technologies, it realizes the data transmission, communication and interworking of "cloud", "network" and "end", constitute an intelligent learning support environment with dynamic learning data analysis as the core. In the process of constructing intelligent learning environment, metauniverse is the cornerstone of intelligent online learning environment. The underlying technologies mainly rely on include 5G / 6G network environment, resource production, big data processing, authentication mechanism, interactive interface, etc. Environmental awareness technology is the basic technology of "intelligent campus", which helps to realize the real-time dynamic monitoring and control of various physical devices on campus. Learning scenario recognition is a key technology in the construction of smart campus. It is the premise of personalized learning resource push, learning partner connection and learning activity suggestion. It involves the comprehensive application of learner feature analysis, sensor technology and automatic reasoning. In addition to the above technologies, the technologies to be used in the intelligent learning environment in the future also include three main machine learning algorithms relied on by the AI based video recognition system, SaaS based applications supported by AI, deep learning algorithms, etc., which can model the contents of learners' personal information and learners' situational information, can reflect the learning process information through interactive text, video and audio, system logs, etc. Automatic interactive text analysis technologies such as participation analysis, social network analysis and content analysis are used to support the natural interaction between future classroom user subjects and classroom technology, resources and environment, so as to realize the flexible sharing, connection and reuse of distributed resources in ubiquitous learning environment. At the same time, it has good expansibility, can be used as the basis of intelligent resource retrieval and push, which greatly enhances the adaptability of the learning system and the ability of personalized service for users. In short, the use of the Internet and various new technologies and new media provides learners with a wealth of cognitive tools and intelligent supporting environment. Changing the traditional teaching structure dominated by teachers into a new teaching structure dominated by students and combined with dominance and subject, promoting the "classroom revolution" is conducive to the personalized growth and intellectual development of students.

Keywords: Intelligent learning, data mining, deep learning, algorithm

1.INTRODUCTION

Based on the thinking mode of "Internet +" and the new generation of information technology, the intelligent classroom platform is built. The backstage data resource storage, processing and service support are based on the intelligent education cloud platform. The front-end application is to use smart mobile terminal equipment such as smart phones, tablet computers and app services. Through the classroom wireless network, the data transmission and communication of "cloud", "network" and "end" are realized, the intelligent learning supporting environment with dynamic learning data analysis as the core is formed. In an ideal intelligent learning environment, each learner can hold an intelligent mobile device (such as iPad), whose screen size is close to that of the paper textbook, can imitate all the functions of the paper textbook, such as making notes, inserting bookmarks, marking and annotation, which has the effect of paper textbooks. This kind of "textbook" loaded in intelligent mobile devices is called electronic textbook.

The content of electronic teaching material is multimedia, the knowledge points can be displayed individually according to the semantic relation. Electronic textbooks can be bound with learners' learning progress, can realize the synchronization of cloud services of learning data, record the learning process of learners, intelligent analysis of learners' learning results, graphically present the analysis results, provide guidance and help for learners' learning in combination with the teachers' opinions. For students in school, the intelligent learning environment will make their study in school, family and society have the "wisdom".

Table 1: List of devices in smart learning environment

Cloud platform of holographic classroom	Holographic blackboard	
Ar station	Holographic platform	
Vrpie three-dimensional network platform	Table holographic table	
Virtual reality helmet	VRP virtual reality software	CAVE

2.INTELLIGENT LEARNING MODE IN DIFFERENT ENVIRONMENTS

In school learning, teachers can use augmented reality technology to present various real learning scenarios, so that students can experience the learning objects in their own circumstances and enhance their interest and motivation. According to the results of the student preview recorded systematically, the teacher focuses on the knowledge points that student are difficult to understand. The system provides rich learning resources, design various learning activities. Teachers can control the learning terminal flexibly and push the relevant learning resources in real time through the integrated classroom control system [1]. Teachers can quickly group according to the characteristics of learners, which is convenient for organizing classroom cooperative learning. Students can use the convenient interactive tools provided by the system to interact with peers and teachers. Students can also use the built-in voting device to interact with teachers in time. Teachers can obtain the feedback information of students at the first time, adjust teaching timely according to the feedback information. Intelligent learning environment can provide intelligent teaching design support to assist teachers in classroom teaching design, can automatically correct and analyze students' homework and test papers. Intelligent learning environment provides such synchronous communication tools as QQ, MSN, and asynchronous communication tools such as microblog and virtual learning community, which are convenient for teachers and students to contact with students.

In family learning, students can use electronic textbooks to preview and complete homework arranged by teachers. The emphasis of the preview has been marked out, and the homework assigned by the teacher can be attempted after the preview. The system automatically gives feedback of the job results, prompts and answers the difficult problems, and gives the structure diagram of the relationship between the knowledge points according to the main knowledge points and the secondary knowledge points. The system can record the students' homework completion. Teachers can carry out targeted teaching and individualized guidance to students according to statistics. The intelligent learning system provides 1-to-1 tutoring function, which makes it convenient for students to call teachers when they need to learn and guide. Parents can learn about students' learning in school through the learning records provided by electronic textbooks. The electronic signature of parents can be easily transmitted to the school management system through electronic textbooks. In social learning, the intelligent learning environment can perceive the place where the learner is, and actively push the learning resources related to the environment of the learner according to the location and the learning style of the learner, realize the adaptive ubiquitous learning. In some cases, the learners can be grouped according to the position of the learners, the learners in the same place can form a group to meet the needs of cooperative learning in the real situation of students. It can provide the most suitable learning path and the most suitable learning method for the learners. For adults and out of school learners, intelligent learning environment can integrate formal learning and informal learning organically, meet the internal needs of human life-long learning, adapt to the needs of school learning, family learning and social learning, so as to realize the concept of "seamless learning".

Intelligent learning environment includes several aspects. First, learning resources. Advocate rich media of resources, online access has become the mainstream, and users can choose resources. Encourage teaching resources to be independent of equipment, seamless link or automatic synchronization has become a fashion, and push resources on demand. Second, learning tools. General tools can help learners judge the technical environment and learning situation, and specialized tools can automatically perceive that the technical environment and learning situation are automatically identified. Third, the learning community. Virtual community focuses on online communication and selects its own circle, but it is subject to information skills. There is also a real community combined with mobile Internet, which can communicate anytime and anywhere and automatically match the circle, but it depends on media literacy. Fourth, teaching community. The formation of teaching communities is highly dependent on experience, so regional communities are often easier to form. Now it is more about automatically forming communities and

paying high attention to user experience. Moreover, cross domain communities have become fashionable. Fifth, learning style. Focusing on individual knowledge construction and low-level cognitive goals, and unifying the evaluation requirements, interest has become the key to the difference of learning methods. Highlighting the construction of group collaborative knowledge, paying attention to high-order cognitive objectives and diversified evaluation requirements, thinking has become the key to the difference of learning methods.

Sixth, teaching methods. Pay attention to resource design and explanation, conduct summative evaluation of learning results based on learners' behavior, and be able to observe learning behavior. Adaptive evaluation of learning results based on learners' cognitive characteristics and timely intervention of learning activities.

Table2: Intelligent learning environment diagram

Intelligent learning environment	Data analysis system technology	Recommended learning form	Learning Repository:	
student	Clear objectives	Choose learning form	Micro class Multimedia resources test	
teacher	Learning situation analysis level objectives	Guided learning form selection	Provide personalized resources	
Equipment support: electronic whiteboard, projection multimedia	Exercise bank and data analysis	Personalized Learning Resource Recommendation	Evaluation system record and feedback	
Achievement report and group exploration	In class test	Targeted practice	General reflection and personal records	Personal promotion
Layered guidance	Timely feedback	Push personalized exercises	Personalized micro – Class Counseling	Evaluation summary

3.TECHNICAL SCENARIO OF INTELLIGENT LEARNING ENVIRONMENT

3.1. Tracking learning process

The intelligent learning environment can perceive and record learners' knowledge acquisition, classroom interaction, group cooperation and other aspects through action capture, emotion calculation and eye tracking. It also can track the learning process, analyze the learning results and establish a learner model, which is more comprehensive. Accurate evaluation of learners' learning effect provides an important basis.

3.2. Recognizing learning scenario

Intelligent learning environment can provide learners with personalized resources and tools according to learner models and learning scenarios to promote effective learning [2]. Intelligent learning environment can identify learning situations, including learning time, learning place, learning partners and learning activities. The identification of learning situations provides support for the development of teaching activities.

3.3. Awareness of physical environment

Intelligent learning environment can use sensor technology to monitor physical environment factors such as air, temperature, light, sound and smell, so as to provide learners with a comfortable physical environment.

## 3.4. Connecting learning community

The intelligent learning environment can establish a learning community for specific learning situations and

provide support for learners to effectively connect and use the learning community for communication.

3.5. Easy, engaged and effective learning

The goal of intelligent learning environment is to create process record, situation recognition, environment aware and community connected conditions for learning [3], promote learners' easy, input and effective learning. Recording process, identifying scenarios, perceiving environment and connecting communities to promote learners' easy, input and effective learning not only reflects the technical characteristics of the intelligent learning environment, but also its functional requirements. It can be referred to as trace3 intelligent learning environment function model.

Table3: Trace3 intelligent learning environment function model
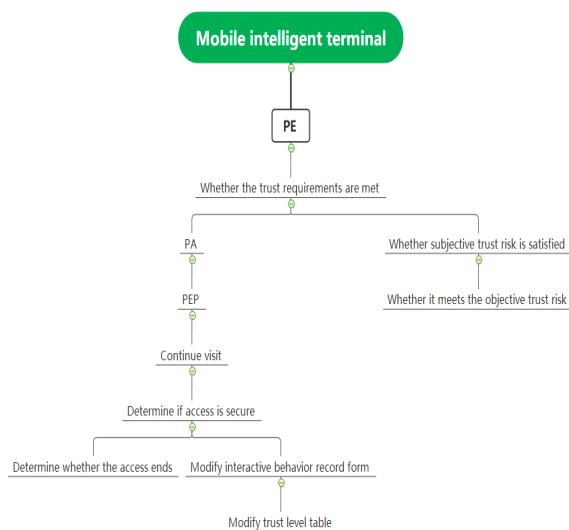
4.METAVERSE IS THE CORNERSTONE OF INTELLIGENT ONLINE LEARNING ENVIRONMENT

Metaverse has complied with the concept of subversive, intelligent, green and international development of the sixth scientific and technological revolution, pushed forward the technological development track of "single technology - composite technology - rich technology", showed new intelligence of human nature by controlling various technologies. In a comprehensive way, the underlying technologies that the metauniverse mainly relies on include:

4.1.5g/6g network environment

Metaverse will build a new generation communication network with 5g/6g, thoroughly break through the communication barrier of intelligent technology integration and enabling. Metaverse network integrates cloud computing, ubiquitous computing and edge computing, forms a new technology connecting field, promotes the deep integration of "Information Physics Society"[4]. The development of meta universe network points to "all things are intelligent and digital twin", which shows the innovative characteristics of intelligent endogenesis, security endogenesis, multi domain integration and integration of computing network. Based on the meta universe immersion multi-sensor network, the real-time control of immersive cloud expansion reality, holographic communication, sensory interconnection, intelligent interaction and other events can be realized.

4.2. Resource production

The meta universe will form the resource ecological development field by means of artificial intelligence technology. First, the continuous intelligence will generate a large amount of mining content to realize the dynamic growth of meta universe resources. Second, the personalized learning resources are generated intelligently on demand, and the intelligent adaptation of meta universe resources is pushed dynamically. Third, the resource intelligence review covers all the resources, and realizes the security and legality of meta universe resources.

4.3. Big data processing

The meta universe will further promote the intelligent computing system, and the architecture conforms to web3.0 resource aggregation configured service system. With the support of intelligent technology, cloud computing will promote the intelligent virtualization of hardware and intelligent service transformation of software of meta universe online education system, form a new mode of deep intelligent integration of each subsystem [5]. Through the data cloud, resource cloud and service cloud in the cloud, seamless transformation and connection of data communication and distribution in meta universe can be realized, a new logical framework, architecture and service mode of online education of meta universe can be generated, and configurable scalability, multi resource integration and sharing and dynamic precision service can be realized.

4.4. Authentication mechanism

Blockchain has the characteristics of decentralization, traceability, tampering and trustworthiness, which will promote the change of production relations in meta universe, change from information network to value network, and form a certified ecosystem matching intelligent online learning environment. In terms of resource construction, blockchain technology can help to form an ecosystem of online resources storage, connection, transaction sharing and management of metauniverse, and realize the optimal circulation and

allocation of resources. In terms of learning certification, blockchain technology will help promote credit certification, learning achievement certification and ability certification, and realize intelligent, safe, efficient and common recognition of certification management.

4.5. Interactive interface

The meta universe will surpass the interactive stage of graphic interface and truly turn to a new stage of human-computer interaction based on reality. From the perspective of human-computer interaction, meta universe online learning interaction will integrate action, touch, eye movement, gesture and electromyography in multiple channels to achieve physical natural interaction. From the perspective of the interaction between human and computer, metauniverse will establish a direct relationship with human brain through brain computer interface, realize the dynamic transformation of brain nerve signal and external representation modeling, create ideal learning experience of mind.

**Table4:** The construction model of intelligent online learning environment of Metaverse
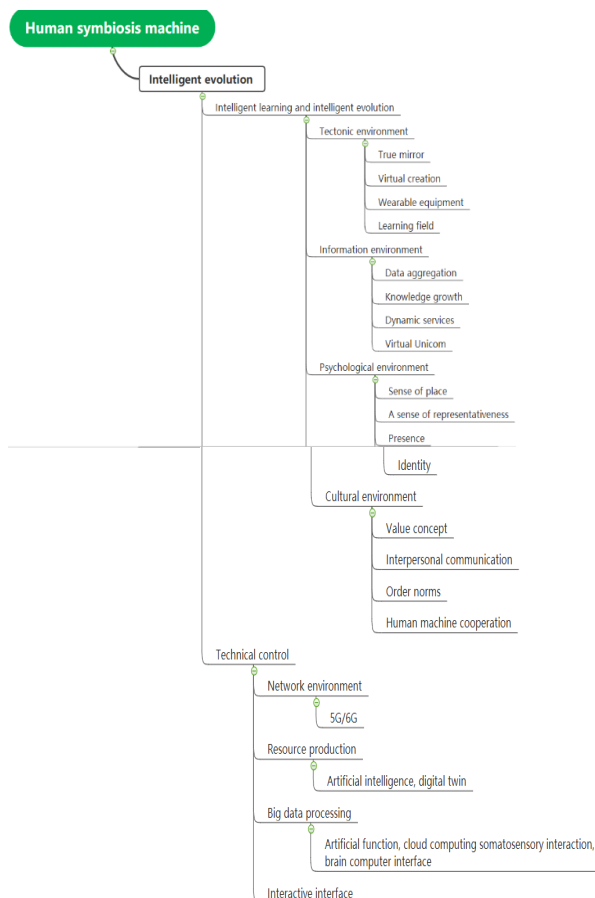
5.KEY SUPPORTING TECHNOLOGY OF INTELLIGENT LEARNING ENVIRONMENT

5.1. Machine learning algorithm

The current and next generation of AI based video recognition system rely on three main machine learning algorithms: supervised learning algorithm - supervised machine learning algorithm is good at finding the abnormal situation of image changing with time. They can recognize the correct image of the target by training the data set, so they can recognize the abnormal image. Agriculture, construction, oil and gas and utilities rely on supervised machine learning algorithms to identify, track and monitor vehicle, machinery, assets and remote location usage patterns [6]. Construction companies will benefit from these algorithms, which not only protect remote sites, but also anticipate the harmful working conditions that their production teams may face. The supervised machine learning algorithm is written to use scikit-learn and caret by AI developers for AI based video recognition systems. In order to break the limitation of manual data annotation in supervised learning, Mintz put forward a distance supervision algorithm. The core idea of this algorithm is to align the text with large-scale knowledge map and mark the text by using the existing relationship between entities in knowledge map.

The basic assumption of remote supervision is that if Tripler (E1, E2) can be obtained from knowledge map (Note: R represents relationship, E1 and E2 represent two entities), and E1 and E2 co-exist in sentence s, s expresses the relationship R between E1 and E2, which is marked as training example. Remote monitoring algorithm is a popular method in relation extraction system and one of the research hotspots in this field. The algorithm solves the problem of data annotation scale well, but the basic assumption based on it is too strong, which will introduce a lot of noise data. In order to reduce the influence of the wrong label problem, many improved algorithms have been put forward in the academic circles, including three kinds of methods. Rule based method: by statistical analysis of the right label cases, adding rules, the original positive label cases are marked as negative cases directly, or the original positive labels are offset by the control of score. The method based on graph model: construct the graph model which can represent the correlation between variables such as factor graph. Through the learning of features and the calculation of feature weight, the influence of the right label cases on the global is reduced.

Table5: Machine learning diagram learning environment
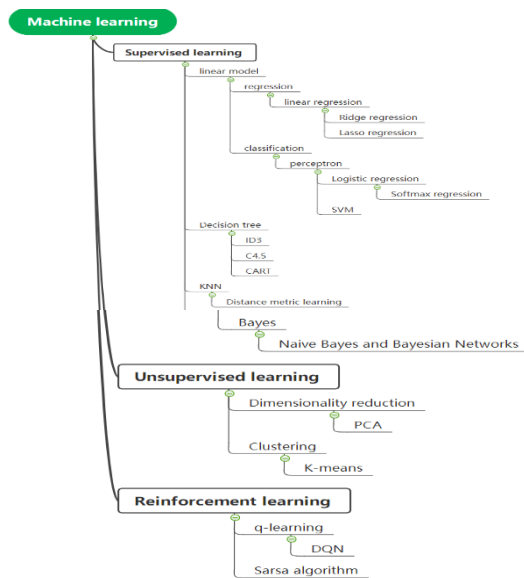
Based on multi-instance learning model: All the sentences containing (E1, E2) are formed into a bag, and the training samples are generated by filtering sentences from each bag. The first time such methods were proposed, it was assumed that if R (E1, E2) existed in the knowledge map, at least one of all instances containing (E1, E2) in the corpus expressed the relationship Generally, combined with the undirected graph model, the samples with the highest confidence in each package are calculated, which are labeled as positive training examples. This hypothesis is more reasonable than the remote monitoring hypothesis, but it may lose a lot of training samples, resulting in the loss of useful information and insufficient training. In order to get more abundant training samples, a multi-instance multi labels method is proposed. The assumption of this method is that in the same package, a sense can only represent one relationship of (E1, E2), that is, only one label can be given, but different senses can represent different relationships (E1, E2), so that different labels can be obtained. The label value of multi label is not positive or negative, but a relationship. It provides a possible way to realize the multi relationship of an entity pair at the same time. Another improved method is to select multiple valid senses from one package as training set, which is generally combined with deep learning method.

Unsupervised learning algorithm. This class of algorithms is good at discovering new patterns in images, which is very valuable for discovering and reporting anomalies in real-time video streams. Oil and gas companies rely on these algorithms to monitor infrared and thermal data from remote equipment and assets [7]. Popular tools for writing unsupervised machine learning algorithms include tensor flow, PyTorch, and Keras. There is a free in-depth Stanford University Course online. Reinforcement learning algorithm - based on the concept of reinforcement results, AI based video recognition system uses these algorithms to modify the way it recognizes and updates known images. In remote construction, oil and gas and utility stations rely on the combination of real-time monitoring and reinforcement learning algorithm to continuously evaluate the status of equipment and assets. The insights provided by the enhanced learning algorithm can help ensure that remote devices located in different geographic locations are consistent, compliant and secure at the best level. Google's autonomous vehicle project and Tesla autonomous driving feature rely on enhanced learning algorithms to navigate the test cities they are in today.

5.2. SaaS based applications supported by AI

5.2.1. AIOps

The growing popularity of SAAS and cloud based solutions is driving enterprise content consumption. This change in content consumption and the demand for scalable SaaS platforms lead to an increase in demand for AI based operations or AIOps.AIOps is a multi-layer technology platform, which surpasses the current SaaS based it functions. So if you want to know how to develop SaaS based solutions driven by AI, you can use AIOps to improve your remote capabilities to a new level. It encapsulates analysis and machine learning algorithms to provide excellent intelligent operation. First, AIOps platform utilizes big data and aggregates data from multiple resources within the organization. Next, it deploys ML algorithm, and enables real-time operation for sudden changes in SaaS based operations through detailed analysis of different parameters. AIOps works on two main components: big data and machine learning. These platforms need to exceed the data sources recorded by logging and monitoring tools.

5.2.2.AI service

AIaas enables enterprises to integrate reliable third parties into their SaaS applications. Let's take an example of a reputation management marketing solution that you want to integrate into your CRM application.AI based algorithms can help you design custom API or application programming interfaces according to the supplier's environment, and seamlessly integrate with your existing SaaS based CRM software. Most organizations leverage the development of custom APIs for such integration. However, each time you integrate, you must create a new API from scratch.AI can help you create reusable scripts that can be changed slightly according to the new environment and reduce the time of API development. However, some frameworks provide such reusable scripts, but they are very self-righteous and cannot be flexibly adjusted according to different environments. In addition, remote integration requires enterprises to be able to deploy these APIs on cloud-based platforms, which requires more intelligent functions and close monitoring

of assets.AI based SaaS monitoring tools can help your organization track deployment remotely in different environments. Similarly, performing remote deployment of applications is also a challenge that AI can help through a more intelligent CI / CD pipeline.

Table6: SaaS monitoring tool based on AI
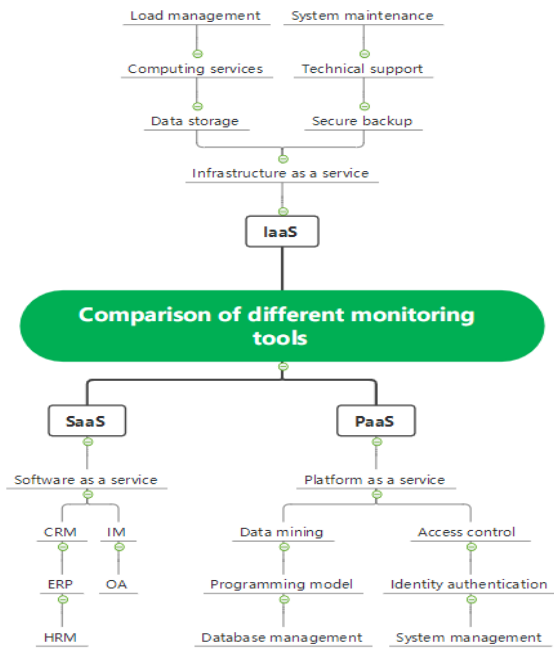

5.2.3. Remote deployment

Deploying SaaS applications remotely is not easy because you may want to store core services in your local data center to improve security and uptime. Here, you can take a hybrid cloud approach to deployment. However, deployment requires continuous integration and delivery to simplify. Take the chat robot implementation of your SaaS application as an example. It is a computer program that can simulate the communication between people to achieve better participation. For the deployment of chat robot, you must configure multiple trigger functions and enable storage, analysis and data processing. The core of chat robot needs artificial intelligence-based algorithm to run, but at the same time, you can also use artificial intelligence technology to deploy. For example, AI algorithms can orchestrate deployment pipelines and simplify everything from design to testing SaaS applications. In terms of remote deployment, another key aspect is the effective delivery of content across platforms, while creating and collaborating content remotely.

5.2.4. SaaS customization

When you want to customize the trigger for your application, you need to have a well-designed SaaS based policy. Once you have a strategy for AI integration, the next step is to assess existing applications and define the key features you need to trigger. For example, if you are developing SaaS based applications for marketing purposes, you need to define trigger features such as automatic reply, follow-up email, and so on. Here, you can leverage SaaS consultant expertise to identify, evaluate, and develop important triggers to enhance customer journey.

Table7: Integrated application model of cockpit in smart classroom
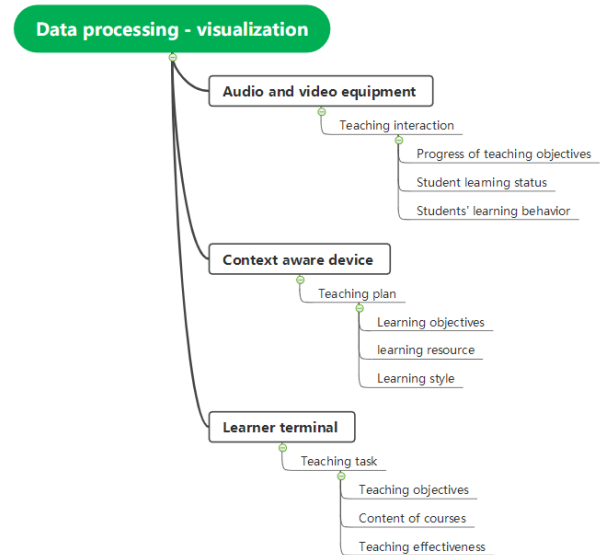
5.3. Main deep learning algorithms

Machine learning is essentially an approximation to the real model of the problem. Among them, supervised classification algorithms have been widely used in many business scenarios, such as: judging whether users will default according to personal education, gender, age and other information. Classification problem belongs to the prediction task. It is to get a target function f (model) through the learning of existing data sets (training sets), map each attribute set X to the target attribute y (class), and y must be discrete (if y is continuous, it belongs to regression algorithm). There are many methods to solve the classification problems. The basic classification methods include: decision tree, naive Bayesian, artificial neural network, k-nearest neighbor, support vector machine, etc;In addition, there are also integrated learning algorithms for combining basic classifiers. The representative algorithms of integrated learning include random forest, AdaBoost, xgboot, etc. This paper summarizes the basic principles, advantages and disadvantages of each basic classifier.

5.3.1. Self-encoder

Self-encoder is a feedforward neural network, and it is a deep learning algorithm with the same input and output. It was developed by Geoffrey Hinton in 1980 to address unsupervised learning. It has trained neural

network, which transfers data from input layer to output layer. Some important use cases of automatic encoder include image processing, drug recovery and population prediction.

5.3.2. limited Boltzmann machine (RBM)

Limited Boltzmann machine (RBM) is a kind of stochastic neural network, which can learn from probability distribution rather than a set of inputs. This deep learning algorithm is developed by Geoffrey Hinton, which is used for theme modeling, feature learning, collaborative filtering, regression, classification and dimension reduction. The restricted Boltzmann machine (RBM) is divided into two stages, including forward and reverse transfer. In addition, it consists of two layers, namely, hidden and visible. Each visible cell is connected to all existing hidden cells. The RBM also has a bias unit connected to all hidden units and visible units, but no output nodes.

5.3.3. Self-organizing mapping (SOM)

Self-organizing mapping (SOM) realizes data visualization through self-organizing artificial neural network to reduce the dimension of data. This deep learning algorithm was developed by Professor teuvo Kohonen.Data visualization can solve the problem that it is difficult for human to realize visualization when processing high-dimensional data. The purpose of developing self-organizing mapping (SOM) is to better understand high-dimensional information.

5.3.4. Deep belief network (DBN)

Deep belief network (DBN) has multiple potential variables and random variables. Potential variables are often called hidden cells and contain binary values. These are Boltzmann machine stacks with inter layer connections. Each restricted Boltzmann machine (RBM) layer is connected with the subsequent layer and the previous layer. The use cases of deep belief network (DBN) include video recognition, image recognition and motion capture data.

5.3.5. Radial basis function network (RBFN)

Radial basis function network (RBFN) is a special feedforward neural network, which uses radial basis function as activation function. It includes input layer, hidden layer, output layer, and radial basis function network (RBFN) layer is used for regression, classification and time series prediction.

5.3.6. Generated counter network (GAN)

Generative counter network (GAN) is a deep learning algorithm, which can create new data instances similar to training data. The generative anti network (GAN) is helpful to generate realistic images, cartoon characters, face image creation and 3D object rendering. The generative anti network (GAN) is used by video game developers to improve resolution through image training. There are two important components of generative counter network (GAN), in which the generator can generate false data. Discriminators can learn from false information.

5.3.7. Circular neural network (RNN)

The RNN consists of connections that help to form a loop, which allows the output of the long and short-term memory network (LSTM) to be provided as input to the current phase. Because of its internal memory, RNN can remember the previous input. Some common use cases of RNN are handwriting recognition, machine translation, natural language processing, time series analysis, and image subtitle.

5.3.8. Long and short term memory network (LSTM)

Long term memory network (LSTM) is a kind of recursive neural network (RNN) which can learn and memory long-term dependence. LSTM can also remember the past information for a long time. It retains information that changes over time, which has proved useful in time series prediction. It has a chain structure, of which four interaction layers are connected and communicated in a unique way. In addition to time series prediction, LSTM is also used in drug development, music creation and speech recognition.

6.CONCLUSIONS

In the process of learning, students participate in the process of physical and mental participation, so that the new knowledge acquired through the situation experience and the directly perceived picture content are integrated, so as to obtain the complete content of knowledge and the deep understanding of knowledge, form effective learning. In the interaction with the situation, the students' intelligence and integration will be improved. First, students will find the starting point of knowledge in the context experience. Secondly, through the learning experience, students' thinking will be clearer, form a high perception of learning content, and improve the sense of cognitive on-site. Finally, by creating the transfer situation, students can not only learn knowledge, but also creatively apply knowledge to real life, which can make knowledge produce practical meaning, realize the transformation from "knowledge man" to "intelligent person", and achieve the goal of effective learning. The use of Internet and various new technologies and new media provides learners with rich cognitive tools and intelligent supporting environment. On the basis of

"learning first and then teaching", we further realize "teaching by learning", and make flipped classroom enter the stage of "structural change" from "process reversal" to "structural change", and form a new classroom mode in the era of "Internet +" - smart classroom. The traditional teaching structure of "Teacher centered" dominated by teachers is changed into a new teaching structure of "student centered, leading and main body" to promote the "classroom revolution", which is conducive to the personalized growth and intelligent development of students.

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