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Computer-Aided Design AND APPLICATIONS

Cultural and Creative Products Design Based on Graphic Visualization System

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Abstract. Affected by the rapid economic progress, Wenchuang (culture and creativity) industry has developed rapidly, and the requirements for related professional courses are getting higher and higher. Graphic and image processing technology is widely used in various fields. With the support of CAD (Computer Aided Design) technology, the optimization of Wenchuang's product modeling design can be realized. Combining detail feature recognition and optimization detection method, it is of practical value to study the virtual reconstruction method of product 3D image based on visual perception in Wenchuang product design. In this article, graphic visualization method is applied to the teaching of product CAD design in Wenchuang, and a virtual reconstruction algorithm of 3D image of product design based on visual perception is proposed. Through the simulation display of Wenchuang product design for learners, the sensory experience of learners can be improved, thus further improving the effectiveness of CAD design teaching. The simulation results show that the overall performance of this method is better than that of the control method. The fusion of features at all levels can provide more situational information for the prediction of product characteristics. Colleges and universities must combine their own actual situation, stand at a certain social height, constantly update the teaching concept of product design education and keep pace with the times.

Keywords: Graphic Visualization; Product Design; CAD; Virtual Reconstruction
DOI: https://doi.org/10.14733/cadaps.2024.S10.121-135

1 INTRODUCTION

With the continuous progress of the times, CAD has been applied to the design of goods, and it is gradually increasing in the field of Wenchuang products. Compared with the traditional design mode, CAD has its own superior skills and more personalized design. Banfi [1] further enhances the immersion of HBIM through virtual reality (VR) and augmented reality (AR) technologies. Users can experience architectural design firsthand, as if they are in the actual environment. AR can overlay digital models into the real world, allowing designers and engineers to see the effects of

the models during the actual construction process. Another important feature of HBIM is interoperability. Due to the universal open file format used by HBIM, data can be easily exchanged between different software and platforms. This makes collaboration between different teams smoother, regardless of the design tool they use. By using HBIM and VR/AR technology, a detailed and realistic model can be created that not only displays the exterior of the building, but also showcases its internal structure and design decisions. This not only helps designers and engineers better understand the structure of buildings, but also provides the public with an opportunity. Multi view visualization is a method of presenting data in the form of multiple views, in order to better understand and analyze data. The composition and configuration mode of multi view visualization can vary according to specific application requirements. Chen et al. [2] analyzed the composition and configuration patterns in multi view visualization. Multi view visualization is a method that helps users better understand and analyze data by displaying different aspects of data in multiple windows. The composition and configuration mode of this method can vary according to the specific application requirements. In the design and research of Wenchuang products, product designers can constantly try and explore, improve the charm and value of Wenchuang products, deeply explore the best effect of new Wenchuang product design and its combination, lay a good and stable foundation for the all-round growth of Wenchuang product design and provide continuous support and powerful motivation for this. The design of creative products for Yi intangible cultural heritage based on QFD-TRIZ is a complex process that requires combining the special elements of Yi intangible cultural heritage with creative product design. QFD (Quality Function Deployment) and TRIZ (Theory of Invention Problem Solving) are two commonly used innovative design and problem-solving tools. Chen et al. [3] collected users' expectations and needs for creative products of Yi intangible cultural heritage through market research, user interviews, and focus group discussions. Determine the characteristics that the product should possess based on user needs. These characteristics may include shape, color, material, function, etc. Using the QFD method, establish a quality house that correlates user needs with product characteristics. The House of Quality is a matrix that displays the relationship between user needs and product characteristics, as well as the contribution of each characteristic to meeting user needs. Identify innovative issues that need to be addressed in the House of Quality. Apply TRIZ theory to find possible innovative solutions. TRIZ provides a structured approach to solving problems by analyzing problems, identifying inherent contradictions, and using corresponding innovative principles to find solutions. Colleges and universities are important positions of cultural communication, which not only have the commonness of developing with social development and progressing with social progress, but also have their own personalities different from other colleges and universities because of the influence of different factors such as their historical changes, development direction and regional environment, and they have strong inclusiveness and compatibility. Due to the rapid economic progress, Wenchuang industry has developed rapidly, and the requirements for related professional courses are getting higher and higher. Improving the teaching level of product design course in colleges and universities has become an urgent task to develop Wenchuang industry. Computer graphics processing plays an important role in visual communication design. Designers can create various types of visual effects, including static images, dynamic images, 3D models, virtual reality, and more. Intelligence and fuzzy systems also have applications in visual communication design. Fan and Li [4] use fuzzy logic to create complex images and shapes, or use artificial intelligence technology to automate the design process. In addition, intelligent systems can help designers better understand their design work and provide suggestions on how to improve the design. In summary, computer graphics processing and intelligent and fuzzy systems have wide applications in visual communication design. These technologies help improve design quality and efficiency, while also providing designers with more creativity and expression methods.

Computer Aided Molecular Product Design (MPD) is a multidisciplinary field aimed at designing new molecular products through computational and simulation methods. In MPD, property uncertainty is a common issue, referring to the uncertainty that exists when calculating the properties of molecular products. This uncertainty may come from factors such as computational

errors, insufficient experimental data, or simplification of molecular models. In MPD, Monte Carlo methods can be used to evaluate the impact of property uncertainty and reduce this uncertainty by optimizing design. Frutiger et al. [5] analyzed computer-aided molecular product process design under property uncertainty. Evaluate the expected value of the objective function through random sampling and gradually adjust the design plan to maximize the expected value. The evaluation method can be to calculate the objective function value of the optimal design scheme, or to calculate indicators such as the risk value or confidence interval of the design scheme. Based on the evaluation results, we can further adjust the design scheme, such as changing the molecular structure, adjusting reaction conditions, etc., to improve the performance of molecular products and reduce the uncertainty of properties. In summary, optimization strategies based on Monte Carlo have important application value in MPD. It can help us comprehensively consider the uncertainty of properties and the trade-off between optimal values, and find the optimal design solution. In recent years, Wenchuang industry has developed continuously and deeply in various fields. The prosperity of the industry has formed a demand for innovative talents with great potential. The extension and connotation of product design specialty also presents a diversified development trend in the stage of continuous integration in new fields such as creative design, artificial intelligence, user experience and service design. González et al. [6] has built an automatic imaging segmentation, 3D reconstruction, and 3D model visualization platform for augmented reality and virtual reality. Augmented reality (AR) and virtual reality (VR) are two very powerful technologies that can be used for automatic imaging segmentation, 3D reconstruction, and 3D model visualization. This process involves using image processing algorithms to identify and segment specific parts of an image. For example, you can use deep learning algorithms to recognize and segment faces. This process can be implemented in AR and VR to add virtual elements in specific scenarios. This process involves reconstructing a 3D model from a series of images or scanned data. This model can be the external shape of an object or its internal structure. This process usually requires the use of specialized 3D reconstruction algorithms and software. This process involves presenting 3D models in AR or VR environments. This requires the use of specialized 3D rendering engines and software. In VR, headworn displays (HMDs) can be used to present 3D models, while in AR, mobile devices or smart glasses can be used to present models. In the early stage of product design course, it is needed to build various teaching practice platforms and integrate factors such as science and technology, manufacturing industry and industrial culture development. Based on the background of Wenchuang industry, the reconstruction of product design curriculum system and the cultivation of students' multi-dimensional ability have become the inevitable challenges for product design education facing new industries and new demands. The prosperity of Wenchuang industry and new ideas for the growth of product design specialty. The extension and connotation of product design also show with the continuous addition of new fields of knowledge such as cultural innovation, artificial intelligence, user experience and service design. This article expounds the performance of CAD in Wenchuang product design, and explores the construction strategy of teaching mode of Wenchuang product CAD design based on graphic visualization system.

As a traditional art form in China, Beijing Opera has unique literary and dramatic value in its script. However, with the development of the times and changes in audience aesthetics, there are certain obstacles in understanding and reading traditional textual forms of Peking Opera scripts. The goal of Hou and Zhang [7] is to use computer-aided design technology to transform traditional textual Peking Opera scripts into visual forms, in order to enhance their understanding and reading experience. The results of its research not only enhance the understanding and reading experience of Peking Opera scripts, but also contribute to the inheritance and promotion of Peking Opera. At the same time, this method can also provide a new visual design and research method for other types of text art forms (such as novels, movie scripts, etc.). Graphic and image processing technology is widely used in various fields. With the support of CAD technology, the optimization of Wenchuang product modeling design can be realized. Combined with CAD technology, it can greatly improve the efficiency of manufacturing industry, improve the overall output value of enterprises, and the degree of automation will also be improved. At the same time, because of the

addition of CAD technology, the human error is reduced, the product qualification rate is also improved accordingly, and the probability of defective products is also reduced. Most of the traditional reconstruction methods are in the form of modeling calculation. Although this method can quickly model, the modeling effect of artistic images is not ideal, or even vague, which is a kind of destruction for artistic images themselves. With the growth of image information processing technology, the requirements for image imaging and visual expression are increasing. Combining detail feature recognition and optimization detection methods, it is of practical value to study the virtual reconstruction method of product 3D image based on visual perception in Wenchuang product design. Wenchuang industry, as a new industry, its enrichment and development cannot be separated from the analysis and exploration of academic theory. This article explores the application of graphic visualization system in the teaching of product CAD design in Wenchuang, and makes the following innovations:

⊖ This article applies the graphic visualization method to the teaching of product CAD design in Wenchuang, and proposes a virtual reconstruction algorithm of 3D image of product design based on visual perception.

⊖ The algorithm extracts the geometric features expressed from the graphic files generated by general CAD software according to certain algorithm principles, redraws the 3D geometric model, and realizes the visualization of graphic data.

This article expounds the application of CAD in Wenchuang product design; This article puts forward the visual modeling method of Wenchuang products and analyzes its application in the teaching of Wenchuang product CAD design. Finally, the application effect of the model is tested by experiments.

2 RELATED WORK

The competition of manufacturing enterprises is fundamentally the competition of their products. The growth of science and technology in the world will be more rapid, the technical content of products will be continuously improved, and the product life cycle will be shortened. The CAD design of Wenchuang products includes two aspects, one is the CAD design technology, and the other is the design thinking of CAD design itself. In the era of science and technology economy, science and technology has become an important resource for economic and industrial development, but Wenchuang products are one of the products deeply influenced by it. Compared with the previous Wenchuang product design, the involvement of CAD is quite different from the previous design, whether in manufacturing technology or in display. Wenchuang industry takes culture as the main body. The vigorous growth of Wenchuang industry and the change of talent demand will inevitably have an impact on the development and trend of design education, the framework of related majors, teaching ideas, curriculum and talent training objectives. Lampinen et al. [8] conducted autonomous robot rock fragmentation analysis using a real-time 3D visual perception system. The autonomous robot rock fragmentation using real-time 3D visual perception system is a complex technical problem that needs to be solved by combining knowledge from multiple fields. Firstly, the robot needs a real-time 3D visual perception system to be able to identify and locate rocks. This system may require the use of technologies such as LiDAR or depth cameras to obtain 3D images or point cloud data. Then, by using 3D vision algorithms or machine learning models, robots can recognize and locate the shape and position of rocks. After identifying and locating rocks, robots need to be able to navigate autonomously in the environment in order to reach the correct position for fragmentation. This requires the use of navigation systems such as GPS, inertial measurement units (IMUs), and wheel encoders to ensure that the robot can accurately reach the target position. Robots need an effective mechanical design and control system to apply sufficient force to break rocks. This may require the use of high-power actuators, such as electric motors or hydraulic systems, as well as complex control systems to ensure that the robot can accurately perform the required actions. During the process of rock fragmentation, robots need to ensure the safety of themselves and their surrounding environment.

Liu and To [9] constructed a topology optimization system based on computer-aided design with dynamic feature shapes and modeling history evolution. A topology optimization system based on computer-aided design with dynamic feature shapes and modeling history evolution is a complex and powerful tool. This system combines computer-aided design (CAD), optimization algorithms, and simulation techniques to find the optimal material distribution that meets specific performance requirements. This system can be used in various fields, including engineering design, architectural design, biomedical engineering, etc. The system can generate shapes with dynamic features based on input parameters or constraints. These shapes can change with time, load, or other conditions. The system can record and display the historical evolution process of design. This means that users can view and compare models at different iteration stages to understand how design evolves gradually from the initial stage. The system uses optimization algorithms to find the optimal material distribution. These algorithms will adjust the material distribution of the design based on the set objective functions (such as minimizing weight, maximizing strength, etc.). The system can simulate the optimized design to verify whether its performance meets the requirements. This can help users predict and solve potential problems before manufacturing. With the development of social networks, social relationships between people are becoming increasingly complex. Understanding and analyzing this relationship is of great significance for understanding social dynamics, interpersonal relationships, and group behavior. Meanwhile, by visualizing social network relationships, interpersonal relationships and group behavior can be more intuitively displayed, which helps to better understand and analyze social phenomena. Lu et al. [10] analyzed the impact of group collaboration on social network relationships and presented the analysis results through visualization techniques. Through this study, we hope to gain a deeper understanding of how group collaboration affects individual relationships and group interactions, in order to better understand the composition and dynamics of social networks. The research results can help us better understand how group collaboration affects social network relationships, thereby better managing and guiding group behavior, improving team collaboration efficiency, and overall stability of social networks. At the same time, this study can also provide important methods and tools for social network analysis, group behavior analysis, and other related fields.

Plumed et al. [11] constructed a voice-based annotation system for collaborative computer-aided design. This is a voice-based annotation system that can be used in collaborative computer-aided design. The system allows users to input annotations through voice and associate these annotations with relevant design files or models. This system is very useful for communication and collaboration within the team, as it can automatically convert voice to text and allow users to add annotations to different parts of the design. This is crucial for maintaining smooth communication and information sharing in complex design processes. In order to implement this system. This system can use existing speech recognition technologies, such as Google Speech Recognition or Apple's Siri. The system needs to associate annotations with relevant design files or models. This can be achieved by adding a reference to a file or model in the annotation system. This means that when a user adds or edits comments, other users should be able to see these changes. For any collaborative work system, data security is crucial. Therefore, this system requires the use of secure encryption technology to protect user data. Using voice input can reduce annotation errors caused by manual input errors. Users can add comments anywhere, even if they do not have a keyboard or cannot enter comments manually. Mo et al. [12] analyzed the modeling of product information that captures design intent in computer-aided intelligent assembly modeling to support subsequent manufacturing and assembly processes. To achieve this goal, two key issues need to be addressed: firstly, how to reduce manual intervention and improve the automation of modeling; The second is how to improve the intelligence level of modeling, so that it can better reflect the design intent. For the first problem, machine learning algorithms can be introduced to automatically identify and extract product information. For example, deep learning algorithms can be used to identify features and geometric elements in product drawings, and automatically extract relevant parameters and constraints. In addition, prior knowledge and empirical data can be utilized to optimize the model and further improve the automation level of modeling. For the

second issue, a modeling method based on design intent can be introduced. Design intent is a high-level abstract description that can express the functional, performance, and aesthetic requirements of a product. In the modeling process, introducing design intent can better reflect the designer's intentions and improve the intelligence of modeling. For example, by establishing the concept of Interaction Feature Pairs (IFP), design intent can be transformed into actionable task lists to guide the modeling process.

Sun and Liu [13] analyzed how design technology can improve the sustainability of intangible cultural heritage products. The main material of bamboo baskets is bamboo, which is a renewable resource. Compared to using limited resources such as metals or plastics, using renewable materials is more sustainable. Design techniques can help optimize the design of bamboo baskets to more effectively utilize bamboo and reduce waste. Design technology can optimize the production process of bamboo baskets through tools such as computer-aided design (CAD) and computer numerical control (CNC). Taking Wuhu Iron Painting as an example, Zhang and Chu [14] explored the application of modern advanced processing technology in the design of non-traditional cultural and creative products. Through a deep understanding of Wuhu Iron Painting, combined with modern processing technology, we explore its design elements and concepts, providing new ideas and methods for the design of non-traditional cultural and creative products. 3D printing technology can simulate the traditional production process of iron paintings in Wuhu. CNC technology can also improve machining efficiency, reduce manual operations, and reduce human errors. Laser cutting technology can accurately cut iron painting products, achieving fine lines and patterns. This technology can improve machining accuracy and production efficiency, while also reducing material waste. Wang [15] has constructed a product design differentiation perception model based on visual communication technology. The perception model of product design differences based on visual communication technology is a complex process that requires consideration of multiple factors. Firstly, it is necessary to determine the importance of perceived differences in product design. Visual communication technology can help designers determine the appearance, shape, color, and texture characteristics of products, and how these features affect consumers' perception of the product. By collecting user feedback, we can understand consumers' perception of the product.

Yang et al. [16] analyzed how visual perception enables industrial intelligence. Visual perception is an important component of industrial intelligence, which utilizes machine vision technology to identify, measure, and locate objects, thereby achieving automation and intelligence in the production process. At present, visual perception has been widely applied in industrial fields, such as automated assembly lines, robot visual recognition, intelligent monitoring, etc. Visual perception technology has been widely applied in the field of industrial automation, such as robot visual recognition, automated assembly lines, intelligent monitoring, etc. With the continuous development of machine vision technology, visual perception technology has gradually matured and can achieve more accurate recognition and positioning. With the continuous development of industrial automation, the demand for visual perception technology is also increasing. The research and development of visual perception technology has a wide range of fields and is difficult, requiring a significant investment of human and material resources. Visual perception technology requires professional talents for research and application, with high requirements for personnel's technical background and experience. Zhang [17] conducted an exploration of computer-aided graphic design teaching under the experiential teaching mode. In computer-aided graphic design teaching, students need to master the application skills of various software tools, which need to be mastered through practical operations. Teachers can design practical projects or tasks that allow students to learn software application skills and solve practical problems in practice. In the experiential teaching mode, reflection and communication are very important links. Teachers can organize discussions and exchanges among students, share their learning experiences and insights, and further deepen their understanding and mastery of knowledge through mutual learning and reference. Zhou et al. [18] applied specific artistic styles from different cultures to design elements to achieve cross-cultural design integration. Although this is not a deep learning technology, automatic translation tools such as Google Translate and Baidu Translate can help

designers quickly understand and translate text or images from different cultures. By analyzing emotions in text or speech, designers can better understand the emotions and needs of users in different cultural backgrounds. For example, deep learning models can be used to analyze user feedback in order to better adjust the design. This is a complex deep learning model that can generate images with specific cultural features based on input cultural data. For example, designers can use this technique to generate design sketches with specific cultural elements. Deep learning can help designers create more realistic 3D models and scenes.

3 VISUAL MODELING OF WENCHUANG PRODUCTS

3.1 Virtual Reconstruction of 3D Images of Products

The stage of Wenchuang product design generally includes concept presentation, sketch drawing, detailed design and other processes. In the design process, Wenchuang product modeling is usually revised repeatedly. This will inevitably bring a lot of repetitive work, which is not conducive to the growth of design. In CAD, we can combine them through technology to create a more perfect product design. In the stage of CAD, that is, product design has completely entered the stage of digitalization and informatization. People's visual behavior is not only a simple physical activity behavior, but also a psychological behavior, which needs to watch the subject's thinking activities. Therefore, it is needed to pay attention to the stage of stereoscopic imaging in the virtual reconstruction of 3D images, that is, pay attention to the fact that human visual organs are two eyes, and the distance will lead to different 3D perception experiences. Camera parameters are always relative to some geometric imaging model, which simplifies the optical imaging process. The pinhole model of the camera is shown in Figure 1.

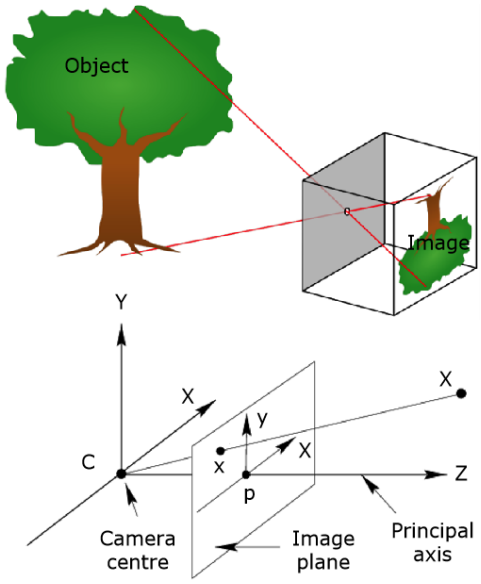

Figure 1: Pinhole model.

Punch a small hole in the first plane, and the light emitted and reflected by the object will form an inverted image on the second plane through this small hole. Among them, plane 1 is the focal plane, plane 2 is the image plane, and the pinhole is the optical center. The 3D graphical user interface is composed of static 2D graphics and dynamic 3D graphics. This dynamic and static contrast and the visual difference between 3D and 2D make users pay more attention to the

interface. The stage of camera imaging is the stage of projecting objects from 3D space to 2D plane. Only by determining the projection model of the camera can the relationship between 3D space points and their projection on 2D image plane be determined. Its visual volume is similar to a pyramid with its top and bottom cut off. Perspective projection is usually used in animation, visual simulation and many other aspects with realistic reflection.

If there are vectors $a_1,\cdots,a_n$, connecting them together can get $\left(a_1^T,\cdots,a_1^T\right)$. The optimization problem of 3D reconstruction can be expressed as:

$$\min \sum_{k=1}^{m}\sum_{i=1}^{n} D\left(m_{ki}, P_k M_i\right)^2 \tag{1}$$

In this formula, k represents the number of photos taken at different positions, with a total of m images; i represents the serial number of 3D points, with n 3D coordinate points in total;

P_k represents the projection matrix of the k-th image, M_i represents the coordinates of the i-th 3D point, $P_k M_i$ represents the calculated 3D coordinates multiplied by the projection matrix and projected back into the image coordinate system, and m_{ki} represents the 2D coordinates of the i-th 3D point on the k images. The whole formula represents the sum of squares to minimize the projection error.

This description uses the difference of two kinds of Gaussian distributions to describe their proximity, and accurately describes the merging rules.

$$J_{merge}\left(i,j;\Theta^*\right)=\left(P_i\left(\Theta^*\right)-P_j\left(\Theta^*\right)\right)^T * \left(P_i\left(\Theta^*\right)-P_j\left(\Theta^*\right)\right) \tag{2}$$

Here, the smaller $J_{merge}\left(i,j;\Theta^*\right)$ is, the closer the two Gaussian distributions are, and they can be merged.

Establish independent relationships among the system modules, which is convenient for the maintenance and expansion of the system and ensures users to have a good use experience. Let the gray function of a 2D discrete image of $m\times n$ be represented by $f(x,y)$, and its order $p+q$ moment is defined as:

$$m_{pq}=\sum_{x=1}^{m}\sum_{y=1}^{n} x^p y^q f(x,y) \tag{3}$$

Two first-order moments (m_{10},m_{01}) represent the gray center of gravity of the image.

There is an original image $f(x,y)$ of $N\times N$, and the image processed by the neighborhood average method is $g(x,y)$:

$$g(x,y)=\frac{1}{M}\sum_{(m,n)\in S} f(m,n) \tag{4}$$

Where S is the neighborhood centered on (x,y), and M is the total number of coordinate points in the set S.

In the 3D image virtual reconstruction system, the input image should be analyzed first, including data input, file analysis and image display. Then the original 2D data is preprocessed to transform the surface image into a 3D image. The weighted code can be expressed as:

$$c_i = \sum_{j=0}^{T_x} a_{ij} f\left(x_j\right) \tag{5}$$

i represents the time, j represents the j th characteristic element, T_x represents the characteristic length of creative products, and $f(\cdot)$ represents the coding of element x_j. a_{ij} is the probability value, indicating the importance of element h_j to c_i, which can be expressed as:

$$a_{ij} = \frac{\exp\left(e_{ij}\right)}{\sum_{k=1}^{T_x} \exp\left(e_{ik}\right)} \tag{6}$$

e_{ij} represents the matching degree between the feature to be coded and other features.

Through the understanding from the 2D screen to the 3D scene, it is convenient for users to manipulate the models in the 3D world through the program interface of the 2D screen window, such as the selection of models in the 3D world and the related transformation of the selected models.

3.2 Visual Modeling of Product Modeling

The key function of CAD design teaching platform is to improve the creativity of designers in innovative design, and to provide useful tools for technicians in the conceptual design and scheme design stages of products. Supported by this model, the product design process is a parallel, collaborative and life-cycle oriented design model. From Figure 2, it can be seen that a low signal-to-noise ratio leads to a higher level of noise in the image, thereby interfering with the recognition of the target object. This may lead to the algorithm mistaking the noise for the target object, or completely ignoring the noise, both of which may lead to a decrease in recognition accuracy.

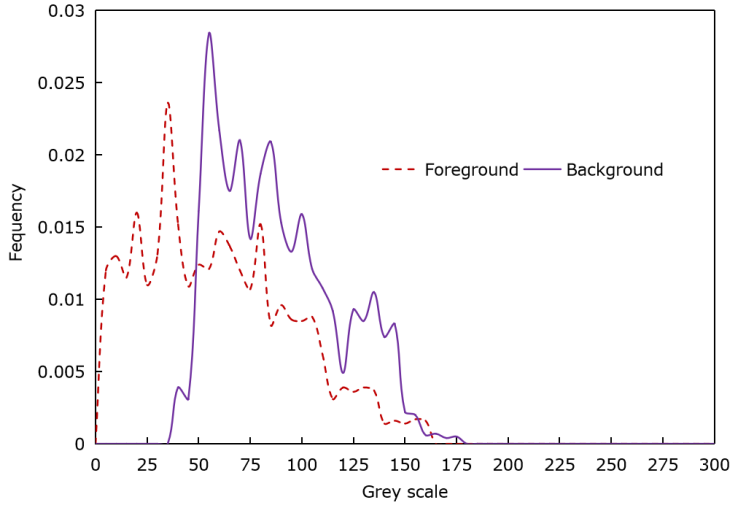

Figure 2: Gray distribution of foreground area and background area.

It is convenient to understand the realization of scene observation in computer by understanding the realization process from 3D model to 2D screen window. The observation of the scene focuses

on the stage of transforming from a 3D world to a 2D screen. Assuming that the observer of the scene uses a camera to record the changes of the world all the time, the camera position movement, angle deflection, focal length change and lens type selection will change the content presented on the negative. The principle of CAD image enhancement based on CNN is shown in Figure 3.

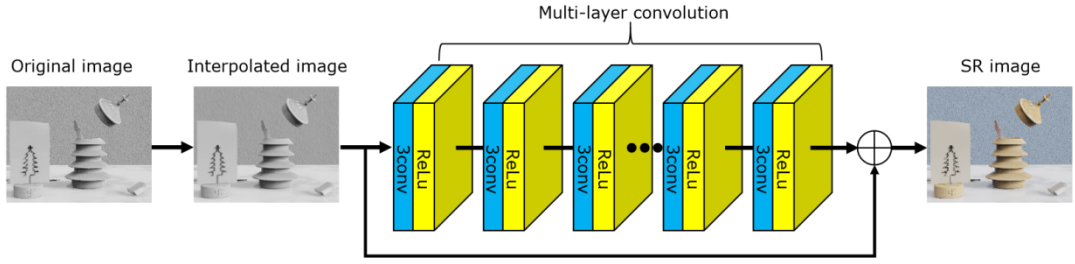

Figure 3: CAD image enhancement.

Changing the position and direction of the observation point through viewpoint transformation is equivalent to changing the position and shooting angle of the camera, so that the final display has also changed. The inverse operation of viewpoint transformation is equivalent to model transformation. If the viewpoint is moved by a certain distance in a certain direction, it is equivalent to moving the whole scene by the same distance in that direction.

Let the original image be $P(x,y)$ and the convolution kernel be $Q(x,y)$, and the final result H is:

$$H = P(x,y) * Q(x,y) = \sum i \sum j P(i,j) Q(x-i, x-j) \tag{7}$$

The Sigmoid function is expressed as:

$$y = \frac{1}{1+e^{-x}} \tag{8}$$

The continuous random variable X has the following distribution function and density function:

$$F(x) = P(X \le x) = \frac{1}{1+e^{-\frac{x-\mu}{\gamma}}} \tag{9}$$

$$f(x) = F'(x) = \frac{e^{-\frac{x-\mu}{\gamma}}}{\gamma\left(1+e^{-\frac{x-\mu}{\gamma}}\right)^2} \tag{10}$$

γ is an open polymorphic parameter, and μ is a positional parameter.

If CAD wants to be combined with product design, it is needed to find the meeting point between them and consider some limiting factors of product design together with CAD. Using different scientific effects to solve the same design problem may produce novel design schemes.

4 APPLICATION OF VISUAL MODELING TECHNOLOGY IN CAD DESIGN TEACHING

When studying the course of product design, students' visual control ability is very important, so cultivating students' good visual thinking and visual methods is the key to the success of the course. The cultivation of visual ability depends on not only innate visual talent, but also acquired visual training. At present, in the teaching of product design course in colleges and universities, the coordination between the internal structure of products and the external environment is still not paid enough attention. While understanding and observing products, we should also look at the design thinking of product design from multiple angles and levels, as well as explore the artistic level of product design and determine the assessment criteria of product design. Culture is the source of product creativity, art is the most expressive form of creativity, and traditional culture and art industry constitute the core content of Wenchuang industry. Product design puts the aesthetic level into practice through creativity, and influences the growth of industry through artistic aesthetics.

For Wenchuang products, it is very important to express the cultural connotation of products, and seeking suitable expression should be a creative thinking activity from the inside out, rather than analyzing existing things with a single visual thinking, which will lead to a lack of integrity in understanding things. Exploring new design methods and paths on the basis of cultural inheritance and activation stems from the inherent needs of product design itself. Therefore, basing design research and development on the study of culture and placing art aesthetics education, cultural inheritance and design innovation education in the same important position are conducive to expanding design horizons and thinking dimensions.

5 RESULT ANALYSIS AND DISCUSSION

In the experiment, the program is used to simulate the matching points on two images from different perspectives of the same scene. In order to simulate the matching effect of real image feature points, Gaussian noise with a variance of 2 pixels is superimposed on each pair of simulated matching points. Because the method in this article takes the degree of difference as the constraint condition, it can effectively denoise the image, which makes the virtual reconstruction time of 3D image shorter, and the efficiency is obviously higher than the other two methods, which shows that the degree of difference is of great significance to the virtual reconstruction of 3D image. The experimental results of training loss of different feature recognition algorithms are shown in Figure 4.

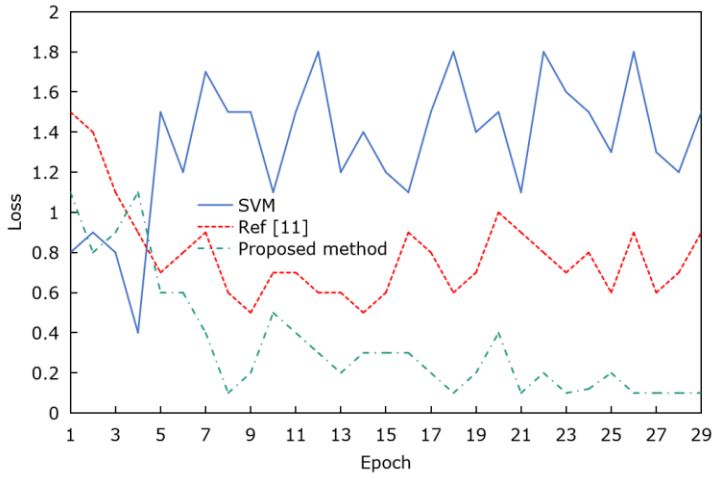

Figure 4: Training experiment results of different networks.

From the simulation results of Loss in the image, the algorithm in this article has achieved good results. Through the above derivation from 3D to 2D, the transformation from 2D to 3D is obtained by a series of matrix transformations, and the coordinates in a model coordinate system are transformed into screen coordinates. Now, if the whole process is reversed, the coordinate of a 2D point on the screen can be transformed into the world coordinate system.

The observation of the scene focuses on the stage of transforming from a 3D world to a 2D screen. Suppose the observer of the scene uses a camera to record the change of the world, then the camera's movement, angle deflection and focal length change will change the content appearing on the negative, that is, the way to observe the world, which involves 3D human-computer interaction. The modeling performance of this algorithm is compared with SVM algorithm and BPNN. Modeling accuracy test modeling Figure 5. The recall test is shown in Figure 6.

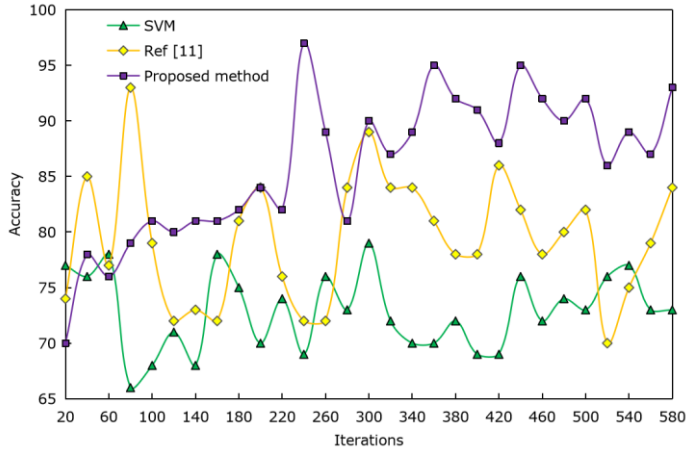

Figure 5: Modeling accuracy test.

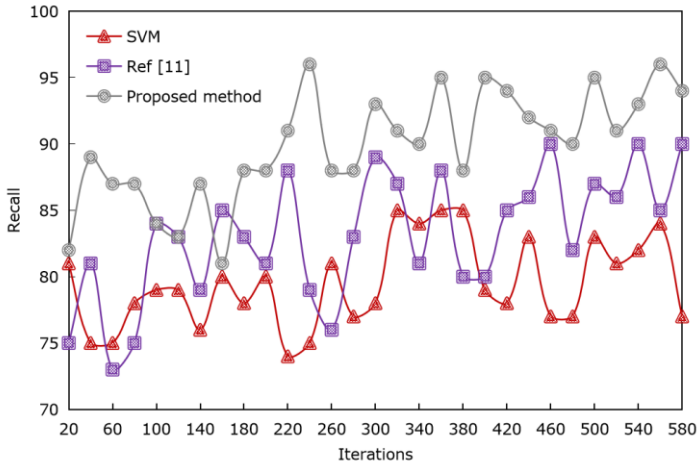

Figure 6: Recall rate test.

It can be seen that the modeling accuracy and recall index of this algorithm have certain advantages compared with traditional modeling methods. The nonlinear part is mainly introduced by three angles in the rotation matrix, which leads to the extremely complicated solution process

and low accuracy. At the same time, the traditional method can only deal with the problem of small angle rotation, that is, the angle transformation is approximated by Taylor formula expansion, but it is helpless when facing the large angle rotation transformation. The nonlinear problem is transformed into a linear problem, and there is no limit to the angle, which improves the efficiency and accuracy of calculation. The F1 test results of the algorithm are shown in Figure 7.

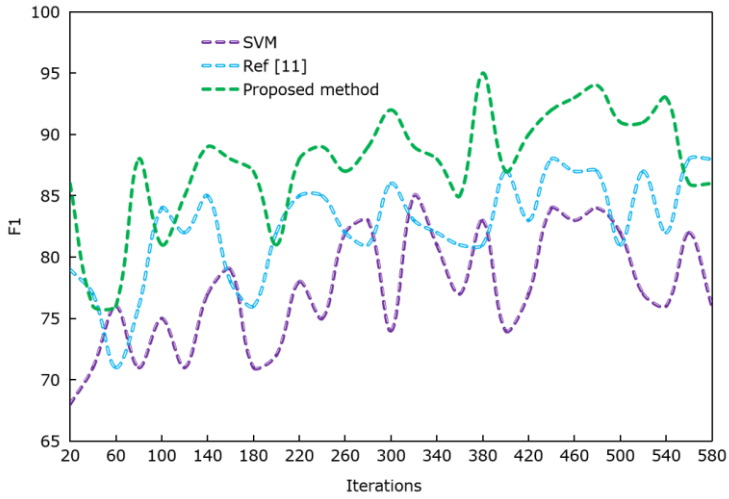

Figure 7: F1 test results of different algorithms.

By comparison, it can be seen that the overall performance of this method is better than that of the control method. The fusion of features at all levels can provide more situational information for the prediction of product characteristics. Designers are no longer limited to a certain design art style and school, but try to improve an open design principle and give the initiative of design to the end user-the user. The design concept of 3D graphical user interface is becoming more and more perfect and mature, and it is developing towards the ideal of "interface-free" man-machine interface. With the modeling function of computer software, the 3D effect can be virtualized, and the matching of the structure, shape and color of the model can affect Wenchuang products. This technology can run through the whole design stage of product design, as well as the rapid prototyping technology and 3D printing technology that have been repeatedly verified through the structural relationship, helping designers optimize the appearance of products and choose the best scheme that best meets the design requirements.

6 CONCLUSIONS

The growth and application of CAD function has fundamentally changed the traditional manual design mode, greatly improved the success rate and efficiency of product design, shortened the product design cycle, improved the product design quality and reduced the production cost. Wenchuang industry has brought various frontier problems to design education. Product design specialty has changed from a single discipline to interdisciplinary and cross-cultural, and has become a talent training mechanism with market demand as the guide, general education as the basis and interdisciplinary characteristics. This article expounds the performance of CAD in Wenchuang product design, and explores the construction strategy of teaching mode of Wenchuang product CAD design based on graphic visualization system. The simulation results show that the overall performance of this method is better than that of the control method. The fusion of features at all levels can provide more situational information for the prediction of

product characteristics. After the graphic library is built, the user applies the system to draw graphics. First, the type of drawing primitives is selected, and then the main parameters of drawing graphic elements are input. The corresponding primitive class creates objects and calls the drawing member functions in the class to complete the display and output of graphics in the workspace.

In view of the problem of data loss in the reading stage of graphic files and the display disorder in dimension marking and tolerance marking, further research and experiments are needed, and the analysis of file format needs further deepening and refinement. The course of product design should not stick to the traditional art education mode, but explore the role of design education in industrial theory, policy and development, and cultivate research-oriented and planning creative talents who pay equal attention to students' humanistic connotation, artistic accomplishment and professional skills with a pluralistic and open vision.

7 ACKNOWLEDGEMENT

This work was supported by 2022 Project of Henan Provincial Philosophy and Social Science Planning: Research on the protection and artistic innovation path of Henan's material cultural heritage under the background of digital economy (No.:2022BYS005).

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