

# Exploring Opportunities for the Computer Science Program in the New Era Based on ChatGPT

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**Abstract**— As generative AI technology continues to evolve, 2023 becomes the "year" of the shift from decision-based AI (AIDC) to generative AI. Nowadays, the basic structure used behind ChatGPT, the most powerful algorithm, the most systematic training data and the most mature large model, is a neural network structure based on the self-attention mechanism called Transformer. Nowadays, the basic structure used behind ChatGPT, the strongest part of the computer science program, has been developed in three directions: artificial intelligence and machine learning research and applications, data science and big data analytics, and ethics and law of artificial intelligence. Artificial Intelligence and Machine Learning Research and Application focuses on some of the feats of Neural Networks and Deep Learning in medicine; Big Data is both a product of technology and a function of technology as well as ever-growing analytical and computational power, and its potential impact in medical innovation cannot be ignored; the continuous development of AI technology has caused conceptual innovation and technological change, and a series of ethical issues triggered by the technology are gradually surfacing, this paper The development and application of AI, and the future development of AI are discussed.

**Keywords**— ChatGPT; Artificial Intelligence; Machine Learning; Big Data Analytics.

## I. INTRODUCTION

Recently, generative artificial intelligence is different from analytical artificial intelligence, the main function of analytical artificial intelligence is to judge the nature of the data outside the training, such as trend prediction through the analysis of historical data; and generative artificial intelligence lies in the generation of new content through the training of data, for example, there have been a number of scholars combined with the technical characteristics of the ChatGPT, through the theoretical deduction of the way that the introduction of ChatGPT will promote the transformation of the function of accountants [1]. The introduction of ChatGPT will promote the functional transformation of accountants. As a representative product of generative artificial intelligence, ChatGPT has the general characteristics of artificial intelligence, but also presents different characteristics from the previous artificial intelligence. ChatGPT can not be separated from the support of big data, big arithmetic and algorithms [2]. With the rapid development of science and technology, AI technology has gone through several stages, of which 2023 marks the beginning of the dominance of generative AI technology (AIGC), marking the transformation of decision-making AI (AIDC) to generative AI. In this new era, the computer science profession faces unprecedented opportunities and challenges. In this paper, we will make an

important analysis of the employment of computer science majors in three directions: artificial intelligence and machine learning research and application, data science and big data analytics, and artificial intelligence ethics and law.

The development of big models is already a big trend, and the generative AI explosion in 2023 is not a coincidence. Take ChatGPT for example, a natural language processing tool based on the generative pre-training model GPT-3.5 released in November 2022 by OpenAI, an AI research lab in the U.S. ChatGPT can interact with each other based on the context of the chat to accomplish various tasks such as writing copy, code, emails, video scripts, and so on. The large multimodal model GPT-4, released in March of this year, enables ChatGPT to receive both image and text input and allows ChatGPT to show amazing judgment in image reading. Although ChatGPT is not yet comparable to human abilities in many real-world scenarios, it has shown to be comparable to humans in many professional and academic benchmark tests [3].

One of the key values of generative models is their integration with productivity apps, while AI startups routinely raise capital at valuations in excess of \$1 billion. AI startups have emerged as a bright spot for investment in 2023 amidst a broader funding slowdown due to rising interest rates and hyperinflation [4]. Since ChatGPT came to prominence in 2023, generative AI technology has made tremendous strides, a trend that has had a profound impact on the computer science profession. As generative AI matures, it has shown amazing potential in areas such as speech recognition, natural language processing, and image generation. The year 2023 officially marks a brand new era in this technological direction, and the transition from decision-based AI to generative AI is an even greater opportunity for the computer science profession. In the history of human development, Marx for the first time from the perspective of human practice, elucidated the social and historical relationship between tools and the subject of labor, pointing out that the tools of labor "are the organs of the human mind created by the human hand". ChatGPT, as a new type of labor tool, can also be called a further extension of the organs of the human mind. Therefore, generative AI is not only able to better simulate human creative thinking, it is expected to bring revolutionary changes in the fields of healthcare, big data, social ethics, etc., which will be an important opportunity for computer science majors in the generative AI environment.

## II. OVERVIEW OF CHATGPT

ChatGPT, as an outstanding representative of generative AI technology, has experienced continuous development and technological evolution. Since 2023 has become a key inflection point in the field of artificial intelligence, ChatGPT has gradually attracted worldwide attention due to its outstanding natural language generation capabilities and the prospect of a wide range of application areas.

The evolution of ChatGPT can be divided into several key stages in Fig.1. The initial GPT model, based on the Transformer architecture, demonstrated strong performance on various natural language processing tasks by means of pre-training and fine-tuning. And with the increasing amount of data and model size, the GPT model has also made significant progress in the direction of generative dialog, i.e., ChatGPT.

From ChatGPT-1 to ChatGPT-3, the model size and language generation capabilities have been dramatically improved, allowing them to show amazing intelligence in a variety of dialog scenarios. Behind these models is the continuous development of deep learning technology and the exploration of large-scale pre-training, allowing the models to better capture the structure and semantics of language.

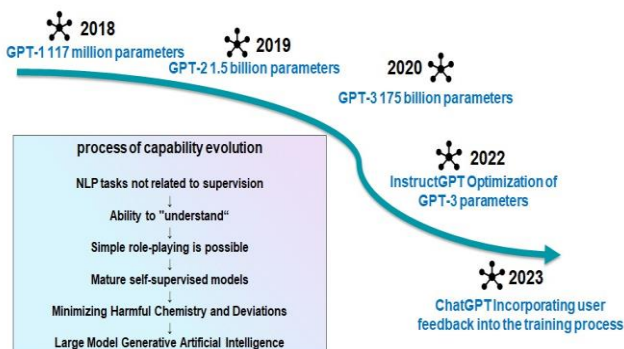


Fig. 1 Evolution of the GPT family

In terms of training data, the training of generative AI usually requires huge amounts of data in order to output high-quality models, giving rise to the phenomenon of "emergence" (when the amount of data on which a model has been trained exceeds a certain threshold, the accuracy of the model will skyrocket), in which obtaining and preparing the data is a difficult and time-consuming process. It is also important to ensure data quality and diversity, privacy and security, and digital property protection. In terms of model complexity, generative AI models are usually more complex than decision-based AI models, which require more parameters and arithmetic resources for training and inference. This may raise the issues of long training time, high arithmetic cost and complex model development and maintenance difficulty.

In terms of content output control, generative AI applications need to control the generated content of the output. Generative models are usually based on statistical models characterized by probability distributions, and thus their generation results cannot be fully predicted. This may lead to inaccurate output results, requiring additional processing or manual intervention.

In summary, the rise of generative AI technologies marks the dawn of a new era in the field of artificial intelligence, in which ChatGPT, as one of the representatives, will play an important role in the future of computer science majors. In the next chapters, we will explore more deeply the core technology and application prospects of ChatGPT, as well as the opportunities and challenges for computer science majors in this new era. ChatGPT, as a representative of generative AI technology, demonstrates strong natural language processing capabilities and creativity in its core technology and working principle. This chapter will deeply analyze the technical details of ChatGPT, explain its working principle, and how to realize the generation and interaction of conversations.

The algorithmic structure of ChatGPT is a clever blend of Recurrent Neural Network (RNN) and Transformer architectures. This structure allows ChatGPT to better process conversation history and generate coherent responses. Specifically, ChatGPT employs an encoder-decoder architecture. In the encoder stage, the conversation history is fed into the model and processed by a multi-layer self-attention mechanism and a feed-forward neural network to generate a contextual representation. This context representation is passed to the decoder, which generates appropriate replies based on this context. The encoder-decoder structure enables ChatGPT to understand the semantics of the context and generate coherent and accurate replies.

In the working process, the user's input text is fed into the ChatGPT model, which makes inferences based on the context of the input and then generates appropriate replies. This process includes the input of the encoder and the output of the decoder, which centers on capturing the relevance of the text through the self-attention mechanism for effective semantic understanding and generation. Accompanied by the acceleration of the new round of technological revolution and industrial change as well as the rapid development of artificial intelligence technology, digital transformation is becoming a key force driving socio-economic development. The rise of generative AI technology, especially the new generation of big models represented by ChatGPT, has brought unprecedented application prospects in several fields. In the new era, ChatGPT will play an important role in various scenarios and promote innovation and development in many fields such as healthcare, education, and social ethics. This chapter will focus on exploring the future opportunities for computer science majors from two perspectives: the practical application of artificial intelligence and machine learning and data science.

## III. APPLICATION OF CHATGPT

ChatGPT and Metaverse not only overlap in application scenarios, but also share a common origin in technology application, i.e. both are based on the continuous accumulation and iterative updating of modern digital technologies. Both are based on the continuous accumulation and iterative updating of modern digital technologies, and both are dedicated to facilitating the continuous and convenient digital applications to serve the real world. If we look at the meta-universe as a pool of spring water, ChatGPT is undoubtedly a blooming

lotus flower in the center of the water, which is in full bloom and dazzling. To clarify the relationship between the two, we should return to the original point in order to see the direction of the road ahead [5].

The various digital interactions in the meta-universe will generate a large amount of data. Data scientists can use data collection and analysis technologies to dig deeper into information about user behavior, preferences, and needs in the meta-universe to provide targeted products and services for businesses and organizations. The meta-universe is based on virtual reality (VR) and augmented reality (AR) technologies that can provide immersive digital experiences. Data scientists can use these technologies to design and develop virtual scenarios, virtual social networks, digital products, etc. with personalization and interactivity.

The technological basis of Web 2.0, characterized by cloud data centers for storing and processing data, building algorithms for the analysis of large data sets, 5G wireless networks, and intelligent sensors for IoT devices, is not sufficient to meet these requirements [6]. By users interacting with ChatGPT, content creators and developers in the meta-universe can more quickly generate virtual text, dialog, and plots to create immersive virtual experiences for users. Most importantly, although the ChatGPT big model cannot directly solve the problem of excessive data volume in the meta-universe, it can be used as a useful tool in the meta-universe to assist users in data querying, analyzing, and interacting with each other, providing convenience and enhancing user experience, which lays a certain advanced foundation for the development of the meta-universe.

The development of meta-universe has entered the third year, and a large number of meta-universe technological innovations and industrial attempts have also blossomed in multiple fields around the world." Gong Caichun, president of Wuhan meta-universe research institute, told the China economic times reporter, but with the breakthrough of AI and other artificial intelligence technology, the meta-universe each track of industrial development will also step into the deep water, and the industry will also explore the closed-loop creation of the business model. Therefore, with the aid of chatgpt, yuan universe for the problem of excessive data volume will appear to have a significant effect to solve the problem, yuan universe will eventually become the next spring of the computer profession.

Artificial intelligence and ethics is an important topic. As AI develops and becomes more widely used, we need to think seriously about how to respect and uphold ethical principles when using AI technology.

The design and use of AI should be guided by basic ethical principles that protect human dignity and rights, and do not cause unnecessary harm or invade personal privacy. AI systems should be designed to be transparent and explainable, and people should be able to understand and be held accountable for their decision-making processes and behaviors. AI systems should be designed to be transparent and explainable, and people should be able to understand their decision-making processes and behaviors.

Its technology should serve the interests of human beings, not replace them or disempower them. We need to ensure that the development of AI is in the overall interest of society and provides fair and equal opportunities. At the same time the development of AI should be transparent, cooperative and accountable. AI-related research and technology should be shared openly to promote innovation and cooperation. At the same time, we must recognize the limitations and risks of AI, proactively address the challenges it may pose, and ensure that its development is consistent with human values.

The generative AI technology represented by ChatGPT is embedded and penetrated into the field of social life, and along with the continuous expansion of the depth and scope of interaction, it has wrapped up many ideological risks with new characteristics. Clearly identifying the intrinsic mechanism of ideological risks generated by generative AI such as ChatGPT is a prerequisite for preventing the ideological risks of generative AI [7].

From "Deep Blue" to "AlphaGo", from "Nine Songs" to "Siri", from "intelligent drones" to "ChatGPT", AI has gradually moved from a specific field to a comprehensive "human-like intelligence" system, showing a broader application prospect [8]. At present, although generative artificial intelligence is not yet perfect in terms of high-precision simulation algorithms for thinking and movement, its extraordinary "intelligence" in data collection, data processing, and data output is enough to make human beings pay great attention to and reflect on the impact of the survival situation they may encounter in the future. The development of generative AI represented by ChatGPT and its wide range of applications are believed to be reshaping the whole society, and human beings, while enjoying the convenience brought by the new technology, will also be subjected to unprecedented challenges, prominently manifested in the alienation of generative AI to human beings, reshaping human interactions, human thinking and human labor.

Overall, AI ethics is an emerging and relatively new field that has emerged in response to growing concerns about the impact of artificial intelligence (AI) on individual human beings and their social institutions. In turn, AI ethics is part of the broader field of digital ethics, which addresses similar issues arising from the development and deployment of new digital technologies. Here we address the important issue that digital ethics in general, and AI ethics in particular, lack sufficient philosophical underpinnings

Generative artificial intelligence technology, especially the new generation of models represented by ChatGPT, is leading the development and innovation of the computer profession. This thesis demonstrates the importance and impact of this technology in the new era by discussing the technical principles, application prospects and future development directions of ChatGPT. Generative AI technology brings unprecedented application opportunities in several fields. From medical diagnosis to education personalized learning to creative industries and customer service, ChatGPT brings more efficient and smarter solutions to human society with its powerful natural language processing capabilities. However, along with the rapid development of the technology, a series

of technical challenges have emerged that need to be addressed in future research.

The computer science profession will usher in new opportunities in the "era of big models". From education and training to research and innovation, to cross-disciplinary collaboration and industrial applications, computing professionals will play an important role. Cultivating professionals who master the training and application of big models, expanding cutting-edge research areas, and applying generative AI technology to various industries will promote the development of technology and social progress. However, we also need to realize that the development of generative AI technology is not all smooth. The application of the technology has also brought about a series of ethical, legal and social issues. How to guarantee the morality and accuracy of generated content, how to protect the privacy of user data, and how to solve the problems of interpretability and misleading models all require continuous exploration and efforts.

Generative AI technology, represented by ChatGPT, is leading to a new era in the computer profession. The development of this technology will bring innovation, progress and change to human society. The exploration of computer professionals in the practical application of AI, the innovation of the application of data science and IoT, and the social and ethical issues based on generative AI will be an important direction for the future development of generative AI technology and the sustainable progress of the society.

#### IV. CONCLUSION

Generative artificial intelligence technology, especially the new generation of models represented by ChatGPT, is leading the development and innovation of the computer profession. This thesis demonstrates the importance and impact of this technology in the new era by discussing the technical principles, application prospects and future development directions of ChatGPT. Generative AI technology brings unprecedented application opportunities in several fields. From medical diagnosis to education personalized learning to creative industries and customer service, ChatGPT brings more efficient and smarter solutions to human society with its powerful natural language processing capabilities. However, along with the rapid development of the technology, a series of technical challenges have emerged that need to be addressed in future research.

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