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Overview of the Application of VR Technology in the Field of Deep Learning

Zhengge Xu

Northeastern University, Boston, 02215, United States

*Corresponding author's e-mail: xu.zhengg@northeastern.edu

Abstract

In the past few years, deep learning technology has made landmark progress, which makes it widely used in Natural language processing, computer vision and other fields. However, traditional deep learning methods have limitations in Data and information visualization, model interpretation and interaction. In order to overcome these limitations, virtual reality (VR) technology has been introduced into the field of deep learning, providing researchers with new tools and perspectives.. With the continuous progress of technology, VR has become a powerful tool, bringing enormous potential and opportunities to the field of deep learning. It not only provides a more immersive environment, but also can change our understanding of Data and information visualization, model interpretation and interaction methods. Based on this, this paper systematically reviews and summarizes the application research of VR technology in the field of deep learning through literature review, focusing on innovation in Data and information visualization, model interpretation and interaction.

Keywords

Virtual Reality; Deep Learning; Visualization.

1. Introduction

Deep learning technology is widely known worldwide and has now been widely applied in various fields. Nowadays, VR (VR) technology is increasingly being combined with deep learning to develop practical tools or systems that allow users to perform specific tasks. The introduction of VR technology is aimed at reducing the burden on users, providing a good user experience, and breaking through usage limitations in certain scenarios. As an important branch of the field of artificial intelligence, thanks to its strong learning ability and highly automated characteristics, deep learning has been widely recognized for its achievements in Natural language processing, image and language recognition and other fields. However, the application of deep learning is not limited to traditional computer interfaces, but rather becomes a trend of interaction and integration with the real world. In this regard, VR technology provides an ideal platform that combines deep learning with immersive experience, creating a more realistic and immersive interactive environment for users [1]. Through VR technology, researchers can build virtual environments with rich and diverse scenes, including artificially generated images, videos, and audio. These virtual environments can not only simulate various scenarios in the real world, but also flexibly control and adjust various parameters and factors, providing more training samples and scenarios for deep learning algorithms, thereby improving their learning ability and robustness. In the research and application of deep learning, the advantages of VR technology are not only reflected in visualization and interactivity, but also in data generation and simulation [2].

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Through VR devices, researchers can present the output results of deep learning algorithms to users in a more intuitive way, deepening their understanding and evaluation of the algorithms. However, despite the enormous potential of VR technology in the field of deep learning, it also faces a series of challenges and problems. How to effectively utilize VR technology to generate high-quality virtual environment data, how to solve the limitations of sensors and devices to improve interactivity and fidelity, and how to combine VR with deep learning algorithms to achieve more optimized results are all current issues that need to be deeply studied and solved. Therefore, in this article, the author will delve into the application of VR technology in the field of deep learning. This study aims to provide a comprehensive summary of relevant research and practice, in order to reveal the potential impact and driving role of VR technology on deep learning, and provide inspiration and guidance for future research and application.

2. Literature Review

According to existing research on VR technology, VR technology has the following characteristics:

2.1 Immersive

Immersive VR technology is one of the most important features. It creates a deeply immersive environment for users, using special stimuli to influence their perception system, thereby generating a sense of psychological immersion in the virtual environment [3]. This immersion plays a decisive role in the performance of VR systems. Many research achievements have demonstrated the application of immersive VR technology in various fields, including gaming, training, and therapy.

2.2 Interactivity

Interactivity refers to the ability of users to provide feedback on the surrounding environment in a virtual environment and interact with the virtual environment in terms of operability. VR systems can effectively respond to user instructions and operations, thus maintaining good interactivity with users [4]. In the field of deep learning, researchers are exploring how to combine VR technology with deep learning algorithms to achieve a more intelligent and adaptive interactive experience [5]. For example, using deep learning algorithms to recognize and analyze user gestures and expressions can achieve more natural and intuitive interaction.

2.3 Multi Perception

The purpose of multi perception is to capture the ability of human perception through computers. In recent years, with the rapid development of advanced deep learning technologies, VR systems can effectively process human visual images through digital visual processing approaches [6]. VR technology can update users' visual perception by generating realistic visual stimuli. Not only that, VR technology can also create other perceptual modes, such as hearing and touch, to provide a more comprehensive and immersive experience. For example, enhancing the realism and immersion of VR scenes through the use of sound and tactile feedback.

2.4 Summary

The technology of deep learning is based on artificial neural networks. It discovers the distributed feature representation of data through deep learning structures such as Multilayer perceptron (MLP), thus forming a more abstract high-level representation. However, the traditional Backpropagation is not applicable to the depth structure with only a few layers, because in the depth structure, the local minimum is the main obstacle to training difficulties. To address this issue, Hinton et al. proposed a layer by layer training algorithm based on deep confidence networks (DBNs), which provides a new method for solving optimization problems related to deep structures. In addition, there are other deep learning structures, such as Convolutional neural network (CNNs), cyclic automatic encoders (RNNs) and deep convolutional networks (DCNs), which have achieved remarkable research results in different tasks and fields. Among them, CNN reduces the number of parameters by utilizing spatial

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relative relationships, improves the performance of backpropagation training, and is widely used in image and video processing tasks [7].

3. Application Analysis of VR Technology in the Field of Deep Learning

VR technology can provide users with a way to interact with virtual environments. There are currently various visualization methods for virtual environments to achieve such interaction, including presenting virtual environments as real environments or fully visualizing them. Until people cannot directly distinguish the differences between virtual and real environments through their senses, virtual environments always maintain their authenticity.

Generally speaking, the application of VR technology can be divided into three categories, as shown below:

1) Desktop VR system: An important advantage of a desktop VR system is its low cost, where users only need to interact in a simple interaction window. Based on its characteristics, desktop VR systems are widely used in fields such as CAD or CAM in the construction industry [8].

2) Immersive VR system: This type of VR system achieves human-computer interaction through the use of specialized VR devices, including gloves, research, and helmets [9]. It can help users gain sensory experiences such as touch, hearing, and vision in virtual environments through VR devices.

3) Distributed VR system: This VR system is mainly based on distributed computer simulation systems and immersive VR systems, and conducts some simulation training through network structure, including early prevention of natural disasters and pre training of medical procedures [10].

Overall, different categories of VR technology have their own characteristics. Desktop VR systems have lower costs and are suitable for specific industries. Immersive VR systems provide a multi sensory experience through hardware devices, while distributed VR systems are mainly used in fields such as network simulation training. These different VR technologies provide people with rich experiences and application opportunities.

With the outstanding ability of deep learning in the field of image processing, the fusion between VR technology and deep learning has also received widespread attention. In the field of VR, the ability to process visual images plays an important role in achieving better multi perception and user interaction. In reality, humans rely on vision to obtain over 70% of information, so excellent image processing capabilities become crucial in the process of deep learning. Based on this factor, many organizations in the VR industry have begun to focus on the field of AI deep learning and attempt to promote the development of VR technology. Among them, OpenAI has designed a relatively mature deep learning system and integrated it with VR Technological convergence. The purpose of deep learning is to identify and process images of interest to its target users. For example, in VR, the operating system can learn and imitate many instructions that are independently operated and executed by the user themselves, thereby achieving the goal of accurate operation. In addition, the integration of VR technology and deep learning is also of great significance in the medical field. Doctors can fully utilize advanced medical imaging technology to diagnose diseases and even perform simulated surgeries on patients. During this process, doctors can use VR technology to simulate surgeries in advance. At the same time, doctors can use deep learning technology to display high-definition medical images of patients to provide doctors with a more realistic experience, making it easier for doctors to simulate surgeries.

In summary, the combination of VR technology and deep learning is driving innovation and progress in various fields. Through the application of deep learning algorithms, VR technology can provide a more realistic, interactive, and multi sensory experience, while bringing new opportunities and development prospects for fields such as medicine, music, and robotics.

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4. Evaluation and Conclusion

With the advancement of digitization and artificial intelligence technology, VR technology is gradually evolving into a comprehensive collection of multiple modal cross composite technologies. This development has made VR technology no longer isolated, but a popular technology that integrates into human life, especially with the rise of deep learning in the context of the rapid development of artificial intelligence. The combination of VR technology and deep learning has received increasing attention. However, the current development of VR technology is still in its early stages, and there are still some problems to be solved. Especially, the current software and hardware facilities that support VR environments are not yet mature, and the field of deep and deep learning also needs further development. Nevertheless, the deep integration of VR technology and deep learning remains an important area for future research. With the continuous development of VR technology, it will be applied in more and more fields. For example, in the field of education, VR combined with deep learning can provide an immersive learning experience, and students can deepen their understanding of knowledge through interaction with virtual environments. Also, medical providers can utilize VR technology and deep learning for surgical simulation and diagnostic assistance, improving medical effectiveness and reducing risks. VR technology can also play an important role in areas such as architectural design, entertainment games, and tourism experiences. Although there are still challenges and limitations in VR technology and deep learning, with the continuous progress and innovation of technology, it is reasonable to believe that the integration of more advanced and mature VR technology and deep learning will become an important development trend in the future. This integration will bring richer and more realistic virtual experiences, and bring new development opportunities for various industries.

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