Explore the Development Status of Artificial Intelligence and the Application Analysis of Specific Fields

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Abstract: In the wave of scientific and technological development in the new era, artificial intelligence technology has increasingly become one of the hot scientific and technological fields of social development. Since the concept was proposed, the development of artificial intelligence has also virtually stimulated the market and business strategies in a variety of industry fields. Starting from the actual situation, this paper now divides the four development stages of artificial intelligence from the past to the future in detail and uses the small-range questionnaire survey method to understand the current Chinese society's understanding of and interest in artificial intelligence and its products. Then, literature analysis is used to search and read relevant materials and literature, and the development status, capabilities, and prospects of artificial intelligence in the field of natural language processing and machine learning large models and image and face recognition are analyzed and summarized. In the field of face recognition selected popular processing methods and material library, simple simulation of mainstream recognition options and means, through further examples to help readers understand the development of artificial intelligence status and direction. Understanding the information and relevant viewpoints and attitudes in the specific field, detailing the logic behind the inability of artificial intelligence to replace human beings and the technical difficulties and challenges faced, is of great value to improving the popularization of the concept of artificial intelligence and its development and progress in the future society.

Keywords: artificial intelligence, natural language processing, face recognition, current situation analysis, ChatGPT

1. Introduction

Under the background of the vigorous development of science and technology in today's society, the science and technology period also moved steadily toward the direction of science fiction [1]. Artificial intelligence rose to the occasion and has gone through many stages to grow to the size and shape it is today. This paper refers to a large number of relevant literatures that starts with the development status of artificial intelligence, and summarizes the historical development stage, reality, and future trends into four stages, with the purpose of helping readers understand the development process and future outlook of artificial intelligence more quickly. Here is a description of the four stages:

The first stage is the information retrieval stage, this stage is the most preliminary stage of artificial intelligence, only in the early stage of the concept, cannot be completely called artificial intelligence, at most called quasi-artificial intelligence stage. This stage of artificial intelligence is mainly search as the core function, when there are doubts and problems, log in to the network search engine, enter the problem or key fields, and through the computer network big data retrieval, can get massive data information. The biggest feature of the information search stage is that users can get enough information in a very short time. At present, there are many application products with search functions, such as Google, Baidu, and other large Internet companies are operating this kind of search engine business, users will enter the key fields they want to know, and then the computer will display them after searching, but this still requires a lot of effort to screen and analyze, and costs matching manpower and experience. To get valuable literature.

The second stage is the information push stage, which is the intermediate stage of the development of artificial intelligence. At this stage, the gold content of the word "intelligence" of artificial intelligence has greatly increased, which is equivalent to the elegant appearance of "artificial intelligence". In the information push stage, after users pay attention to a topic on the Internet, the Internet will continue to push relevant topic information according to the topic pay attention to in order to meet the needs and ideas of users. Users will continue to push relevant topic information according to the Internet and pay selective attention to it. At the same time, Internet companies can also accumulate deep learning through the analysis results in time dimension. Provide information consciously according to long-term personal needs. This is the second stage of AI development, the information push stage. For example, some Internet products such as TikTok, Instagram, and Facebook have this function.

The third stage is the information generation stage, which is the current stage of the development of artificial intelligence in modern society. The information generation stage refers to the products developed in this stage that have the functions of information contact, understanding, screening, analysis, induction, and a certain degree of creation. In this stage, most products have the functions of learning, creation, and output. For example, ChatGPT, Baidu's Wenchuanyixin, and other related products that appear on the Internet can be searched and analyzed according to the keywords proposed by users, extract, summarize, and create effective information, on this basis, carry out a certain accumulation of common sense and model pre-training, and generate the corresponding results to the user. It is undeniable that at this stage, artificial intelligence will improve work efficiency and quality in some occasions, but it will also cause a certain degree of impact on some traditional information fields, which is where the current public opinion is concerned.

The last stage is the information prediction stage, which is the future stage of the development of artificial intelligence. The information prediction stage is the stage where the Internet can not only learn, analyze, and create, but also predict the next trend and behavior of users, and provide corresponding help and precise support. At this stage, artificial intelligence has a lot of self-awareness, and from the social attribute analysis, it has been close to an independent individual, which can better provide services for humans and replace many industry jobs.

The typical representatives in the final stage currently exist strictly in the setting of science fiction movies, and it is expected that artificial intelligence will trigger historic events similar to the fourth Industrial Revolution in the future.

2.   Research Methods and Results

In order to better understand the popularity of artificial intelligence in the current society and the acceptance of it in Chinese society, this paper conducted a small-range questionnaire survey, from the basic questions (age, suggestions), understanding of artificial intelligence, and desire to understand and other aspects, to the design of a total of seven questions with the popular social model

ChatGPT as a typical example. Some of the responses were based on the Likert scale. A total of 142 data were collected as of October 2023. The topic of the questionnaire is a survey on the degree of understanding and interest in artificial intelligence (take ChatGPT as an example), which is carried out according to the current understanding degree and desire of the public on artificial intelligence. First, the age of the respondents is asked, and then the understanding degree of the respondents on artificial intelligence developed by the society is asked, with 5 representing very understanding, 4 representing understanding, and 3 representing average. 2 means don't know, 1 means don't know at all, the result is shown in Figure 1.
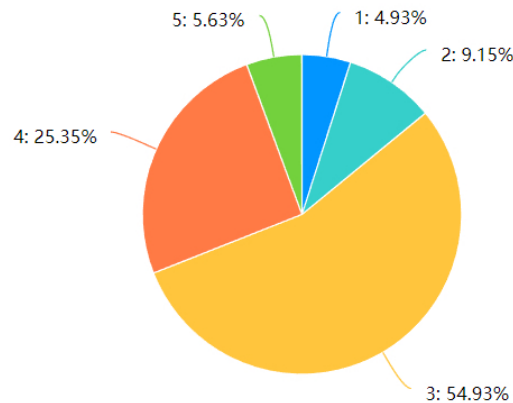

Figure 1: Statistical results of the public's understanding of current AI.

The respondents were consulted about their interest in artificial intelligence, with 5 representing very interested, 4 representing interested, 3 representing average, 2 representing not interested, and 1 representing not interested at all. The results are shown in Figure 2.
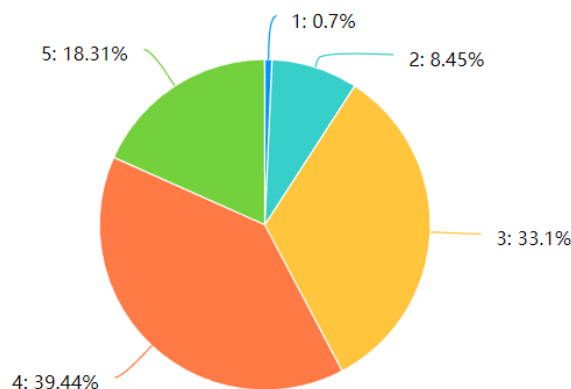

Figure 2: Statistical results on the level of public interest in current AI.

Based on the substantial changes, the following questions focus on daily life. The questions are set to score the impact and change degree of People's Daily lives under the premise of current artificial intelligence technology, where 5 represents complete change, 4 represents a lot of change, 3 represents average, 2 represents no change, and 1 represents no change at all. The results are shown in Figure 3.
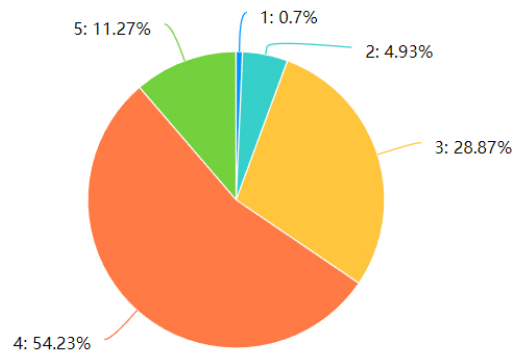
Figure 3: The proportion of life changes caused by artificial intelligence technology.

The first of the following two questions focuses on the understanding level of ChatGPT, a popular AI model at present, with 5 representing very understanding, 4 representing understanding, 3 representing average, 2 representing not understanding, and 1 representing not understanding at all. The results are shown in Figure 4.
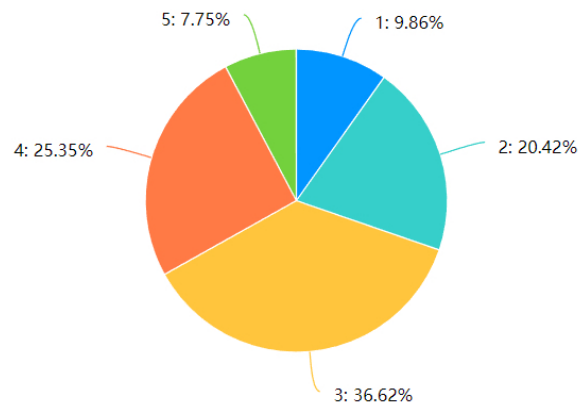
Figure 4: Proportion of respondents' understanding of ChatGPT.

The second is the rating statistics of how interested the respondents are in learning or continuing to learn more about the use of ChatGPT. The results are shown in Figure 5.
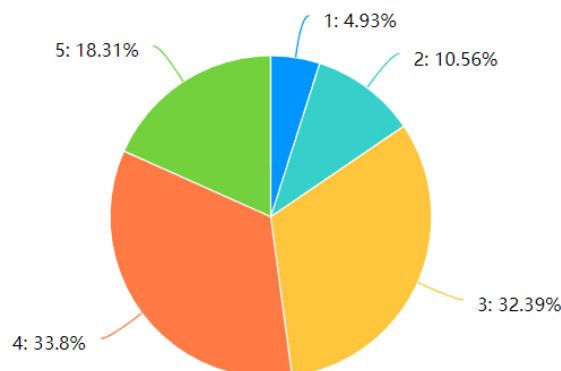
Figure 5: Statistical result of knowledge level of ChatGPT.

The next question has preconditions. By taking the respondents' previous exposure to ChatGPT as a prerequisite, the degree to which the respondents think ChatGPT's influence on all aspects of life has been changed is calculated. As shown in Figure 6, the horizontal coordinate from left to right is food, drink, travel, entertainment, research, work, and other aspects. There are a total of five aspects to choose from, and the selection results are not necessarily unique and do not limit the number of choices.
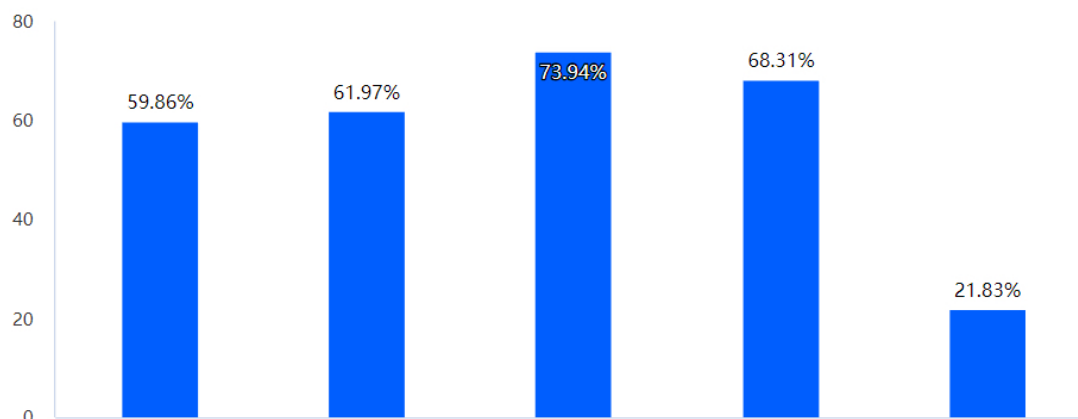

Figure 6: Results of the degree of change in ChatGPT's impact on life (from left to right, eating, drinking, and traveling to others).

3.   Discussion

According to the analysis of the survey results, the respondents are mostly concentrated in the age stage of 18 to 50 years old, belong to the young adults in the social attribute classification, and are the main contributors and fresh forces of social forces. At this stage, the group has more opportunities to contact new things, and the ability to accept new things is faster, but it also means that the statistical results and predictions may be biased and one-sided to a certain extent. First of all, when it comes to understanding the respondents' interest in artificial intelligence, 80.28% choose general and relatively familiar. This reflects the fact that people's overall understanding of artificial intelligence is at an above-average level. In the question of their desire to know about the future, the proportion greater than or equal to 3 is as high as 90.81%, proving that most people want to have friendly contact with artificial intelligence, which is a good signal for the future development of technology and technology. When asked how much AI is changing daily life, 65.5% of respondents answered more than 4. Well over half of the respondents believe their lives have changed in a significant way.

The next few questions are all aimed at the example given by ChatGPT, mainly exploring its degree of cognition and influence in society, without going into too much detail. As to which aspect of its specific influence is reflected, the top choice rate is as follows: 73.94% study and research and 68.31% work and office, while three or four entertainment games and eating and drinking and traveling accounted for 61.97% and 59.86% respectively, far exceeding other options, which proves that ChatGPT or other artificial intelligence products are currently more applied in the field of learning and office. It has not shifted its focus and objectives to the entertainment industry too early, in short, it has not yet carried out universal entertainment. However, in the face of not small numbers, a certain conclusion can be reached: artificial intelligence has entered the lives of the vast majority of people and achieved zero-distance contact.

Therefore, this paper will focus on artificial intelligence products and affected popular mainstream fields, and carefully analyze the status quo, technology, advantages and disadvantages of each field, and future prospects.

3.1. Large Model of Natural Language Processing and Machine Learning

New algorithms of artificial intelligence continue to emerge, deep learning and natural language processing are the main lines of development in this period, through which they try to solve more complex application tasks, and then make the industrial pattern and ecosystem of artificial intelligence more clear, and the open source development framework pattern is gradually established [1]. This builds on the words repeatedly mentioned above ChatGPT. It's basically an AI interactive robot that can learn on its own, ChatGPT is a chatbot program released by OpenAI (an artificial intelligence research company founded in the United States) on November 30, 2022. It is an artificial intelligence technology-driven natural language processing tool that can conduct dialogue by learning and understanding human language. It uses Transformer neural network architecture with language understanding and text generation capabilities [2]. It can also interact according to the context of the chat, really like humans to chat and communicate, and even complete tasks such as writing emails, video scripts, copywriting, translation, code, etc. [3]. In fact, this magical product relies on the support of huge computing power and is trained on massive data such as Wikipedia, journal articles, book materials, and web content [4]. Because it has received huge text training and simulation norms, it can imitate human communication methods to answer questions. Also relying on the Internet of Everything interconnection characteristics, things will be retrieved, classified, integrated, and output related topic answers. In addition, ChatGPT also introduced a feedback system, which emphasized the learning improvement ability of the model, and fed back the human judgment on the answers provided to the model in order to adjust the parameters of the constructed model, and then realize the change of the generation through the opening of the permission and the improvement of the computing power. As previously summarized by Chinese professors, the existing basic model of artificial intelligence is symbolist AI with logical reasoning as the core, connectionist AI with data-driven as the core (deep learning), and behaviorist AI with feedback control as the core (reinforcement learning). ChatGPT is an innovative integration of existing AI methods and technologies [3].

A Large Language model (LLM) is an artificial intelligence model designed to understand and generate human language. The model is trained on a large amount of text data and can perform a wide range of tasks, including text understanding, translation, sentiment analysis, and more. The Transformer framework used by the GPT model is one of the popular large language models [5].

For such a functional large language processing model, it is absurd and unworkable from the perspective of overly pessimistic deification of artificial intelligence and overly optimistic contempt for artificial intelligence. The specification of the model is not absolute, there is no exact answer to how to understand the processing of language, and the degree to which the machine can only recognize the examples provided by the text data and cannot "draw inferential parallels" like humans is one of the main problems it faces now. In the period of the third stage, the complicated environment may "mislead" the results of the model training, and the most obvious feedback is to give wrong answers and conclusions, but in the eyes of the robot, the answer is an accurate calculation, such problems emerge endlessly. Coincidentally, the current technology is not enough to support the establishment of self-awareness of artificial intelligence, more learning is built on the basis of practice makes perfect rather than active learning and creation, of course, this is closely related to the factors of the era background, there is not enough computing power support and technical means, this innovative time point will not come immediately. And will natural language processing models such as ChatGPT, which currently resonate in basic fields, be less effective when transferred to more serious fields (military, medical, economic, scientific, etc.)? These are the problems and challenges facing the future development of large models of natural language processing and machine learning.

3.2. Artificial Intelligence and Image Recognition

As one of the leading technologies in the field of artificial intelligence, image recognition technology can well represent the problems faced by many fields. The application of artificial intelligence can reduce the ambiguity of target identification and provide sufficient support for the development of many related industries. In addition, the wide application of image recognition technology can significantly reduce the defect function of target recognition.

This paper takes face recognition technology, which is more prominent in image recognition, as an example to analyze. When users think about human identification, the face is one of the most direct, obvious, and stable biometric features. Based on this feature, face recognition technology came into being, which is a biometric technology that uses face feature information for identity authentication. While widely used in specific fields such as security protection and finance, face recognition has also developed and shown significant practical value in many basic fields such as transportation, education, medical care, and e-commerce. The author has done a reference experiment for face recognition technology. In this experiment, based on VGG and PCA dimension reduction as feature extraction, the support vector machine classifier recognition method is tested, and then the face recognition system is realized. According to the principle of face recognition technology, the specific implementation of the technical process mainly includes three parts: face image library, face image feature extraction, and classifier recognition.

3.2.1. Relevant Training Data Set

The first step in the application of image recognition technology in artificial intelligence is to obtain relevant images [6]. ORL face database is selected as the research object. The ORL Face dataset, consisting of 400 images of 40 different people, was created between 1992 and 1994 by Olivetti's Research laboratory in Cambridge, England. The dataset is divided into 40 folders, each containing 10 images. All images are grayscale images in PGM format with a size of 92×112 pixels. The images in each category are taken from different situations with different timing, lighting, facial expressions (open/shut, smile/no smile), and facial details (with/without glasses). All images are taken against a dark, uniform background, and the face photos (some photos are slightly skewed) are placed in the corresponding photography area [7].

3.2.2. Core Algorithms

PCA dimensionality reduction: It is a commonly used dimensionality reduction algorithm that can be applied to face recognition tasks. There is a lot of non-critical information in the face image from the computer perspective, which is not very helpful for the realization of the face recognition algorithm but will greatly increase the calculation time and difficulty of the algorithm. By calculating the contribution rate of the feature value and selecting the feature vector corresponding to the first K feature values, the main information of the image can be reflected without causing loopholes in the success rate of subsequent recognition, so as to reduce the effective calculation time of face feature extraction [8]. The main idea of the PCA algorithm is to reduce the redundant information in the data and to effectively express the information contained in the original data while reducing the dimension. Fewer dimensions can solve most problems, so its role is very critical, can reduce the consumption of computing power and increase efficiency.

VGG feature extraction: There is no uniform form and process for the feature recognition methods used in face recognition technology [9]. The VGG model was proposed by the Visual Geometry Group in 2014. VGG feature extraction is a method of image feature extraction using the convolutional neural network CNN. The core idea is to extract image features by using multiple convolutional layers and pooling layers. Images have a lot of semantic information and features, such

as brightness, edge, texture, color, etc., which can be abstracted into features in convolutional neural networks. Through the convolution operation, CNN can gradually extract the features of different levels of images, so as to achieve the task of image classification and recognition. VGG feature extraction adopts the structure of multiple convolution layers and pooling layers, which can effectively extract different features of images, reduce the feature dimension, and improve the efficiency of feature extraction. It has been widely used in image classification, target detection, image segmentation, and other fields [10].

Classifier recognition: First of all, the training sample data needs to be imported into the classifier and trained by a specific classification algorithm to establish the classifier model. In this process, the commonly used classification algorithm is support vector machine (SVM) [7]. Once the classifier model is trained, the face image to be tested can be input into the system. The image data after dimensionality reduction is input into the classifier and the image is classified according to the classification basis of the classifier. By using the trained classifier model to compare the dimensionality-reduced face image data with the training data, to judge its category, and then compare with the training data, face recognition can be completed. SVM adopted in this experiment is a common supervised learning method, which can effectively deal with high-dimensional data, and has good generalization ability and high accuracy. By training the SVM classifier, it can classify new face images with the knowledge it has learned and realize the task of face recognition.

Analysis of simulation results:

In the UI interface, first, click the training model for training, and then click Read training set to read the ORL face library into the current path. Then click feature extraction, load the pre-trained VGG16 network according to the file path read in the previous step, and extract the image features. Then click PCA dimensionality reduction and use the PCA algorithm mentioned above to reduce the image features extracted in the previous step to 20 dimensions.
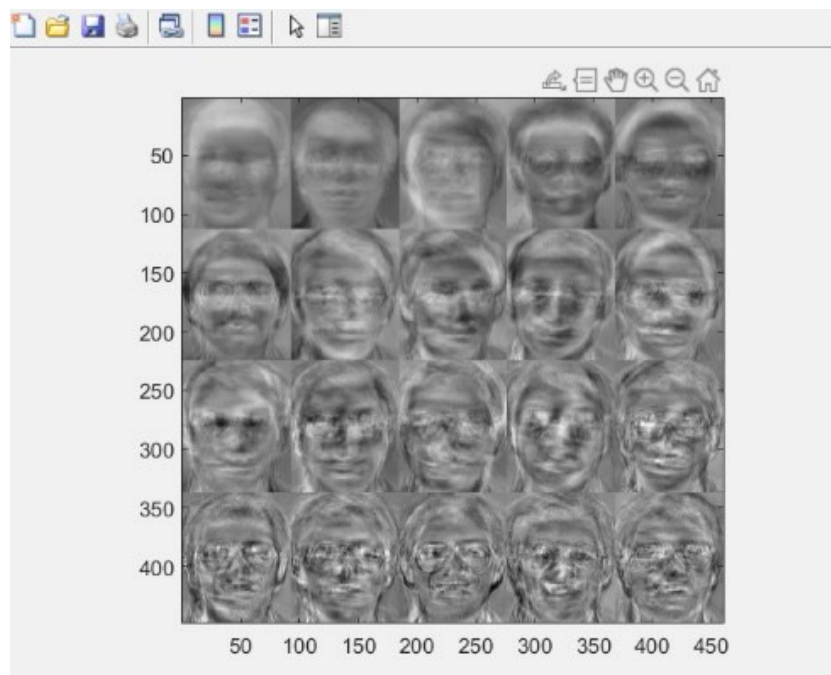

Figure 7: Reference graph with image features reduced to 20 dimensions according to PCA algorithm.

As shown in Figure 7, the 20-dimension was selected first, and then the experiment and modification were done to reduce the dimension to 10, and it was found that the recognition accuracy at this time was greatly reduced, less than 50%; then the dimension was changed to 25, and the

accuracy was not much different from that at 20, but the time spent was longer. In summary, the reduced dimension is set at 20 dimensions, which is a very cost-effective dimension. Then click normalization to make the final image features involved in the classifier training fluctuate within the interval of 1 to -1. Finally, the SVM classifier is trained, and a structure containing multiple classes of SVM training results is obtained by inputting the processed training data into the SVM classifier. Click face recognition to carry out face recognition work, select test objects in the test set for testing, and the experiment is over.

4. Problem Analysis

The accuracy rate of this experiment can reach about 97.5%, and the corresponding faces in the ORL database can be recognized accurately. There are also many shortcomings in this experiment. The feature extraction in the experiment is insufficient, the extracted features are not obvious the number is small, and the extraction is not completely combined with all the effective features corresponding to the face. The number of samples and sample data selected is not large enough, so should increase the sample data and find methods and algorithms that can reduce the training time.

The above experiments illustrate many of the universality problems facing AI in image recognition today:

The model training method is not unique. In most cases, there are few options for optimal solutions, and the choice of each link is only tendentious but not absolute. This is also limited by the limitations of today's technology and is difficult to solve immediately.

The training set pictures used are specially processed: the accuracy of face recognition technology in the experiment must be much higher than that in the actual application. Because the actual occlusion of facial features, the presence of similar features, and imitation and anti-recognition technology will have a greater impact on the results, how to more strictly control and more accurate recognition is also a challenge for the application of artificial intelligence in the field of image recognition.

Due to the reasons of computing power and investment, the currently applied image recognition technology still has room to improve the "cost performance". How to give full play to the advantages of artificial intelligence in the field of image recognition on the basis of saving manpower, material, and financial resources can make such technological integration more practical and valuable.

5. Conclusion

This paper puts forward four development stages of artificial intelligence, including a summary of the past history, a description of reality, and a vision for the future. Then, a small-range network questionnaire survey was used to investigate and analyze the interest and understanding degree of artificial intelligence and representative derivative products among major groups in Chinese society. Although it can be obtained from the analysis of specific application fields involved in current artificial intelligence technology, modern society is only in the preliminary stage of the third stage of information generation. The development of many application areas is still immature, and the ability to fully utilize the technology and deploy it in most areas needs to be improved. However, the public's interest in artificial intelligence technology did not produce negative emotions such as resistance, which undoubtedly provides a good soil and environment for the development of artificial intelligence technology.

Next, this paper starts with two specific hot areas. First, it points out the current situation and technical limitations of large models of natural language processing and machine learning and concludes that the impact and influence of products such as ChatGPT on the industry will not completely liberate human views. Then MATLAB software is used to simulate the state and function

of artificial intelligence-embedded image recognition, especially face recognition, and the status and technical breakthrough in this field are further explained through experiments. The description of specific fields can better reflect the current level of development and strength of artificial intelligence. In the future, it should focus more on reality and apply artificial intelligence technology and means in more fields. At the same time, it also hopes that governments and institutions will introduce more relevant policies to increase cooperation and exchanges at the technical level under the premise of not causing information leakage. After all, breakthroughs in artificial intelligence technology will be the well-being of people all over the world. It is also up to all human beings to make efforts to create a better future.

References

[1] *Artificial Intelligence Era under Deep Learning Technology. (2021) Big Data Era, 06: 56-76.*

[2] *Gao Hanyu. (2023) What Artificial Intelligence ChatGPT Will Bring to the Market. China Quality Miles Travel, 08, 75-76.*

[3] *Bolin, S. (2023) ChatGPT: The New Round of Artificial Intelligence Revolution. Automation Expo, 40, 8-11.*

[4] *Zhifeng, L., Yaping, W. Jimin, W. (2023) The Impact of Artificial Intelligence-Generated Content Technology on Knowledge Production and Dissemination. Journal of Information Technology, 42, 123-130.*

[5] *Zihan, L. (2023) Zhou Shuangshuang, Tang Guoheng, et al. Overview and Application of ChatGPT. Bonds, 06, 70-75.*

[6] *Min, L. (2022) Application of Image Recognition Technology in Artificial Intelligence. China New Communications, 24, 74-76.*

[7] *Xu, Y. Yaodan, C. Boqi, W. et al. (2021) Research on Face Recognition Technology Based on PCA Algorithm. Information Technology and Informatization, 03, 34-37+41.*

[8] *Tao, L. (2021) Facial Recognition Based on PCA Algorithm Design Optimization Study. Xi'an University of Electronic Science and Technology.*

[9] *Huan, L. (2021) Application Analysis of Face Recognition Technology in Artificial Intelligence. Electronic Testing, 1, 137-138, 130.*

[10] *Yan, B. (2022) Guo Yanhui. Image recognition technology based on artificial intelligence analysis. Journal of TV technology, 8, 140-143.*