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Computer-Aided Design AND APPLICATIONS

3D Model Design and Interactive Experience Optimization of Cultural Creativity Product Based on Virtual Reality Technology

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Abstract. The purpose of this article is to study the 3D model design and interactive experience optimization strategy of cultural creativity product CAD (computer aided design) based on VR (virtual reality) technology, improve the accuracy and recall rate of cultural creativity's product image feature detection, and locate the edge contour of the product image relatively accurately. Therefore, an optimization method of 3D modeling of cultural creativity products based on generative antagonism network (GAN) is proposed. The performance of this algorithm and the layout optimization algorithm based on convolutional neural network (CNN) are compared through experiments. Experimental show that, compared with the layout optimization algorithm based on CNN algorithm, the accuracy of the proposed algorithm is improved by more than 20%, and the recall rate is also significantly improved. Moreover, the algorithm can also protect the detailed features of cultural creativity products, making the applications of 3D reconstruction and virtual display of cultural creativity products more accurate and reliable. Through deep learning and special optimization strategies, the algorithm can identify and locate the key features of products more accurately, thus playing an important role in product quality control, detail repair and digital protection. In addition, the algorithm can also be applied to other areas of 3D image feature detection and related application research, which has certain theoretical significance and practical application value.

Keywords: Virtual Reality; Cultural creativity Products; Computer Aided Design; 3D Model; Interactive Experience
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1 INTRODUCTION

Cultural creativity products, as the core component of cultural creativity industry, range from a hand-painted illustration to a landmark building, and their design and innovation have greatly

promoted the growth of cultural creativity industry. With the continuous development of technology, the application of computer-aided design (CAD) tools in the field of microelectronics is becoming increasingly widespread. In order to help students better grasp the essence of microelectronic circuit design and improve design efficiency, this article explores the integration of various state-of-the-art computer-aided design tools in microelectronic circuit design courses. Multiple computer-aided design tools can help students complete circuit design tasks faster and reduce the time cost of manual design and calculation. These tools have the characteristics of high precision and efficiency, which can help students avoid errors in the design process, improve circuit performance and quality. Multiple design tools can provide design solutions from different perspectives, helping students optimize circuit design, improve circuit performance and stability. Students use the Synopsys tool to verify and simulate the functionality of the layout file after layout and wiring, ensuring the correctness of circuit functionality and performance standards. By integrating various computer-aided design tools, the student successfully designed a high-speed digital circuit and achieved excellent design results. At the same time, this method of integrating multiple advanced tools has also improved students' comprehensive application ability and team collaboration ability [1]. In today's increasingly integrated technology and culture, how to improve the user experience of cultural creativity products with advanced technology has become the focus of attention in the industry. Topological optimization of 3D models can optimize material distribution, structural configuration, and system performance through iterative calculations under given constraints. This optimization method can significantly improve the design quality and efficiency of products, reduce manufacturing and maintenance costs, and shorten the product development cycle. Therefore, topology optimization of 3D models is of great significance in engineering practice. Bacciaglia et al. [2] ensured the accuracy of parameters such as the geometric shape and boundary conditions of the model; Secondly, select appropriate optimization algorithms and parameter settings to avoid local optima. Finally, fully consider the balance between computational efficiency and accuracy. By eliminating defects such as burrs and gaps on the surface of the model, the surface of the model is made smoother. Common surface smoothing methods include mesh redrawing and finite element method. These methods can gradually optimize the surface quality of the model through iterative calculations, improving the accuracy and aesthetics of the model. In traditional cultural creativity product design, designers usually use two-dimensional graphic design software to create. However, this design method is often difficult to accurately convey the designer's creativity and intention, nor can it intuitively show the 3D form of the product. Deininger et al. [3] will introduce a continuous, semi-automatic workflow, ranging from 3D urban models with geometric optimization and CFD simulation to visualization of urban environmental stroke. Through this workflow, we can better understand the changes in urban wind environment and provide scientific basis for urban planning and design. In order to provide readers with a more intuitive view of the changes and trends in the wind field, we can use methods such as images and animations to visualize the data. At the same time, virtual reality (VR) technology can also be used to immerse the audience in the changing urban wind environment. Through these visual display methods, we can gain a deeper understanding of the characteristics and patterns of urban wind environment, and improve the quality of urban planning and design. This workflow provides an effective solution for visualizing urban environments from 3D city models with geometric optimization and CFD simulation to stroke. In order to solve this problem, people began to use CAD software for 3D modeling. Compared with the traditional two-dimensional design, 3D modeling can show the shape, structure and spatial characteristics of products more accurately and vividly, and provide designers with more creative space. With the continuous development of technology, virtual reality technology has become an important tool in many fields, especially in the field of tourism product design. Using virtual reality technology to design a tourism product CAD 3D modeling system can help designers express their design intentions more intuitively and accurately, improving design efficiency and quality. Deng et al. [4] introduced the relevant content of the system, including system architecture, functional modules, and practical applications. The data management module is responsible for storing and managing 3D models, materials, textures, and other data information of tourism products. In order to improve the efficiency and security of

data management, this module adopts a combination of database and file system for data storage and management. The model building module is developed based on 3D modeling software, mainly responsible for creating, editing, and optimizing 3D models of tourism products. However, the traditional 3D modeling software pays too much attention to the accuracy and functionality of the model and ignores the user experience. Users often need to go through complicated steps and complicated instructions in the operation process to complete the design task, which greatly reduces the enthusiasm of users to participate and limits the innovation and progress of cultural creativity products. With the development of digitalization and internet technology, the traditional presentation method of Peking Opera scripts can no longer meet the needs of modern audiences. This system is an online platform that supports users to upload their own scripts and can edit and format them. It uses HTML5 to implement this system. HTML5 is a web development standard that provides rich APIs and elements to easily implement various functions. CSS3 was used to beautify the interface. CSS3 provides rich styles and animation effects, which can make the interface more beautiful and vivid. Adopting a responsive design, the system can be used on multiple devices. We have used technologies such as media querying and streaming layout to enable the interface to adapt to the screen size and resolution of different devices. This article will focus on VR, and discuss its application and value in 3D model design and interactive experience optimization of cultural creativity product CAD.

Laksono and Aditya [5] analyzed the use of game engines for interactive 3D terrain data visualization. Game engine is a software framework that provides powerful functions for game development, which can greatly improve game development efficiency and quality. Compared with traditional 3D terrain data visualization methods, game engines have richer interactivity and higher rendering efficiency. At the same time, game engines can also provide high-precision model rendering, enabling more realistic and vivid visualization of 3D terrain data. Utilize game engines to achieve interactive operations. Through input devices provided by game engines, such as mice, keyboards, touch screens, etc., users can freely control the movement and scaling of views, making it more convenient to observe terrain data. Utilize game engines for real-time data updates. During the interactive 3D terrain data visualization process, users may make modifications or updates to the data. The game engine can respond to these changes in real-time and re render the corresponding terrain areas, thereby improving the interactive experience. The rise of VR has brought a new breakthrough for the design of 3D CAD model and the optimization of interactive experience of cultural creativity products. VR can create a realistic 3D virtual environment, enabling users to communicate and interact with designers in an immersive experience. This not only improves the designer's design efficiency, but also enables users to participate in the design process more intuitively and deeply, which provides new possibilities for improving the pertinence and practicability of cultural creativity products. In this article, the use of VR in the design of 3D CAD model of cultural creativity products and the optimization of interactive experience will be studied. Through the research on 3D model design and interactive experience optimization of cultural creativity product CAD based on VR, we hope to provide users with richer and more real product experience and further expand the application scope and market space of cultural creativity products. Moreover, I also hope to provide designers with more efficient and accurate design tools and methods to promote the innovation and growth of cultural creativity products.

The rise of VR provides a new turning point for the design of 3D CAD model and the optimization of interactive experience of cultural creativity products. This not only improves the designer's design efficiency, but also allows users to participate in the design process more deeply, improving the pertinence and practicability of the design. The innovation of this article mainly includes the following aspects:

(1) VR is introduced into the CAD 3D model design and interactive experience optimization of cultural creativity products, which breaks through the limitation of traditional design methods, provides designers with a more realistic 3D virtual environment and a more convenient operation mode, and also brings users a more intuitive and immersive experience.

(2) This article proposes a 3D CAD modeling method of cultural creativity products based on multi-feature fusion. This method comprehensively considers various features of cultural creativity products, such as shape, structure, material, function, etc., and integrates and comprehensively processes these features, so as to obtain more comprehensive and accurate design results and models. This method improves the designer's design efficiency and quality, and at the same time, it also enhances the user's cognition and feeling of cultural creativity products.

(3) Through the introduction of VR, a new breakthrough has been brought to the interactive experience of cultural creativity products. Users can communicate and interact with designers in real time in the 3D virtual environment, and participate in the design process more intuitively. Moreover, they can display and experience Cultural creativity products in an all-round way through VR, which enhances users' knowledge and feelings of products and further improves the practicality and pertinence of cultural creativity products.

(4) The research results provide new ideas and methods for the innovation and growth of cultural creativity industry. By introducing VR and 3D modeling method of cultural creativity product CAD with multi-features, designers can be provided with more comprehensive and accurate design tools and methods to promote the innovation and growth of cultural creativity products.

Chapter arrangement:

Section Ⅰ: Introduction

This article introduces the research background and purpose, expounds the importance of VR in the design of CAD 3D model of creative products, and puts forward the research method of this article.

Section Ⅱ: Theoretical basis

This article introduces the related technologies involved in this study, and provides technical support for the subsequent algorithm design and experimental analysis.

Section III: Algorithm Design

This article will introduce in detail the design idea and implementation process of cultural creativity's product image feature optimization algorithm, including model architecture, training process, generator and discriminator design.

Section IV: Experimental Analysis

The experimental process, experimental data set, experimental results and their analysis are described to verify the effectiveness and advantages of the algorithm in this article.

Section V: Conclusion and Prospect

Summarize the main research results and contributions of this article, explain the significance of this algorithm to the digital transformation and upgrading of cultural creativity industry, and discuss the future research direction and possible improvements.

2 RELATED WORK

With the continuous development of technology, machine learning and design laboratories have become indispensable tools in the process of artistic creation. Liow et al. [6] will explore how to enhance the effectiveness of artistic works through machine learning and design laboratory techniques, and analyze practical application cases. Machine learning is an artificial intelligence technology that learns rules and patterns in data through training models, thereby achieving prediction and analysis of new data. In the field of artistic creation, machine learning can be used to generate new artistic styles, optimize design processes, and more. A design laboratory refers to an experimental venue that integrates various advanced equipment and technologies, providing artists with creative and research conditions. A painter wants to incorporate the style of another artist into their own work. By using the works of two artists as training data and using machine

learning algorithms for style transfer, a new work that combines both styles was ultimately generated. The application of machine learning and design laboratory technology in art creation is becoming increasingly widespread. These technologies can not only provide artists with new creative ideas and methods, but also help improve the aesthetic value of their works. Through the combination of machine learning and design laboratories, artists can delve deeper into the infinite possibilities of art, bringing their works of art closer to the design laboratory. With the progress of society and the development of technology, communication and cooperation between people have become increasingly frequent and close. Group collaboration, as an important form of cooperation, plays an important role in various fields such as society, economy, and politics. Lu et al. [7] analyzed and visualized the impact of group collaboration on social network relationships from several aspects. There are various ways of group collaboration, from face-to-face communication and discussion to collaboration through internet platforms, which have different impacts on social network relationships. For example, collaboration through internet platforms can expand the scope of collaboration, allowing more people to participate and forming more complex social network relationships.

By analyzing the evolution of visual user features, task allocation for intra group collaboration relationships was more intuitively carried out, greatly improving the efficiency of group collaboration. Lu [8] aims to explore the optimization of an object-oriented 3D CAD preprocessing system for high-rise building steel structures. Firstly, object-oriented design methods are an important strategy for optimizing CAD preprocessing systems. This method encapsulates data and operations in objects and organizes code through the concepts of classes and objects, improving the readability and maintainability of the code. In the optimization process, we should focus on improving system performance, improving user interfaces, and enhancing data management capabilities. Secondly, in order to optimize system performance, we can use multithreading and parallel computing techniques to improve the system's computational speed. In addition, using cloud computing technology, we can achieve rapid processing and storage of large-scale data, thereby improving the overall performance of the system. With the continuous development of technology, Geographic Information Systems (GIS) and Building Information Modeling (BIM) have become two areas of great concern. In recent years, many researchers have attempted to extend 3D GIS regional models and BIM based building models to computer gaming environments to achieve a more realistic and vivid gaming experience. Ma [9] explored the possibility and challenges of applying 3D-GIS and BIM technology to computer gaming environments. 3D-GIS regional model is a technology that represents physical objects such as geographic regions, cities, and buildings in three-dimensional space. It can provide rich geographic information, such as terrain, hydrology, vegetation, etc., providing game developers with realistic and three-dimensional game scenes. Building models based on BIM are a method of using 3D models to represent the design, structure, and material information of buildings. Through BIM technology, game developers can obtain more refined and realistic building models. However, extending 3D-GIS regional models and BIM based building models to computer gaming environments is not an easy task.

3D factory simulation software has become an important tool in the industrial field. This type of software helps factory designers, engineers, and managers better understand and optimize industrial workplaces and processes through the construction of 3D models, with computer-aided participatory design. Pelliccia et al. [10] explored the applicability of 3D factory simulation software in these two aspects. Through 3D models, it is possible to gain a more intuitive understanding of factory layout, equipment, and process flow. This helps identify potential issues and bottlenecks for optimization. Simulation software can simulate the actual operation of a factory, helping staff to familiarize and master equipment operation, process flow, and emergency response in advance. Through 3D modeling, designers, engineers, and managers can better communicate and collaborate, ensuring that each department has a unified understanding and understanding of factory layout and processes. 3D models are more interactive and operable than traditional graphic designs, allowing users to more intuitively understand and manipulate the design. Rojek et al. [11] explored how to optimize 3D printing materials for selected medical

applications from the perspective of artificial intelligence optimization technology. Artificial intelligence optimization technology is a method that simulates human intelligence to solve problems using computers as carriers. In medical applications, artificial intelligence optimization technology can be used to screen candidate materials suitable for 3D printing from massive material data, and optimize these candidate materials to meet the needs of medical applications. Taking customized orthoses as an example, the production of orthoses needs to meet the personalized needs of patients, while also possessing sufficient mechanical strength and biocompatibility. Through artificial intelligence optimization technology, candidate materials suitable for making orthotics can be selected from massive material data. And optimize according to the personalized needs of patients to improve the comfort and treatment effect of the orthosis.

With the rapid development of technology, computer-aided design (CAD) has become the core technology of modern industrial production. The widespread application of CAD technology in product design plays a crucial role in improving product quality, optimizing design processes, and reducing costs. Saleh et al. [12] explored the definition of high-quality product design based on CAD, the application of computer-aided design in product design, and future development trends to emphasize the importance of high-quality product design. Computer aided design plays a crucial role in product design. Firstly, CAD technology can provide accurate product design data, enabling designers to quickly conduct design validation and optimization. Secondly, CAD technology can optimize the design process, improve the work efficiency of designers, and shorten the product development cycle. At the same time, CAD technology can also reduce design errors and improve the reliability and durability of products. These advantages make CAD an essential tool for modern product design. 3D printing technology is changing our living and working environment, with characteristics such as rapid manufacturing and personalized customization, and has wide applications in many fields. Tawk and Alici [13] explored finite element modeling in the design process of 3D printed pneumatic soft actuators and sensors. These soft actuators and sensors have broad application prospects in fields such as medicine, aviation, and robotics. Through finite element modeling, design optimization and performance improvement can be achieved, providing important guidance for actual manufacturing. Before conducting finite element modeling, we need to prepare some tools and materials. With the rapid development of educational technology, traditional teaching models have become difficult to meet the needs of modern society. Therefore, a learning framework based on topology optimization has emerged, and this new teaching concept called "Powerful Teaching Framework under the Prism of CDIO Method" has brought revolutionary changes to the education industry. Tyflopoulos et al. [14] will elaborate on this innovative teaching framework from four aspects: introduction, theory, practice, and summary. In the introduction section, the powerful teaching framework under the prism of the CDIO method is a new teaching mode that integrates the concept of topology optimization and teaching framework design. It is committed to breaking the limitations of traditional teaching frameworks and helping students learn in a more efficient and targeted manner. Topology optimization is an algorithm for searching and optimizing complex systems. It views the learning framework as a system and optimizes learning resources, learning paths, and learning outcomes to make the learning framework more efficient and accurate in serving teaching objectives.

With the continuous development of technology, the application of virtual reality technology and CAD software in the field of packaging design is becoming increasingly widespread. Yun and Leng [15] discussed how to optimize packaging design using these two technologies, analyzed their advantages and disadvantages, and finally looked forward to future development trends and application prospects. Virtual reality technology can provide a realistic virtual environment, allowing designers to better understand product characteristics and customer needs, thereby better meeting the requirements of packaging design. Through virtual reality technology, designers can conduct "pre-packaging" testing before actual design to better evaluate the effectiveness and feasibility of packaging. CAD software can help designers quickly generate various packaging design schemes, and accurately evaluate and optimize the design schemes. Through CAD software, designers can complete design tasks that originally took several days within a few hours, greatly shortening the design cycle. Virtual reality technology can help

designers better grasp product characteristics and customer needs, reducing the time and cost of later modifications. Customers can observe and evaluate packaging design solutions comprehensively through virtual reality technology, thereby better understanding the designer's ideas and intentions, and improving customer satisfaction. With the advancement of technology and the continuous development of the design field, the role of designer sentiment analysis in collaboration and traditional computer-aided design is becoming increasingly prominent. Traditional computer-aided design (CAD) mainly relies on the manual creation of designers and the auxiliary functions of computer software. During this process, the designer's emotions can have a significant impact on the realization of creativity. Zhou et al. [16] explored the analysis methods and importance of designer emotions in collaborative design and traditional computer-aided design, with the aim of providing useful references for future research on designer emotions. Designer sentiment analysis is mainly studied through methods such as questionnaire surveys, interviews, and literature reviews. These methods can help us understand the emotional expression, emotional experience, and potential difficulties that designers may encounter in the process of collaboration and computer-aided design. Through emotional analysis, designers can effectively improve their work efficiency and creative quality, while promoting team collaboration and innovation. Zhang et al. [17] studied a task service network node matching method based on a multi-objective optimization model in a dynamic hypernetwork environment. A multi-objective optimization model is proposed to achieve efficient matching of tasks and nodes based on the characteristics of dynamic hypernetwork environments. The experimental results show that this method outperforms traditional methods in terms of task completion time and node utilization. This study provides an effective solution for the node matching problem in task service networks in dynamic hypernetwork environments.

3 3D MODELING OPTIMIZATION OF CULTURAL CREATIVITY PRODUCTS BASED ON GAN

In the field of cultural creativity products, CAD 3D model design can help designers to better grasp the shape, structure, materials and other aspects of products, and at the same time, it can also conduct accurate product simulation and testing.

The combination of VR and CAD 3D model design can further improve the efficiency and accuracy of design. First of all, designers can use VR to carry out preliminary design and testing of products, which can reduce the probability of later modification and rework. Secondly, designers can use VR to select and optimize product materials, which can help designers better control the cost and quality of products. Finally, designers can use VR for interactive design and testing of products, which can help designers better understand the user experience and interactive effect of products, so as to optimize and design accurately. Interactive experience refers to the interactive way and effect that users feel in the process of using products. In the field of cultural creativity products, a good interactive experience can increase users' awareness and interest in using products, thus improving the market competitiveness of products.

VR can help designers optimize the interactive experience of cultural creativity products. First of all, VR can provide a more intuitive and vivid way of interaction, which can help users better understand and experience Cultural creativity products. Secondly, VR can simulate more realistic interactive effects, which can improve users' interest and experience. Finally, VR can also be used for user testing and feedback, which can help designers better understand the user experience and needs of products, so as to carry out accurate optimization and design. With the progress of sci & tech, computer technology plays an increasingly important role in cultural creativity industry. They found that artificial intelligence can assist designers in rapid prototype design and optimization, while VR can help designers and users evaluate the appearance and performance of products more accurately. This section will discuss how to optimize the 3D modeling of cultural creativity products by using GAN. The framework design of cultural creativity product pattern integrity detection algorithm is shown in Figure 1.

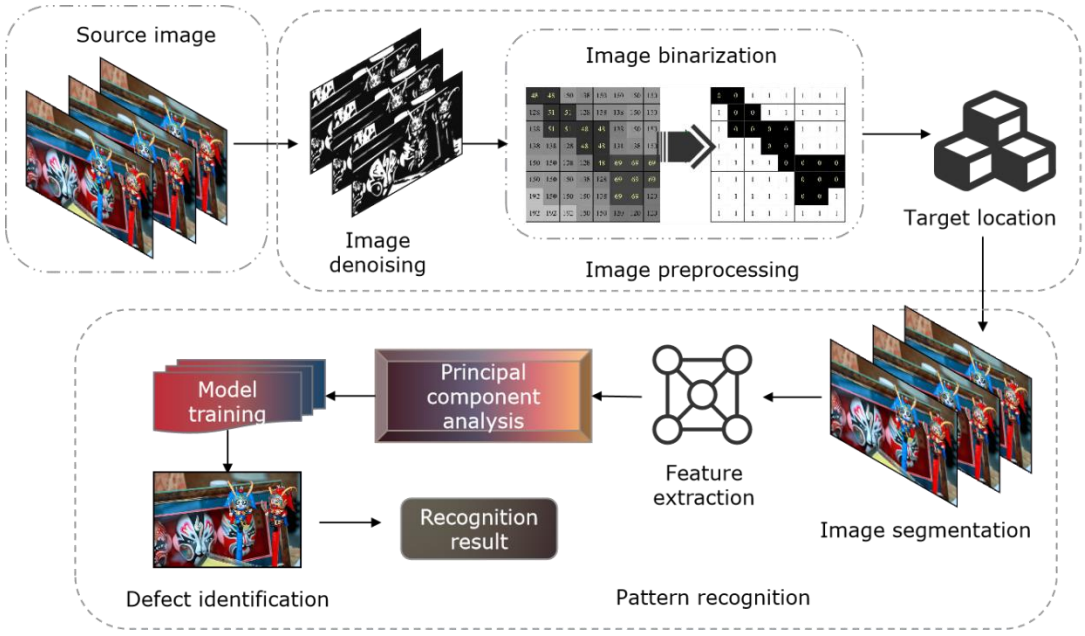

Figure 1: An algorithm framework for pattern integrity detection of cultural creativity products.

In the aspect of product detail repair, by translating the model, we can better observe and repair the details in the product and improve the quality and accuracy of the product. In the aspect of product quality control, by translating the model, we can better understand the structure and shape of the product, so as to control its quality more accurately. Its formula is expressed as:

$$I(x,y,z)=F(x-m_p,y-m_p,z-m_p) \tag{1}$$

If the $L\times M\times N$ size 3D model $F(x,y,z)$ becomes a $KL\times KM\times KN$ size new 3D model $I(x,y,z)$, it is represented by the following formula:

$$I(x,y,z)=F(\text{int}(c\times x),\text{int}(c\times y),\text{int}(c\times z)) \tag{2}$$

$$c=1/k \tag{3}$$

When $k>1$, the 3D model is reduced; when $k<1$, the 3D model is enlarged.

Through this confrontation process, GAN can generate high-quality images or models. In the 3D modeling of cultural creativity products, GAN can be used to automatically generate realistic product models. Designers can provide some samples or reference images, and the network can learn from these samples to generate a 3D model that meets the design intent. In addition, by adjusting network parameters and training strategies, GAN can also generate customized models according to the needs of designers, which greatly improves the design efficiency and accuracy. Figure 2 shows the image feature detection of cultural creativity products.

Under the framework of antagonistic learning, the optimization process of 3D modeling of cultural creativity products can be divided into two main parts: generator and discriminator. In the 3D modeling of cultural creativity products, the generator first receives samples or reference images provided by designers as inputs, and then converts these inputs into 3D models through deep learning networks. This process can be regarded as the first step of the confrontation process, that is, the generator tries to generate as realistic a model as possible to deceive the discriminator. The task of discriminator is to distinguish real samples from false samples.

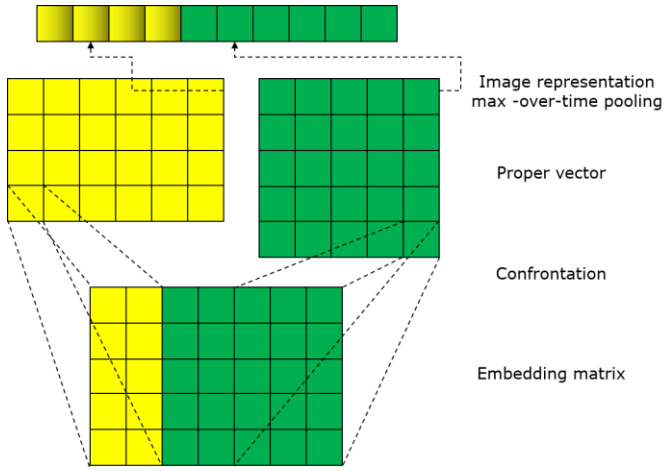

Figure 2: GAN-based image feature detection of cultural creativity products.

In the 3D modeling of cultural creativity products, the discriminator receives the model generated by the generator and the real model as input, and then judges which model is real and which model is generated through the deep learning network. If the discriminator can accurately distinguish real samples from false samples, then the generator will be "punished" and forced to generate a more realistic model. This process can be regarded as the second step of the confrontation process, that is, the discriminator tries to distinguish the real sample from the false sample, so as to urge the generator to generate a better model. The antagonistic learning architecture is shown in Figure 3.

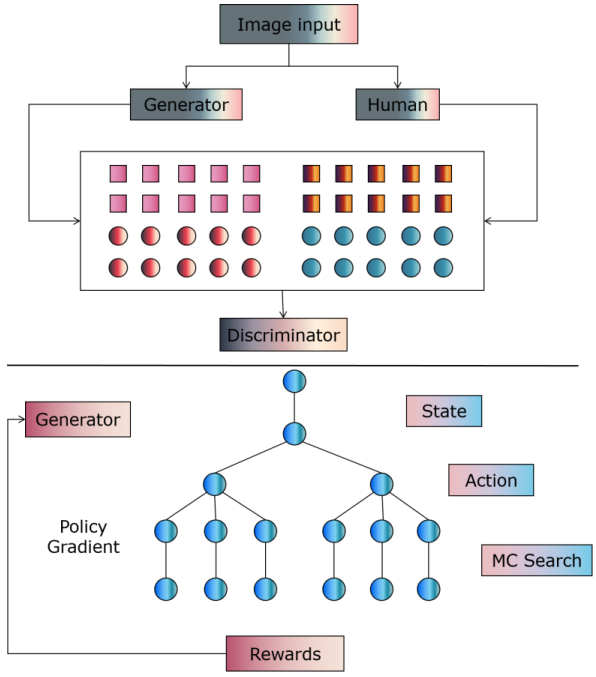

Figure 3: Antagonistic learning architecture.

Under this antagonistic learning framework, the generator and discriminator will be iterated and trained many times. At each iteration, the generator will try to generate a more realistic model, while the discriminator will try to distinguish the real sample from the generated model. This confrontation process will continue until a certain training goal is achieved or a certain performance index is met. Through the application of this antagonistic learning framework, the 3D modeling of cultural creativity products can obtain highly realistic and ornamental models, and the interactive experience can also be optimized and improved.

If it is assumed that the small particles in 3D space can completely absorb the incident light, but have no reflection and luminescence functions, then a light absorption model is formed. Let the intensity of incident light be I and the absorbed part be ΔI, then:

$$\Delta I / I = \rho A \Delta s \tag{4}$$

When Δs approaches 0, the probability of mutual coverage between particles also approaches 0, so there are:

$$\frac{dI}{ds} = -\rho(s) \cdot A \cdot I(s) = -\tau(s) I(s) \tag{5}$$

Where s is the length parameter of the light projection direction; $I(s)$ is the light intensity at the distance s; $\tau(s) = \rho(s) \cdot A$ is the attenuation coefficient of light intensity, which defines the light absorption rate along the light projection direction s. Then:

$$I(s) = I_0 \exp\left(-\int_0^s \tau(t) dt \right) = I_0 T(s) \tag{6}$$

Where I_0 is the light intensity of $(s = 0)$ when the light enters the 3D data field; $T(s) = \exp\left(-\int_0^s \tau(t) dt \right)$ represents the attenuation of light after it reaches s through the edge of the data field. If α is defined as the opacity of this distance, then:

$$\alpha = 1 - T(s) = 1 - \exp\left(-\int_0^s \tau(t) dt \right) \tag{7}$$

This optical model is suitable for the visualization of CT and MRI scanning data.

When the regional boundary is blurred, the algorithm will produce false corners. In order to eliminate the influence of false corners, the following formula is usually used to calculate the center of gravity:

$$\vec{r}\left(\vec{r_0}\right) = \frac{\sum \vec{r}\, c\left(\vec{r}, \vec{r_0}\right)}{\sum \vec{r}^{\, c\left(\vec{r}, \vec{r_0}\right)}} \tag{8}$$

Then the distance from the kernel to the center of gravity is found, which corresponds to the correct corner, and the center of gravity is far from the kernel, so the false corner can be eliminated by this distance. Finally, the non-maximum suppression method is used, that is, by taking an edge point as the center of the 3×3 template and comparing it with the points in its eight neighborhood, the corner point can be found by retaining the largest gray level.

After GAN is used to generate the initial model, the structure of the model can be refined to optimize it. By adding more details or texture features, the model is more realistic and vivid. The high-resolution model can present more details and textures, making the model more ornamental.

Using GAN, high-resolution models can be generated from low-resolution images, which can improve the appreciation and user experience of the models. With GAN, the best color and material combination can be automatically matched according to the samples or reference images provided by designers, making the model more realistic and attractive. In addition to the appearance of 3D model, dynamic interaction is also an important experience link of cultural creativity products. With GAN, a dynamic 3D model can be generated in real time according to users' needs and interaction methods, providing a richer visual experience.

4 SIMULATION EXPERIMENT

In this article, the optimization method of 3D modeling of cultural creativity products based on GAN is studied. In the experimental part, the time required for image resolution enhancement with different numbers of pictures and different nodes is tested. The results show that when the quantity of images is small, the advantages of multi-nodes are not obvious or even the recognition efficiency is worse, as shown in Figure 4.

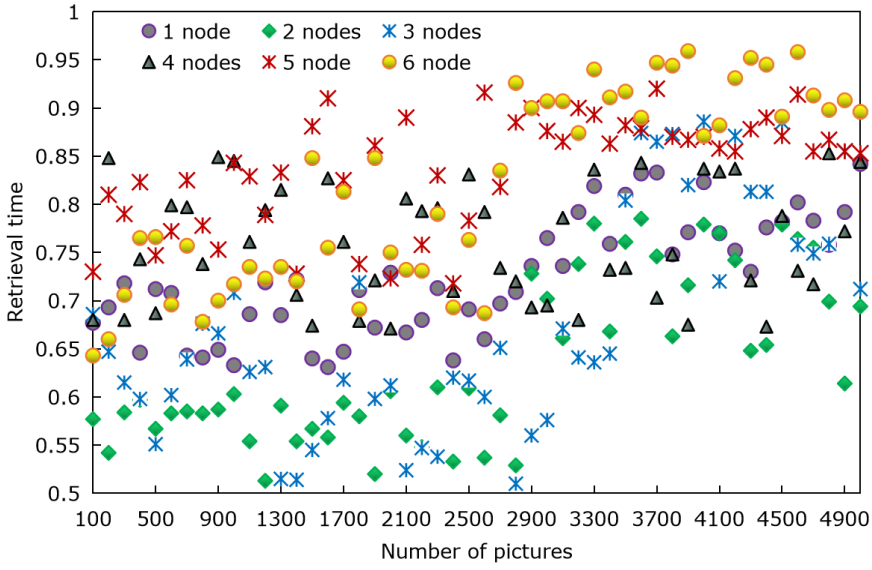

Figure 4: Image recognition consumes time.

In the research, it is found that by using GAN, a realistic Cultural creativity product model can be automatically generated and optimized. In addition, when processing a large quantity of images, increasing the quantity of nodes can significantly improve the processing efficiency, because in this case, each node can independently process a part of images. Although increasing the quantity of nodes can improve the processing efficiency, when processing a small quantity of images, too many nodes may not be a good choice, because this may lead to a decline in efficiency. For a large quantity of images, we should choose as many nodes as possible to improve the processing efficiency. However, for a small quantity of images, too many nodes may not be a good choice, because it may lead to a decline in efficiency.

Through deep learning and special optimization strategies, the algorithm in this article successfully improves the accuracy and recall rate of the algorithm, as shown in Figures 5 and 6. The feature recognition algorithm based on CNN algorithm is adopted as the comparison algorithm. Although the algorithm has a good performance in some aspects, it can't achieve the expected results when dealing with the image feature detection of cultural creativity products. The

main reason is that the algorithm pays too much attention to the macro layout of the image and ignores the extraction of detailed features, resulting in unsatisfactory recall and accuracy.

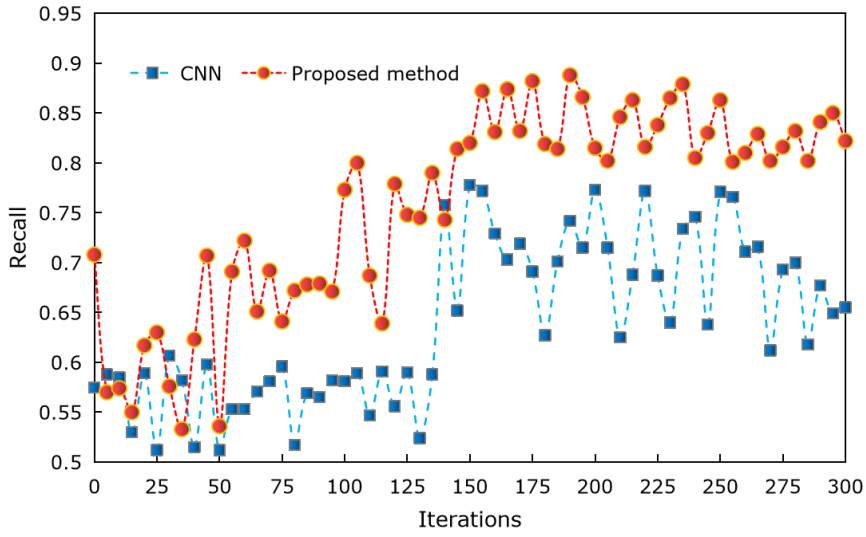

Figure 5: Comparison of recall ratio of 3D image optimization.

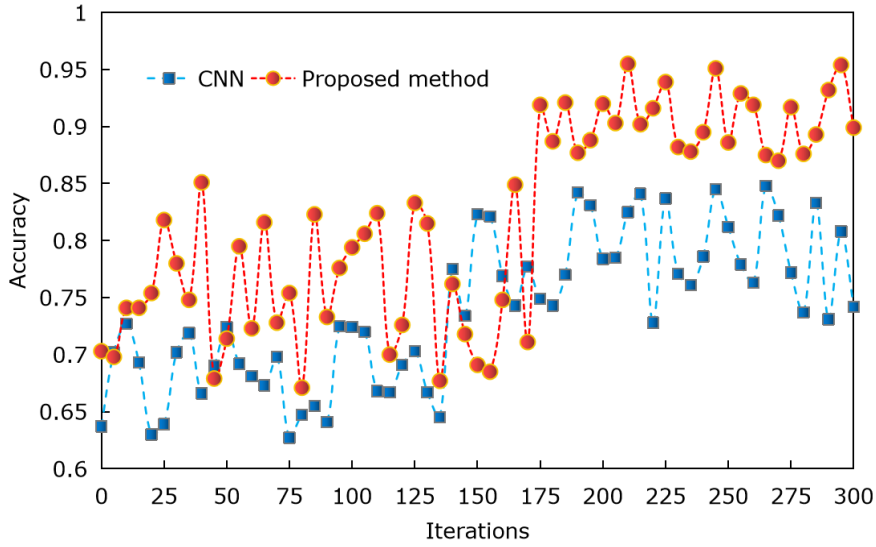

Figure 6: Comparison of 3D image optimization accuracy.

The experimental results show that the proposed algorithm is significantly better than the contrast algorithm in the accuracy and recall of image feature detection of cultural creativity products. It is particularly worth mentioning that the advantage of the algorithm in accuracy exceeds 20%, which means that the algorithm can identify and locate the key features of cultural creativity products more accurately.

Compared with CNN model, GAN model has obviously improved the search efficiency of cultural creativity product image optimization algorithm. As can be seen from Figure 7, the retrieval efficiency curve of GAN model is higher than that of CNN model in most data points. This

means that better search results can be obtained in a shorter time when using GAN model to search for Cultural creativity product image optimization algorithm.

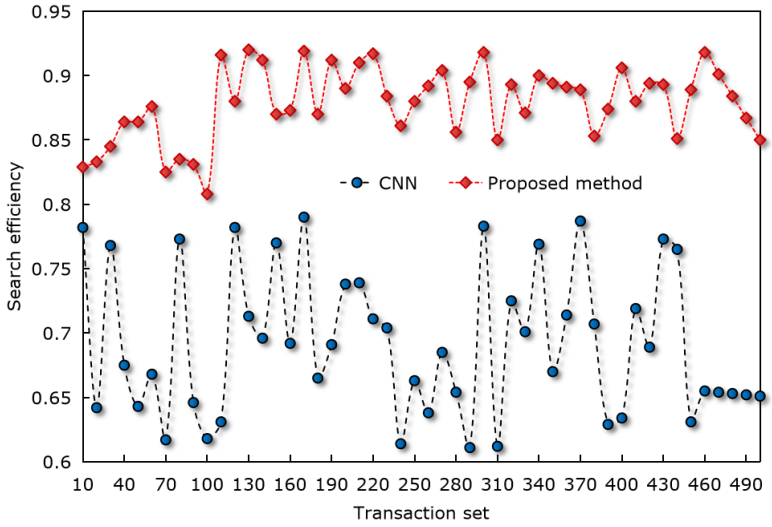

Figure 7: Comparison of search efficiency of algorithms.

Experimental results show that the retrieval efficiency of GAN model in cultural creativity product image optimization algorithm is higher than that of CNN model. The reason for this phenomenon may be that GAN model has better generalization performance and feature representation ability. Because the GAN model can better learn the inherent characteristics and laws of the data through the confrontation training between the generator and the discriminator, the optimal solution can be found faster in the search process of cultural creativity's product image optimization algorithm.

Because the algorithm in this article can extract the image features of cultural creativity products more accurately, these features can be used in detail repair, quality control and digital protection of products in practical applications. These applications are of great significance for improving the overall quality and impression of cultural creativity products, and can provide strong support for the digital transformation of related industries. Through the research and application of this 3D modeling method of cultural creativity product CAD based on multi-feature fusion, it is expected to provide designers with more comprehensive design tools and methods, and further improve the design efficiency and quality of designers. Moreover, it is also expected to provide users with a more real and intuitive product experience and enhance users' knowledge and feelings about cultural creativity products. This will be of great significance and value to promote the innovation and growth of cultural creativity industry.

5 CONCLUSIONS

The rise of VR has brought a new breakthrough for the design of 3D CAD model and the optimization of interactive experience of cultural creativity products. In this study, an optimization method for 3D modeling of cultural creativity products based on GAN is proposed, aiming at improving the accuracy and recall of image feature detection of cultural creativity products, and locating the edge contour of product images relatively accurately. During the experiment, the technologies of deep learning and multi-scale feature detection are adopted. Through comparative experiments and theoretical analysis, the advantages of this algorithm in image feature detection of cultural creativity products are verified. Experimental show that, compared with the layout optimization algorithm based on CNN algorithm, the accuracy of the proposed algorithm is

improved by more than 20%, and the recall rate is also significantly improved. Moreover, the algorithm can also protect the detailed features of cultural creativity products, making the applications of 3D reconstruction and virtual display of cultural creativity products more accurate and reliable. The important application value of the algorithm in this article is that it can provide strong technical support for the digital transformation and upgrading of cultural creativity industry, especially in detail repair, quality control and digital protection of cultural creativity products. Future research directions include further improving and optimizing this algorithm, improving its performance in complex scenes and practical applications, and applying this algorithm to more fields, providing more enlightenment and help for 3D image feature detection and related application research.

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