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The Present Situation of the Application of Artificial Intelligence in the Field of Education in China

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Abstract: *The rapid development of artificial intelligence technology has had a profound impact on the field of education. Based on the introduction of the five core technologies of artificial intelligence, this paper systematically summarizes and summarizes the research of artificial intelligence in the field of education, so as to better promote the application and development of artificial intelligence technology in the field of education. Through the method of literature and content analysis, this paper analyzes the research results of the application of artificial intelligence technology in the field of education in China in the past two decades, so as to provide a relatively objective and valuable reference for future research in this field.*

Keywords: *Artificial intelligence; education field; research status; development*

1. Introduction

As one of the ' greatest inventions ', artificial intelligence has brought great changes to the education industry, changed the educational objectives, learning methods, teacher roles, and educational supply of education, and reshaped the entire educational ecology. The application of artificial intelligence in the field of education is to empower education and teaching with artificial intelligence technology, and promote the deep integration of artificial intelligence technology and education and teaching. In order to gain a better insight into the overall development of the application of artificial intelligence in the field of education in China, and to accurately explore its historical development and research laws, this study systematically summarizes and summarizes the research results of the application of artificial intelligence technology in the field of education in the past two decades in China through literature and content analysis methods on the basis of introducing the latest artificial intelligence technology, so as to better promote the application and development of artificial intelligence technology in the field of education.

2. Five core technologies of artificial intelligence

Machine learning, computer vision, Natural language processing, robot and speech recognition are the five core technologies of artificial intelligence. Machine learning trains by mining the information contained in input data to obtain a model (function), with the core focus on training machines (computers) for learning. Machine learning is divided into Supervised learning, Unsupervised learning, Reinforcement learning and deep learning. Natural language processing is to process the language used by Human communication into Machine code that can be understood by the machine, so that the machine owner has general text processing ability. Computer Vision refers to the ability of computers to recognize objects, scenes, and activities from collected images. From the perspective of visual perception, computer vision includes representation learning, recognition and classification, object detection, and image segmentation. From the perspective of visual generation, computer vision includes the generation of images and videos, as well as the combination of vision and text for "picture reading and speaking". The main research directions of computer vision are object detection, image semantic segmentation, object tracking, etc. [1-2]. Natural language processing generally has two processes, Natural-language understanding and Natural language generation [3].

The main research directions of Natural language processing are Lexical analysis, syntactic analysis, semantic analysis, pragmatic analysis, involving information retrieval, text classification, automatic summarization and other technologies. Integrating cognitive technologies such as machine vision and automatic planning into extremely small but high-performance sensors, brakes, and cleverly designed hardware has given rise to a new generation of robots that have the ability to work with humans and flexibly handle different tasks in various unknown environments. There are two main research directions

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for robots. One is the research on key technologies such as robot mechanisms and dynamics, intelligent perception and control, complex system modeling, and human-machine interaction; The second is the research on the integration technology of robots and intelligent equipment systems. Speech recognition is a technology that utilizes machines to recognize and understand speech signals and convert them into corresponding text and commands. Its main focus is on automatically and accurately transcribing human speech. Speech recognition can be divided into two steps: one is to establish the Acoustic model of the basic recognition unit and the language model for language grammar analysis. The second is to compare the feature parameters of the input target speech with the model to obtain recognition results.

3. The current application status of artificial intelligence in the field of education

3.1 The current situation of computer vision in the field of education

Zhong Xu proposed a three-layer motion description method and based on this, proposed a new HMM based motion recognition method. Finally, using this method, a prototype of a preschool education game system was designed and implemented, which increased the fun and imagery of preschool education [4]. Wang Yifu introduced human behavior recognition from computer vision into human-computer interaction interfaces and designed and implemented a 3D human-computer interaction system based on computer vision, which is suitable for virtual reality systems in education [5-6]. Lin Yezhi designed a gesture interaction system based on Haar like feature recognition and SIFT feature extraction algorithms through extensive experiments, which can be used for human-machine interaction in online teaching processes. In response to the serious issue of emotional deficiency in the E-Learning system, Yu Raodong proposed an attention monitoring scheme that combines computer vision detection with brainwave detection. This scheme to some extent complements the shortcomings of each of the two detection methods [7]. Liu Longpo applied visual interaction to online education, solved the problem of Confounding such as background, lighting, noise and occlusion in the captured image, and built an intelligent education interaction system based on Python Tkinter library [8]. Xu Jun proposed a gesture segmentation and recognition algorithm that can be used in complex environments such as computers, mobile phones and Smart TV, and solved the problem of face interference. Using this algorithm, he developed a finger line of sight interaction system based on monocular vision, which enables teachers and students to obtain a more natural and comfortable experience in human-computer interaction [9]. Xu Tianyu believes that LSTM based video behavior recognition technology is widely used in fields such as smart cities, education, transportation, and national defense, with good market application scenarios [10]. Zhang Feifei used computer vision computing to implement a question card recognition system based on a regular camera. This system uses a regular USB camera to collect question card images, and uses computer vision technology for image preprocessing and answer sheet recognition [11]. Chen Shaohui proposed a teacher identification method based on thermal infrared images and a teacher teaching Gesture recognition method based on feature fusion under the complex background of the smart classroom. The above methods promote the intelligent recognition research of teachers' teaching nonverbal behaviors, and help improve the quantitative calculation and process evaluation of teachers' teaching nonverbal behaviors [12]. Shi Mengzhen designed and implemented a classroom name prompt system based on facial recognition and image stitching to address the issue of student name prompts in university classrooms. This system can help teachers clearly and intuitively obtain the names of students present in the classroom [13]. Guan Shikui designed and developed an intelligent grading system based on computer vision technology as the algorithm core, which can directly recognize the test papers that students have answered [14]. Zhao Chun and others used computer vision technology to design a measurement and analysis system for students' classroom learning behavior engagement. This system measures and analyzes students' classroom learning behavior engagement, providing timely data support for teachers to grasp students' classroom learning engagement status, optimize teaching design and implementation [15]. Guo Chunlin proposed a classroom attention modeling scheme based on head posture detection, and then designed corresponding detection algorithms for two teaching scenarios: lecture class and seminar class. Finally, the feasibility of this scheme was verified in practical environments [16]. Chen Jie proposed a large-scale action behavior recognition method based on human key points and a small-scale behavior recognition method based on object detection, and developed a student behavior analysis system based on Java Web, achieving an automated processing and analysis system for student classroom behavior [17].

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3.2 The current situation of machine learning in the field of education

On the basis of analyzing the characteristics of educational Big data mining, Chen Dexin and others summarized the purpose and process of educational Big data mining based on deep learning [18]. Chen Jinyin et al. designed and implemented an intelligent teaching system based on deep learning, which is divided into two parts: online personalized learning recommendation and offline classroom quality bidirectional evaluation. Among them, online personalized learning recommendation includes performance prediction based on BP neural network model, online learning behavior regularity analysis, and student emotion analysis based on Microexpression recognition and clustering [19]. Zhao Min and others built a teaching quality evaluation model based on the deep learning algorithm of Convolutional neural network, which helps to scientifically evaluate teachers' teaching ability and improve teaching quality [20]. He Xiuling and others put forward a method for students' classroom behavior recognition based on Human skeleton and deep learning. This method first uses Open Pose to extract Human skeleton information, and then uses deep Convolutional neural network CNN-10 to recognize students' classroom behavior. Test results show that this method has higher recognition accuracy and generalization ability. The intelligent perception of learning emotions is a research frontier in learning science [21]. Wang Yonggu et al. established a learning emotion dataset for children with autism by collecting facial expression image data, selecting learning emotion labels, and data preprocessing. They then constructed an Attention AlexNet optimization model with the ability to pay attention to important features, which can provide technical support for educational interventions for children with autism [22]. Zhou Nan and others proposed a method of student behavior recognition and teaching effect evaluation based on deep learning. This method first obtains the video information of students' learning behavior through learning equipment and learning platform, then uses Convolutional neural network to recognize the facial expression in the video, and uses 3D Convolutional neural network to recognize the learning behavior of body posture in the video [23]. Xu Zhenguo et al. constructed a database containing seven types of learning expressions: normal, happy, angry, sad, frightened, focused, and distracted. This database is encoded based on expressions and their intensity, and has 168000 1280 X 960 expression images, improving the efficiency, accuracy, and robustness of learning expression recognition [24]. Tan Min et al. analyzed the multimodal data collected from the fusion of learning behavior texts and online monitoring videos, and constructed a teaching and training model based on multi task deep learning, providing reference for online education and precision teaching [25]. Hu Qintai and others established a multimodal learning analysis model by using the mixed discrimination Restricted Boltzmann machine neural network model. This model uses different deep learning algorithms to analyze the shallow features of different modes of data, and then normalize and fuse the shallow features to obtain the global shallow feature expression as the input of the implicit feature analysis. Finally, HDRBM deep learning network is used to obtain the implicit features [26]. Zhai Xuesong and others built a deep learning Affective computing model based on Convolutional neural network by using the facial expression and facial pose data of middle school students, which solved the problem of low accuracy of facial recognition due to pose changes in the learning process [27]. Li Haojun et al. constructed a bullet screen seed emotion word set containing 666 emotion phrases and 624 negative emotion phrases, and then used BERT BiLSTM neural network to achieve emotion information recognition [28]. Wang Yonggu and others developed an intelligent perception evaluation system for teachers' body language by using the Human skeleton representation of teachers' body language and the pyramid residual neural network model, which makes it possible to accurately evaluate teachers' teaching body language behavior [29]. Tan Liuyan et al. proposed a Bi LSTM neural network model based on the combination of word vectors and word vectors, which improves the intelligence level of educational data classification [30].

3.3 The current situation of robots in the field of education

Li Xuerong et al. designed a simple and easy-to-use low-cost educational robot controller, which uses a microcontroller AT89C2051 as its main chip and has rich expansion interfaces [31]. Song Hongjun and others, aiming at the "Mount Taishan" educational robot, realized the comprehensive software system of educational robot through the virtual reality technology based on OpenGL, which enables the educational robot to have the functions of virtual manufacturing, 3D job editing and simulation [32]. In response to the lack of sound support in robot systems, Sun Wei et al. designed a sound system based on the FMOD engine, which has various sound effects including collision sound, and can meet the sound needs of educational robots [33]. Hu Weihua et al. designed an intelligent educational robot that adopts a layered system combining ARM9 microprocessor and AVR microcontroller, with high control accuracy and strong functional scalability [34]. Yan Qiao et al. designed a text recognition robot that supports WiFi protocol. The robot can recognize Chinese characters on white paper through a camera, which is helpful

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for early childhood literacy education [35]. Liang Liangliang et al. designed an educational robot, which uses an ARM9 embedded system for hardware and a Linux operating system for software, providing a platform for education, teaching, and skill competition [36]. In response to the challenges of learning service authentication and security of educational Big data stored by intelligent learning robots for large-scale learning service systems, Fang Haiguang and others introduced blockchain technology into intelligent learning robots, meeting the needs of learners to learn anytime, anywhere [37]. Wei Xuefeng and others proposed the concept of educational evaluation robots, designing a four layer architecture of data collection layer, data analysis layer, data service layer, and data display layer. The teacher's full process "robot teaching assistant", the student's "learning diagnosis doctor", and the parent's comprehensive understanding of the student's "good helper" have three functions, selecting suitable subject content, meeting students' personalized learning needs, and maintaining students' learning motivation Five application strategies to encourage parents to cooperate and communicate with teachers and improve the information literacy of teachers and students [38]. Wang Jun explored the value of artificial intelligence speech in the field of parent-child reading, and analyzed four major applications of artificial intelligence speech, including intelligent interactive accompanying reading, building a high-quality education resource matrix, two-way innovation of content+design, and constructing local communication scenarios, in combination with the intelligent companion education robot [39]. In view of the problems such as insufficient education, poor interaction and perception of intelligent educational robots, Lu Yu and others designed and implemented the system architecture of "intelligent learning partner" intelligent educational robots by using Knowledge graph, machine learning, Natural language processing, emotional technology and other technologies, giving intelligent educational robots educational professionalism, real-time feedback and perception capabilities [40]. Li Jie and others used questionnaires, emotional simulation, and behavior observation to explore preschool children's life perception of companion robots and the emotional arousal and behavior Inductive effect displayed in interaction. The results confirmed that most preschool children believe that companion robots are artificial products with emotional attributes and are willing to make friends with them; As preschool children age, their emotional recognition rate and interactive behavior towards accompanying robots significantly increase [41]. Jiang Hualin analyzed the impact of AI Chatbot on scientific research achievements and talent evaluation from the perspective of ChatGPT and Microsoft Bing, and gave specific countermeasures [42].

3.4 The Present Situation of Natural language processing in the Field of Education

Jia Jiyou et al. designed an online intelligent English learning system called Xisaike, which is composed of natural language annotation language, natural language object model represented by JAVA, natural language database, world model, communicative response, and client/server interface [43]. Fu Qian and others proposed an algorithm combining rules and statistics to extract terms in the field of educational technology, laying the foundation for the research on the application of Natural-language understanding technology in the field of education, and helping to find new terms in the field of educational technology [44]. Yang Dan and others designed and implemented an intelligent question answering system based on Natural language processing. This system has the functions of processing students' questions, processing subject domain knowledge databases, and retrieving answers in domain knowledge databases [45]. Zhao Chengling and others used the perspective of Natural language processing to explore technology to analyze teachers' teaching behavior in online education courses, and found that teachers' bishop behavior was positively correlated with learners' curriculum evaluation [46]. Li Guangming and others used TF-IDF algorithm, Word2vec model and LDA Topic model to mine and analyze the text data of student management forum, which helps educators to deal with education problems pertinently [47]. Chen Hui and others used Natural language processing technology to build the Knowledge graph of instructional design discipline with a bottom-up approach, providing reference for the construction of Knowledge graph of other disciplines [48]. Zhang Bo and others found that Natural language processing technologies such as emotional analysis and emotional analysis, text classification, question answering and dialogue systems, Machine translation systems will accelerate the development of intelligent education through sorting out the open interviews, speeches, conference reports and published papers of AI scientists [49].

4. Conclusions

Xiong Feili has conducted research on speech signal feature extraction and processing algorithms, as well as speech feature dynamic matching and recognition algorithms, laying the foundation for the application of LCP cepstrum feature speech recognition methods in future intelligent multimedia

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language teaching systems [50]. Xu Jing conducted empirical research and analyzed the information transmission effect and influencing factors of speech recognition technology in classroom teaching for deaf students in universities, improving their understanding of classroom teaching information [51-52]. Zhang Xiaolan believes that the application of intelligent speech technology has changed classroom teaching methods, optimized the teaching environment, and can help learners correct their pronunciation. Zhao Rui designed and implemented a Tibetan pronunciation dictionary and a Tibetan Acoustic model and language model based on hidden Markov, and developed a Tibetan continuous speech recognition system using Qt Creator on this basis, and then applied this system to the Tibetan primary and secondary school language online teaching video [53]. Li Yaoqiang constructed a Tibetan speech recognition model based on active learning and applied it to an online education video speech content recognition system, achieving real-time recognition of Tibetan speech and improving learners' learning efficiency [54]. Zeng Yong proposed an English phonetics assisted learning model based on speech recognition technology, and based on this model, developed an English phonetics assisted learning platform using Asp.net language, which improved learners' English pronunciation accuracy [55]. Taking the School of Special Education of Beijing Union University as an example, Wang Huan et al. investigated 253 students in the School of Special Education with the method of questionnaire, clarified the problems existing in the application of speech recognition technology in the classroom teaching of hearing impaired students, and gave suggestions for the problems [56]. Mao Weihui and others have built AI speech recognition platform applications and industry English hybrid teaching models, which have increased the fun of English learning, improved the quality of English learning, and made teaching evaluations diversified and intelligent [57]. Zhang Ru and others designed a framework of bilingual speech assisted learning system for ethnic minorities based on speech recognition technology, and developed this system using Pycharm, which helps to assist ethnic minorities in learning [58-59]. Ji Li applied speech recognition technology to the MOOC learning platform, helping learners quickly and accurately search for target videos on the MOOC learning platform. Pan Mengyao et al. proposed an innovative method and route for online teaching based on AI intelligent voice technology, which can improve the effectiveness of online teaching and enhance teachers' online teaching ability [60].

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