

Research on the Theory of Artificial Intelligence Recognition Technology

Liang Jin^{a,*}, Weicheng Huang^b, Juncheng Zhao^c

Shenyang Institute of Technology, Fushun, Liaoning, China
^aInjinliang@163.com, ^bhcfxei@163.com, ^c15144589559@163.com
**Corresponding author*

Keywords: AI, AI Recognition Technology, Multimodal Biometric, Neural Network

Abstract: With the continuous development of modern science and technology, artificial intelligence technology has gradually become the main research direction in the computer field. Various artificial intelligence recognition technologies have been widely used in all walks of life, greatly promoting the development of the industry, and also providing convenience for people's daily work and life. In this paper, the connotation, research status, technical characteristics, key technologies and inspiration of artificial intelligence recognition technology are combed out. The analysis and development inspiration of artificial intelligence recognition technology find that artificial intelligence recognition technology has two categories of supervised and unsupervised technologies and is widely used in the use and research of various recognition technologies. This paper discusses the application of computer artificial intelligence recognition technology in exploring the development direction of artificial intelligence innovation and the development of artificial intelligence recognition technology to provide a theoretical research basis.

1. Introduction

With the development of computer and artificial intelligence technology and the continuous improvement of scientific and technological level, the research of computer and artificial intelligence technology has become the focus of researchers' attention, especially in the aspect of artificial intelligence recognition, which has gradually become the most significant application. With the continuous development of technology, the research has been constantly deepened. It has been widely used in many fields such as face recognition, image recognition, intelligent robot and speech recognition [1]. In view of this, this paper starts from the foundation of artificial intelligence recognition technology, analyzes and studies the relevant key technologies and theories formed in the development process of its artificial intelligence recognition technology, which is of great significance for the later research of technology and algorithms [2].

2. Connotation of AI Technology Identification Technology

Artificial intelligence recognition technology is a technical means that takes computer system, scanning equipment, sensors, cameras, etc. as the infrastructure to automatically obtain the data

information of the target object and intelligently recognize information such as instructions and data. The current artificial intelligence recognition is gradually developed from the initial voice technology[3]. So far, it has formed a number of artificial intelligence recognition methods, such as face recognition, image detection, image retrieval, object tracking, style migration, etc. The application of artificial intelligence identification technology to the machine will endow the machine with specific functions, enabling it to identify special sounds, images, fingerprints, etc. For example, enterprises install fingerprint identification systems on the door, and fingerprint scanning is required for entering and exiting, which can effectively identify the fingerprints of staff, prevent staff from leaving early or arriving late, and prevent other personnel from entering the enterprise illegally[4]. The application of artificial intelligence identification technology in actual production and life can also significantly reduce the input of human resources, improve the working efficiency of staff. The emergence of these artificial intelligence identification technologies has improved the quality of people's daily life, reduced people's workload, and improved production and living efficiency, which is of great significance for promoting the development of modern technology in China[5].

3. Research Status of Artificial Intelligence Recognition Technology

Artificial intelligence recognition describes the perception of intelligent devices to the outside world from the perspective of machine intelligence. Collect the signals of the physical world through cameras, microphones, lidars, ultrasonic sensors and other sensor devices, simulate people's hearing, touch, taste and other functions, and map the perceived information into digital information with the help of feature recognition and other technologies[6].

Today, AI technology has made significant breakthroughs in machine vision, fingerprint recognition, target recognition, face recognition, retina recognition, iris recognition, palmprint recognition, situation awareness, unmanned driving, etc. At present, the application of perceptual intelligence focuses on machine vision, so the actual perceptual intelligence mainly focuses on image processing, machine vision and computer vision, and also includes different biometric recognition technologies from fingerprint recognition to face recognition [7].

From the current development of AI recognition technology, AI recognition technology has been applied to many fields. However, the core key technology of artificial intelligence recognition is still in the development stage [8]. Compared with foreign countries, a fully mature technical system has not yet been formed. In recent years, the mutual communication and penetration of artificial intelligence identification technology have been strengthened, which has provided new development opportunities for artificial intelligence technology. In recent years, the level of artificial intelligence technology in China has gradually improved, providing convenience for people's lives and improving their living conditions. From the current technological development, the development of AI recognition technology at this stage is mainly to solve various problems existing in its application process and research on its key technologies [9].

4. Features of Artificial Intelligence Recognition Technology

The characteristics of AI recognition technology are high reaction efficiency, high computing speed, etc., and AI recognition technology can solve problems, transform or create, and do theoretical reasoning or theoretical research through self-learning. In engineering, the artificial intelligence identification technology can strictly monitor the entire production and operation status. If the operation status is abnormal, it can timely grasp the fault information and feed it back to the maintenance personnel. Intelligent data support can also provide [10]

Maintenance personnel provide help, thus greatly improving the stability and safety of

equipment operation. In real life, the application of artificial intelligence recognition technologies such as image recognition and voice recognition can effectively realize the information allocation and communication between people and reduce the waste of resources in life. Therefore, the successful application of artificial intelligence recognition can effectively solve the problems people encounter in actual production and life [11].

5. Key Technologies of Artificial Intelligence Recognition Technology

5.1 Image Recognition Technology

As an important research field and research branch of artificial intelligence technology, image recognition technology is an important technology in the information age. It allows computers to process a large number of graphic images and real object information instead of humans, thus becoming the basis of many other important technologies. The core of this technology is to identify and detect objects or features in digital images or videos [12]. The development of picture recognition technology has gone through three stages: character recognition, digital image processing and recognition, and object recognition. Through the corresponding processing and analysis of image information, we can get the research objectives we need. From the initial development of this technology to today, image is the research goal. Image recognition is not only recognized by the naked eye, but also an important means of recognition by computer. In recognition principle, computer image recognition technology is the same as human visual recognition [13]. Human image recognition is based on the characteristics of the image itself. When we see a picture, our brain will quickly reflect the picture we know, and classify, recognize and store it. AI image recognition technology is based on image features, focusing on the main features of each image, eliminating redundant input information, finding the required key information, and grading.

The completion of the segment organizes the image information to form a complete intuitive image. In the process of artificial intelligence image recognition, pattern recognition is the key. Pattern recognition is to analyze and process the confidence of different forms of things, so as to achieve the goal of Description, identification and classification of phenomena.

Pattern recognition form In image recognition technology, pattern recognition is an effective model, which recognizes images based on a large amount of information data . The recognition model is based on the rich experience accumulated by the experts in image recognition technology for many years and the existing recognition of image recognition. It makes full use of computer technology to calculate, combines with the reasoning of mathematical principles, automatically completes the recognition of many features of the image, and objectively evaluates the above features in the recognition process. The recognition mode can generally be divided into two stages: learning and realization. The essence of the learning stage is a storage process, that is, to collect and store image samples, special information and features in advance, classify and recognize the familiar aggregated information according to the recognition rules according to the computer storage capacity, and form a computer program that can recognize the corresponding image . In the implementation phase, the recognition process is realized based on the fact that the image is completely consistent with the template in the brain. In practical application, there is still a large difference between computer and human brain in recognition, but computer recognition can be combined with previous memory process.

The features, data and information of the latest image are captured by matching one by one. If the matching can be completed according to the established rules, it indicates that the image has been recognized. However, the recognition form has certain limitations. For some special similar features, it is easy to generate recognition errors.

The program is integrated into the neural network algorithm to improve the cost and complexity, but it can play its due role. After the image features are extracted and captured, they can be mapped in the neural network program to achieve more comprehensive and accurate recognition of the image, and classify for processing.

Intelligent vehicle monitoring, photographing and recognition is the application of this technology in the traffic management system, which can quickly identify and distinguish the license plate information at the moment of photographing, and has a very important auxiliary role in improving the intelligent level of traffic management.

The nonlinear recognition technology in the form of nonlinear dimensionality reduction belongs to the high-dimensional recognition technology. The technical advantage is that it can effectively identify images with lower resolution. Because this technology can generate data with nonlinear processing and multi-dimensional characteristics, there are many difficulties in the initial research process. The image recognition in the form of nonlinear dimensionality reduction needs to complete a lot of calculations in a short time, and the dimensionality reduction is divided into two categories according to nonlinear and linear. Comparatively speaking, the nonlinear dimensionality reduction form is simpler and has more outstanding effects. For example, face recognition realized by nonlinear dimension reduction can not effectively extract outstanding feature information due to uneven distribution of face images in high-dimensional space, while nonlinear dimension reduction can significantly improve face recognition, thereby improving the accuracy of image recognition Accuracy.

In the computer image recognition technology, the image content is usually described by image features. These features extracted by the computer can sometimes be very obvious and sometimes very fuzzy, which greatly affects the speed and accuracy of computer recognition.

5.2 Convolution Neural Network Algorithm

Convolution neural network algorithm is a kind of feedforward neural network with depth structure based on convolution calculation. It belongs to the main algorithm of depth learning in current artificial intelligence recognition technology. Its main ability is representation learning, and it can translate and classify information unchanged. This algorithm is developed based on biological visual perception cognitive mechanism, and can be used for supervised and unsupervised learning. With the development of deep learning theory and numerical computing equipment, it has gradually been widely used, commonly in computer vision, natural language processing and other aspects. The convolutional neural network structure includes input layer, hidden layer and output layer. Among them, the input layer is mainly used for multi-dimensional data processing. Through the standardized processing of input features, the purpose of improving learning efficiency is achieved. The hidden layer mainly includes three kinds of common structures, namely, convolution layer, pooling layer and full connection layer. Among them, the main function of the convolution layer is to extract features from the input data, the main function of the pooling layer is to select features and filter information from the feature map output in the previous link, and the full connection layer is responsible for transmitting signals to other full connection layers. The output layer is responsible for outputting classification labels, object center coordinates, size, classification, or pixel classification results, etc., mainly outputting corresponding results according to actual system requirements. Convolutional neural network CNN can be well applied to complex perceptual tasks such as image processing and speech recognition, which makes the task rate of image classification based on convolutional neural network comparable to human ability.

5.3 Multimodal Biometric Technology

Biometric recognition has become one of the most potential recognition technologies. This technology has entered all aspects of people's daily life, showing a trend of networking, non-contact, multimodal and other characteristics. Various application scenarios of biometrics are gradually opening up. At present, the biometric recognition technologies mainly studied and used include face recognition, iris recognition, fingerprint recognition, face recognition, and voice recognition. Different biometric technologies have obvious differences in accuracy, stability, recognition speed, and convenience. In order to improve its accuracy and recognition speed, it puts forward higher requirements and challenges for its current traditional authentication mode, and proposes multimodal technology. Multimodal biometric identification technology uses two or more single-mode biometrics as the object of data comparison. The biometric system mainly consists of four important components. It is possible to fuse each part in the multi-modal identification system .Feature scanning. Different methods are required for extraction and classification .When merging these results. These results must be translated into standard form. It overcomes the drawbacks of single-mode biometric recognition in application, gets rid of the limitations of its use scenarios, improves stability and security, and makes the process of comparison recognition more accurate.

Multimodal biometric recognition system has more advantages than single mode .The problems of nonuniversality, fraud, invalidity and inaccuracy in identity authentication can be effectively solved in multimodal systems. Different techniques such as fusion and standardization make multimodal systems more accurate and effective. Although multimodal identification system also has high cost and other adverse factors. However, with the continuous improvement of hardware technology and system's great potential in public areas such as internet banking, e-commerce, legal research, etc. Multimodal biometric identification system will inevitably become the mainstream of identity authentication technology in the future.

6. Inspiration from the development of key technologies of AI application

After years of development, AI has produced many key technologies, which can be divided into two categories: supervised technology and unsupervised technology. Neural networks, support vector machines, etc. are supervised technologies, while K-means, etc. are unsupervised technologies. Supervised technology can make full use of prior knowledge of artificial intelligence to build a data analysis model with sound functions. Supervised training and learning can improve the universality of model application and the accuracy of data analysis; Unsupervised learning does not require any prior knowledge. The data analysis model can automatically conduct information mining and build a learning mode automatically. After years of improvement, unsupervised learning methods have been widely used in the field of speech recognition and text retrieval. It can be seen that the realization of these key technologies ultimately provides theoretical support and foundation for algorithm research, design and optimization.

7. Development Trend of Nology

Data mining and search comparison technologies based on human biometrics are playing an important role in many areas of social life and bringing about revolutionary changes in people's lifestyle. For example, in the field of work, fingerprints and face access cards for commuting have become popular; In the field of life, the fingerprint unlocking of mobile phones greatly facilitates life; In the field of criminal investigation, DNA, iris and gait have played an active role in solving cases; In the financial field, the mobile payment platform uses biometric information identification technology to strengthen the protection of personal privacy and property security. It can be

predicted that with the continuous growth of social demand, biometric recognition technology will become more mature and perfect.

However, in practical applications, due to the unpredictability of subjective and objective conditions, single-mode biometric recognition technology is not only restricted by sample collection methods, acquisition success rate, hardware level and cost of acquisition equipment, but also by the inherent defects of biological characteristics, which will affect its application scenarios and reduce the success rate and accuracy of recognition. Multimodal biometric recognition technology is based on multiple biometrics of human body and uses data fusion algorithm for fusion recognition. It can not only improve the accuracy of recognition and expand the applicability of the system, but also solve the problem of high system error rate caused by small samples in single-mode biometric recognition, and also reduce the risk of the system, making it more practical. Therefore, multimodal biometric recognition technology considers multiple physiological or behavioral characteristics of individuals in the process of identity authentication and recognition. Therefore, it shows higher reliability and safety than single biometric .It has become one of the trends in the future development of biometrics.

8. Conclusions

Artificial intelligence technology recognition technology is a cutting-edge and high-end technology subject for computer application. At the same time, artificial intelligence recognition technology has been widely used in many fields and has entered people's daily life, greatly improving people's living standards. This paper mainly studies and discusses the artificial intelligence recognition technology from the theoretical perspective. It is found that the artificial intelligence recognition technology has gradually developed from a single technical mode to a multimodal technology, which has greatly improved the accuracy, security and speed of the biometric based recognition technology. Therefore, in the application of artificial intelligence technology, we should better design human behavior accurately in computer programs to achieve breakthroughs in the application of artificial intelligence technology, accelerate innovation in the field of artificial intelligence, and promote the progress of the times.

References

- [1] Sun Liang. *Theoretical breakthrough in computer intelligent image recognition technology [J]. Digital Technology and Application*, 2016 (3)
- [2] Jiang Shuqiang, Min Weiqing, Wang Shu hui. *Overview and prospect of image recognition technology for intelligent interaction [J]. Computer Research and Development*, 2016 (10)
- [3] Deng Chao hui. *Try to analyze the application of image recognition technology in artificial intelligence [J]. Information record materials*, 2019, 20 (11): 134-135
- [4] Zhang Wen juan. *Analysis on Key Technologies of Computer Artificial Intelligence Identification [J]. Electronic Testing*, 2019 (1): 139-140
- [5] Nie Hao, Lu Xi long, Guo Wen zhi, Li Yongyong, Han Guangjie, Zhao Xingchun. *Research Progress of Multimodal Biometric Recognition Technology [J]. Life Science Instruments*, 2020,18 (05): 20-28
- [6] Xu Peng. *Application of computer vision technology in channel monitoring and real observation system [J]. Ship Science and Technology*, 2020, 42 (24): 25-27
- [7] Xia Zhonghua. *Single biometric identification mode is challenged, multimodal identification becomes a trend -- and the year-end review of biometric market development in 2020 and prospects for 2021 [J]. China Security*, 2020 (12): 67-71
- [8] Fan Beibei, Wang Bihu, Zhou Peng cheng, Li Yuan song, Zhao Lian gjun. *Analysis of key technologies of artificial intelligence recognition [J]. Electronic Testing*, 2021 (15): 81-82
- [9] Ross A, Jain AK. *Multimodal biometrics: Anoverview. in Proceedings of 12th European Signal Processing Conference 2004:1221- 1224.*
- [10] Ross a, Jain AK. *Information fusion in biometric. pattern recognition letters 2003 24:2215-2125.*

- [11] Wang Yu, Mu Zhichun, Xu Zhengguang. *Overview of Multimodal Biometric Recognition Technology* [J]. *Computer Application and Software*, 2009, 26 (2): 31-34
- [12] Jain A K, Ross A, Prabhakar S. *An Introduction to Biometric Recognition* [J]. *IEEE Transactions on Circuits and Systems for Video Technology*, 2004, 14(1):4-20
- [13] Gäring S, Brand K, Raake A. *Extended features using machine learning techniques for photo liking prediction* In *Tenth International Conference on Quality of Multimedia Experience*, Cagliari, Italy, 2018: 1 - 6.