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# Analysis and Research on Technology Path, Social Value and Key Technologies of Intelligent Teaching System in the Age of Artificial Intelligence 2.0

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***Abstract:*** *In order to explore the problems in technology path, social value and key technologies of intelligent teaching system in the era of artificial intelligence 2.0, this paper takes four modules of intelligent teaching system in the era of artificial intelligence 2.0 as objects , and discusses the application path and social value of intelligent teaching system, and carries out in-depth research on the key technologies of natural language processing, question answering system, expression recognition and educational data mining corresponding to the four modules. This paper also analyzes the status, role and development trend of four key technologies in the application and development process of intelligent teaching system in the era of artificial intelligence 2.0. The research in this paper can provide the basis for the development and application of intelligent teaching system in the era of artificial intelligence 2.0, and promote the better integration and development of new information technology and education & teaching.*

***Keywords:*** *artificial intelligence 2.0; intelligent teaching system (ITS); social value technology Path; key technology*

## 1. Introduction to intelligent teaching system

AI 2.0 (Artificial intelligence 2.0), which refers to the artificial intelligence technology in the era of big data and ubiquitous network. It is an AI technology combining data driven and knowledge driven. The era of AI 2.0 for the public has the characteristics of intelligence, individuation and autonomy, which affects all fields of society, including education. In the era of AI 2.0, the technology of natural language processing, question and answer system, expression recognition and educational data mining will usher in great progress. ITS in the era of AI 2.0 will lead to great changes in teaching methods, teaching ideas and teaching models, and will also provide a solid foundation for the development and realization of individualized learning and lifelong learning.

### *1.1 Definition of intelligent teaching system*

A widely used definition of ITS is defined as that is an adaptive learning support system that enables the computer to play the role of teachers by means of AI technology, to impart knowledge and provide guidance to learners [1-3]. With the development of information technology, more accurate and real-time updated learner feature data can be formed. According to the different learning characteristics of different learners, we will organize and express learning materials more targeted, adopt more personalized teaching strategies and methods, and achieve the purpose of accurately imparting knowledge, providing guidance and assisting teachers, which will have a more in-depth, comprehensive and thorough impact on future education and teaching.

### *1.2 Basic framework for the ITS of AI 2.0*

In order to better realize the social value of ITS in the era of AI 2.0, reshape the technical path of ITS, give play to the advantages of AI technology, and meet the needs and multi-function requirements

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of ITS multi-dimensional application scenarios, this paper constructs the basic framework of four modules for ITS. The intelligent man-machine interface is the gateway of the ITS, and the application of natural language processing technology to undertake all kinds of cross-media data forms is one of the key modules in the ITS; The teacher module makes use of data mining technology to explore the information with educational value and plays a connecting role in the ITS; The expert module provides database for other modules, realizes autonomous response function with the help of question and answer system and provides more intelligent support for human-computer interaction. All four modules jointly promote ITS to play a more individualized and intelligent role in the field of education and teaching. The frame structure of ITS is shown in figure 1 below [4-6].

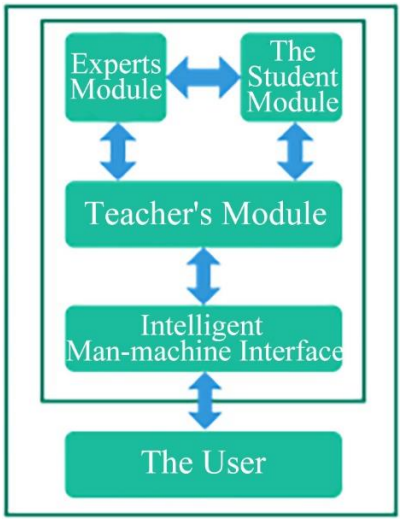


*Figure 1 Basic framework for ITS in the age of AI 2.0*

### *1.2.1 Intelligent man-machine interface*

ITS in the era of AI 2.0, intelligent man-machine interface is a module for effective interaction between users and ITS, which is a portal for the whole ITS and an important basic module. It mainly uses key technologies such as natural language processing to process multi-dimensional cross-media morphological information-receiving user information, presenting teaching materials, providing feedback and so on, providing information sources for other modules. The interaction quality directly affects the function of ITS other modules, thus affecting the performance of ITS. In the era of AI 2.0, key technologies such as natural language processing will make significant progress, leading to a major change in ITS interaction mode, from a traditional interactive mode to a cross-media intelligent mode that integrates a variety of information forms. This pluralistic approach will facilitate users to learn efficiently and promote ITS to be more intelligent and widely used.

### *1.2.2 Teacher module*

In the ITS of AI 2.0, the teacher module has a further mining effect on the learner characteristic information of the student module, and has the function of screening and reorganizing many resources of the expert module. It is a positive factor to mobilize ITS modules to cooperate with each other. Teacher module mainly focusing on "how to teach ", is the core content of the ITS. Under the guidance of the teaching strategy of the expert module and according to the students' digital portrait, educational data mining and other technologies independently arrange the learning resources in the expert module. With the continuous progress of AI and big data intelligence technology in the era of AI 2.0, the teacher module will adjust the learning content, education and teaching strategy and task granularity and difficulty in time and dynamically with the continuous updating of learners' characteristic data to improve learners' learning effectiveness.

### *1.2.3 Student module*

The student module mainly depicts the learner portrait, provides the learner personality characteristic for the other module, is the decisive factor which affects the ITS individualized learning, is the decision basis of the ITS teacher module. It is the basis of choosing learning content from expert module. A student module focuses on identifying "who is learning ", which is the most vital core of the ITS and needs the support of powerful AI technology such as advanced expression recognition

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technology to accurately and comprehensively record the dynamic information of learners' process, usually using" binary values, numerical quantities, or a vector "[3] The way to record learners' basic information, learning ability, learning progress, psychological state and other data. The ITS in the era of AI 2.0 emphasizes that the student module should change dynamically with the continuous judgment, evaluation and real-time interaction of the expert module to the students, and update the digital portrait of the learner in real time to ensure the accurate decision of the ITS.

#### *1.2.4 Expert module*

The expert module provides various databases for other modules in the ITS of AI 2.0. It is the basis of ITS the effective operation of each module. It mainly solves the problem of "what to teach ". It integrates a series of expert databases, such as domain knowledge base, learning resource base, teaching strategy database and reasoning mechanism. In the era of AI 2.0, the expert module can not only automatically generate personalized questions and tasks with the support of the database and according to the personality characteristics provided by the student module, but also automatically infer and answer the questions raised by the user or generated by the system with the help of the question-and-answer system.

## 2. The Technology Path and Social Value of ITS in the AI 2.0.

The application path of ITS in the era of AI 2.0 will play a very important role, which will affect the breadth and depth of ITS application in education, teaching and management. Compared with the era of AI 1.0, it will be more intelligent, individualized and diversified. With the development of AI technology, the application of ITS in education, teaching and management is deepening, and there are different realization paths in different stages. Cross-media intelligent path, big data intelligent path and autonomous intelligent path will be the main path for ITS to realize wide application in different stages of AI 2.0.

### *2.1 Technology path of ITS in the AI 2.0*

#### *2.1.1 Cross-media intelligent paths*

In the primary stage of AI 2.0, cross-media intelligence path plays an important role in the application of ITS, which requires the ITS to integrate all kinds of previously relatively independent visual, listening, tactile and other perceptual technologies to form a more coordinated comprehensive intelligence. Cross-media intelligence is not only the heterogeneous form of the same semantic information, but also the deep connection of various media forms, or the ability to deal with different media types of information. By its support, ITS has many functional innovations and breakthroughs. First of all, the knowledge stored in the ITS expert module is changed from monotonous text to the comprehensive form of heterogeneous and semantic interconnection in the forms of image, audio and text. The comprehensive application of various media forms can stimulate learners' multiple sensory organs, strengthen the same knowledge in many ways, and form multi-dimensional memory. It is helpful for knowledge extraction. Secondly, the teacher module flexibly allocates multiple and heterogeneous materials to form multimedia and complex related individualized teaching resources according to the learning characteristics of different learners, which is helpful to reduce the difficulty of learners' perception and recognition of learning materials, and to improve their learning efficiency. Besides, with the help of knowledge-driven cross-media collaborative reasoning, ITS can also identify the multimedia objects input by learners for cross-media intelligent retrieval or processing.

#### *2.1.2 Big data intelligent path*

At the intermediate stage of AI 2.0, big data intelligent path plays an important role in ITS application. Learners' learning behavior before, during and after class will produce a large number of educational data. Big data intelligent analysis of such data can not only form user portraits to provide the basis for decision-making and personality push, but also form a large number of experimental sample sets to support the development of educational and teaching research. Supported by big data intelligence, the ITS student module can effectively analyze the massive data generated in the process of interaction between the system and learners, sum up and extract personality characteristics, and form a special visual learner portrait. Visual presentation of learner characteristics to teachers, also for the

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system through data mining algorithm to explore the hidden value of data and predictive analysis; Different from using human or basic computing intelligence to do small sample statistical analysis in the past, the distributed architecture of big data intelligence can urge multiple ITS to collect massive learner samples, form distributed databases, support data interconnection, and do distributed processing and tracking.

#### *2.1.3 Autonomous intelligent paths*

At the advanced stage of AI 2.0, autonomous intelligence path plays a revolutionary role in ITS application. In the era of AI 1.0, artificial intelligence mostly follows the instruction to complete the established action and task, does not have the independent thinking ability, but in the era of AI 2.0 advanced stage, the AI will appear the independent intelligence tendency, can carry on the machine learning, the deep learning under certain rules, independent reasoning to solve the problem effectively. The application of autonomous intelligent path in ITS can deepen the function of teacher module, promote teacher module to deeply excavate the educational and teaching value of data. Combined with the existing teaching methods and models in the system, it carries out autonomous operation and deduction through various algorithms of machine learning, rearranges the personalized learning material group and constructs the exclusive learning scheme, so as to provide personalized learning and develop efficient learning path for learners, and constantly test the effect in the process of the implementation of the program to acquire the law. Driven by independent intelligent technology, ITS can further replace teachers to complete more repetitive basic teaching activities, reduce teachers' basic teaching pressure, and urge them to devote more energy to innovative education. It is helpful to improve teaching quality and cultivate innovative talents.

### *2.2 Social value of ITS application in AI 2.0*

ITS in the era of AI 2.0 plays a role in learning style, learning resources, learning levels and so on, which will lead to revolutionary changes in the process of education and teaching. General education informatization based on the integration of information technology and education only plays a superficial and auxiliary role in the field of education and teaching, and has not really played a subversive role. By contrast, the social value of ITS application in the era of AI 2.0 will be more diversified, intelligent and popularized, and its social value is mainly as follows:

#### *2.2.1 The extensive application of ITS in AI 2.0 promotes educational equity*

There are great differences in the quality of basic education in China between regions, urban and rural areas and schools. Students in poor areas, rural areas and non-key schools often face problems such as low professional level of teachers, low teacher-student ratio and shortage of teaching resources. Its learning effect and comprehensive ability usually fall far behind the students of the same age who can get high quality teaching resources and guidance, which is not conducive to the excavation and cultivation of talents. Its functions in the era of AI 2.0 are becoming more and more mature and perfect, which will be widely applied to daily teaching and management.

In AI 2.0, ITS not only can reduce the workload of teachers to complete tedious tasks such as correcting homework, examination papers and so on, but also can collect learning behavior big data in real time and analyze, diagnose, track and present in time, help teachers to understand the characteristics of all students in the class and the current knowledge, promote the construction of wisdom classroom in the new era, and push multi-dimensional, cross-media learning materials for learners at different levels, so that learners in different regions, urban and rural areas and inter-school enjoy the same educational resources. Therefore, the popularization of ITS in poverty-stricken areas, rural areas and non-key schools can further reduce the educational gap in China and promote education equity than ordinary educational information equipment and platforms.

#### *2.2.2 The extensive application of ITS in AI 2.0 promotes lifelong learning and personalized learning*

In order to realize self-development and adapt to the rapid development of society, it is necessary for contemporary people to achieve "lifelong learning "-to constantly update and expand their knowledge. Lifelong learning covers all stages of a person's life. Learners in different stages have different learning characteristics and need to match specific learning resources and learning programs. However, with the help of the ITS in the era of AI 2.0, the realization of this individualized learning

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resource set and learning scheme may not be difficult. ITS teacher module can change the simple and inherent teaching method of general education informatization, arrange the learning content reasonably according to the specific needs of learners, and design a more individualized learning path for learners and push the learning resources and materials that are more suitable for their learning characteristics on the basis of accurate analysis of individual characteristics provided by student modules with the help of educational data mining and other technologies. ITS compatible with a variety of terminal features can also meet the flexibility of lifelong learning needs, support learners to learn anytime, anywhere. In addition, ITS also has the function of automatic question and answer, which can effectively analyze the questions raised by learners and search the knowledge base of expert modules to answer all kinds of learning problems raised by learners in time. Reduce learning obstacles, promote lifelong learning and personalized learning.

#### *2.2.3 The wide application of ITS in AI 2.0 promotes the transformation of education and teaching methods*

Compared with the ordinary education information system, ITS in the era of AI 2.0 undertakes more routine tasks of education and teaching, which can not only correct homework and count homework completion, diagnose students' knowledge mastery, but also independently prepare lessons by invoking massive knowledge in expert module, making clear the key and difficult points of teaching, and reconstructing appropriate teaching methods and modes for classroom teaching. In addition, it can also make targeted intelligent Q & A on students' specific questions with the help of question answering system, which greatly reduces the burden of teachers' daily repetitive tasks, saves a lot of energy, and helps them better focus on the cultivation of critical thinking, creative thinking and other high-level thinking and core literacy which are unable to be completed by ITS and these are very important for students' development. It also urges teachers to provide more warm learning support, better perceive students' emotional changes and make timely communication and adjustment. In order to build a comprehensive and multi-level, man-machine collaborative education of new education and teaching methods, it will help the cultivation of comprehensive talents.

## 3. Analysis of Key Technologies ITS in the Age of AI 2.0

In the era of AI 2.0, ITS can further promote education equity, promote lifelong learning and personalized learning, and promote the reform of education and teaching methods. The realization of these social values is inseparable from the cooperation of ITS four modules, which mainly rely on the corresponding key AI technology. In order to promote the wide application of ITS in the era of AI 2.0, this section will analyze the corresponding key technologies in the four modules: natural language processing technology, question answering system, expression recognition technology and educational data mining. These four key technologies are an essential part of ITS, in which they cooperate with each other and work together. In the era of AI 2.0, these key technologies will usher in breakthrough progress, which is more conducive to role and value of ITS in the field of education and teaching [7-10].

### *3.1 Natural language processing technology*

Natural language processing (Natural Language Processing, NLP) refers to the science that integrates linguistics, AI, computer science, mathematics, cognitive science and other disciplines (Wang Meng, et al. 2015) to analyze and process human natural language through computer. In the era of AI 2.0, the interaction between ITS intelligent human-computer interface and users is expanded from the original single mode of communication to the comprehensive mode of cross media, which depends on NLP. NLP is the general term of all technologies related to the computer processing of natural language. In ITS, it is an indispensable technology to support users to communicate and interact with the system using natural language. NLP supports the wide application of ITS cross media intelligent path, and it is the key technology of intelligent human-machine interface module. In the era of AI 2.0, NLP will make great progress, improve the natural language processing ability and feedback accuracy of ITS, so as to further improve ITS intelligent man-machine interface module function.

### *3.2 Question and answer system*

Question answering system is a kind of intelligent technology which can analyze the problems

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described by natural language and deal with the feedback in the form of natural language. Question answering system is the core part of ITS expert module, and it is the key technology to realize its independent intelligent path and play its response role. In the era of AI 2.0, the progress of question answering system directly affects the application of ITS autonomous intelligent path and the realization of social value. In the era of AI 2.0, NLP will deal with more multi-dimensional information forms across media, and provide more information for question answering system which needs further feedback. This puts forward higher requirements for question answering system of ITS, which needs to answer questions related to knowledge points in time and accurately, saves time and energy for users to find answers, greatly improves user experience & learning efficiency and meets the learning needs of AI 2.0.

### *3.3 Expression recognition technology*

Expression recognition technology refers to the analysis and processing of images and videos to determine the psychological state of the analyte. It is the key technology for ITS student module to form learners' personality data, and is also an indispensable part of its big data intelligent application path in the era of AI 2.0. With the support of expression recognition technology, ITS can intelligently collect and process learners' expressions, so as to form accurate dynamic learner portraits in ITS student modules, which is helpful for ITS to realize accurate learner feature analysis, so that ITS can take corresponding measures to adjust the intensity, difficulty, abstraction and interest of knowledge points, so as to reduce students' learning burnout and learning suspension, and promote the occurrence of effective learning. The expression recognition technology will be further developed in the era of AI 2.0. Image acquisition, image processing, feature extraction and expression classification processing stages will be more rapid, intelligent and efficient, which will help to form more accurate learner feature data and promote the application of ITS big data intelligent path. Support ITS student modules play a more effective role.

### *3.4 Education data mining*

The educational data mining (Educational Data Mining, referred to as EDM) refers to the use of new information technology to deal with the educational and teaching data generated in a certain educational environment and excavate the information of educational and teaching value in order to help teachers better understand students, guide students and provide services to different participants in the field of education and teaching EDM is an important key technology of ITS, which plays a decisive role in the analysis, evaluation and decision-making of ITS teachers' modules, and also provides important technical support for the four modules of ITS, which deeply affects the performance and application of ITS. Applying it to the ITS teacher module, on the one hand, it can excavate the learning characteristics contained in different learner data-consider the learning resources and the existing teaching strategies in the system, construct the data calculation model independently, rearrange the teaching materials, and infer the individualized learning path independently to promote the development and realization of individualized learning. On the other hand, we can test the learning effect of different learners with different types and quantities of teaching resources, construct corresponding mathematical models, and improve and reorganize the existing teaching contents and strategies through independent operation and deduction.

EDM integrated two paths of big data intelligence and autonomous intelligence, which will be more perfect with the support of AI technology such as machine learning and deep learning. EDM will play a more intelligent and autonomous role in the ITS in the era of AI 2.0, which can not only support the ITS teacher modules to better analyze the learner's characteristic data, but also can independently plan more effective learning methods and strategies for learners, promote learners' effective learning, improve learning efficiency and promote the realization of individualized teaching.

## 4. Conclusion

This paper takes the four modules of intelligent teaching system in the era of AI 2.0 as the object, discusses the application path and social value of intelligent teaching system, and deeply explores the status and role of the key technologies corresponding to the four modules, such as natural language processing, question answering system, expression recognition, educational data mining, etc. In the era

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of AI 2.0, these key technologies will usher in breakthrough progress, and can promote its four modules to cooperate more accurately and efficiently, which is more conducive to its role in the field of education and teaching and realize the corresponding social value.

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