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Computer-Aided Design AND APPLICATIONS

Dynamic Adjustment and CAD Real-time Rendering Algorithm for Advertising Art Design based on Machine Vision

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Abstract. Advertising is no longer a singular means of disseminating product information but has developed into a culture and industry that encompasses marketing, media, and art. In advertising art design, machine vision technology can be used to analyze the visual habits and preferences of the audience, providing valuable feedback to designers and helping them create graphic elements that taste. Designers can efficiently use CAD software for graphic design and preview design effects through real-time rendering functionality. As a key component of advertising art design, graphics can intuitively and quickly convey the core information of advertising. The superiority of the algorithm proposed in this article in image rendering quality was verified through comparative experiments on image rendering performance. Compared with traditional gradient filtering algorithms and ant colony optimization (ACO) algorithms, our algorithm has significantly improved the PSNR value of rendering results, proving its higher accuracy and stability in image rendering. This algorithm can enhance the visual effect and attractiveness of advertisements, as well as their dissemination effect and commercial value.

Keywords: Machine Vision; Advertising Art Design; Real-Time Rendering; CAD
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1 INTRODUCTION

In the new media era of information explosion, advertising art design plays a very important role in commodity promotion, brand building, and marketing. As a key part of advertising art design, graphics can convey the core information of advertising intuitively and quickly, which is of indispensable value for attracting the attention of the audience and improving the communication effect of advertising. More and more industries are exploring the application of AI in their own fields. A focus of attention on how to use AI technology to improve production efficiency, optimize resource allocation, and improve product quality. Alexopoulos et al. [1] explored how to use digital video to drive advertising supervision machine learning, providing new ideas and methods. Digital

video-driven advertising supervision machine learning automates the analysis, recognition, and classification of digital videos. The basic principle is to conduct deep learning and training on a large number of digital videos, enabling machines to automatically recognize and judge the content in the videos, and classify, label, and rate the videos based on preset rules. In the manufacturing industry, digital video-driven advertising supervision machine learning can be applied to product production, quality inspection, logistics management, and other links. During the product production process, machines can automatically identify production line faults, product defects, and other issues by analyzing digital videos of the production line, and issue alerts in a timely manner, so that production personnel can quickly take measures. Therefore, the quality of graphic design directly affects the communication effect of advertising information, and then affects the overall benefit of advertising. This requires advertising designers not only to have innovative thinking but also to master advanced design technology to improve the aesthetic feeling and effect of advertising art design.

In the current digital age, the advertising industry is undergoing unprecedented changes. With the help of computer-aided design (CAD) technology, advertising designers can draw and adjust their advertising designs in real time, making them more in line with market demand and consumer preferences. Meanwhile, through feedback from machine vision further understand the effectiveness and attractiveness of advertising design, thereby making dynamic adjustments. Auernhammer et al. [2] explored how to combine machine vision feedback, CAD real-time rendering algorithms, and design thinking to promote the development of advertising art design and product innovation management. Based on machine vision feedback, designers can adjust advertising art design in real time, including elements such as color, layout, font, etc. By dynamically adjusting, advertisements can better adapt to changes and feedback from the audience, thereby improving their click-through and conversion rates. Through machine vision technology and big data analysis, advertisements can be personalized and customized for different audiences. Designers can use this data to create more attractive and targeted advertisements, improving advertising effectiveness and user experience. As an important branch of AI, machine vision has been widely used in many industries. The application is becoming increasingly widespread. Computer graphics processing technology, with its powerful functionality and flexibility, provides infinite possibilities for advertising designers, while also bringing revolutionary changes. Fan and Li [3] discussed its future development trends. Computer graphics processing technology is a technique that utilizes computers to generate and process images. It includes the acquisition, processing, storage, and output of images. In advertising visual communication design, improves the attractiveness of advertising, and achieves better communication effects through image processing. Virtual reality technology is an important branch of computer graphics processing, which can make advertising images more realistic and provide viewers with an immersive feeling. The application enhances the visual effect of advertising but also increases audience engagement.

In advertising art design, machine vision technology can be used to analyze the audience's visual habits and preferences, so as to provide valuable feedback for designers and help them create graphic elements. Georgiou et al. [4] investigated and compared traditional computer vision methods and deep learning-based feature descriptors, exploring their advantages, disadvantages, and application scenarios. Traditional computer vision methods are mainly based on manually extracting features, including SIFT, SURF, HOG, etc. These methods typically require manually selecting key points in image or video frames and calculating their descriptors. Its main advantage is its good stability and robustness, which can effectively describe local features in images or videos. However, due to the need for manual feature extraction, these methods are difficult to adapt to complex and variable data and tasks and are susceptible to interference from factors such as lighting and angles. Feature descriptors based on deep learning have gradually become vision. Deep learning models can automatically learn feature representations in images or videos, thereby avoiding the tedious process of manually extracting features. Designers can use CAD software to design graphics efficiently and preview the design effect through real-time rendering functions. How to combine machine learning and CAD organically to form an automatic method that can dynamically adjust advertising art design and render it in real-time is an important topic in the field of advertising art design. In order to attract user attention and improve the click-through rate of advertisements, visual communication design

based on social network interaction interface design has become increasingly important. Haotian and Guangan [5] discussed how to innovate and improve the visual communication design of applied advertising to better integrate into social network environments and enhance advertising effectiveness. The design of the social network interaction interface is a key bridge connecting users and applications. Excellent design can provide an intuitive and user-friendly interface, allowing users to easily interact with applications. In application advertising, good interactive interface design can enhance the interaction between advertising and users and improve the click-through rate and conversion rate of advertising. Therefore, advertising visual communication design based on social network interaction interface design is crucial for improving advertising effectiveness. Innovative advertising design can attract user attention and stimulate their interest. Creative advertisements can be created through unique elements such as graphics, animation, and sound effects to stand out on social networks. Application advertising should provide an interactive experience, allowing users to interact with the advertisement, thereby enhancing their sense of participation and experience. For example, by clicking or swiping the screen, users can learn more about advertisements or participate in interesting interactive games.

Computer-aided design (CAD) and machine vision feedback fields, especially in environmental advertising and art design teaching. Traditional advertising design education focuses on learning theory and manual skills but often overlooks the application of technology and innovation in advertising design. Jin and Yang [6] discussed how to apply computer-aided design visual feedback to environmental advertising art design teaching to improve teaching quality and student design abilities. Which utilizes computers for graphic design, helping designers create, modify, and optimize designs on the computer. Machine vision feedback is the process and analysis of image and video data through machine learning algorithms to extract useful information such as color, shape, texture, etc. Through CAD software, students can design advertisements in a virtual environment, which helps cultivate their innovative thinking and problem-solving abilities. Meanwhile, machine vision feedback can help students better understand and apply visual elements such as color and shape in the design process. CAD software can accurately create and modify advertising designs, while machine vision feedback can help students more accurately understand and apply elements such as color and shape, thereby improving design accuracy and efficiency. Through the application of CAD software and machine vision feedback, students can learn advertising design in practice, which helps to enhance their practical skills and problem-solving abilities. In today's digital age, the innovation and technicality of advertising art design are increasingly receiving people's attention. CAD technology has provided more possibilities for advertising art design. Liu and Yang [7] explore dynamically adjusting advertising art design with creativity as the center in order to enhance the attractiveness and effectiveness of advertising. Contemporary art process of artistic design and creation through computer software. This technology of artworks, including advertisements. Advertising art design is a way of conveying information through visual elements and creativity. In advertising design, creativity is crucial, and contemporary art computer-aided design provides advertising designers with more tools and means to achieve their creativity. Through computer-aided design software, designers can receive real-time feedback on whether their designs are effective and have achieved the expected results. This feedback can help designers make timely adjustments and make advertisements more in line with the needs of the target audience.

In order to overcome the problems of poor performance and high iterative complexity of existing image processing algorithms for texture rendering, this article mainly studies the dynamic adjustment of advertising art design and CAD real-time rendering algorithm based on machine vision feedback, in order to provide a novel solution for advertising art design. By constructing a fuzzy membership function, the image is mapped to a fuzzy domain, and an adaptive fuzzy enhancement factor is constructed to enhance the contrast between the target area and the texture area. It is hoped that this method can help advertising designers convey advertising information more effectively, enhance the aesthetic feeling and attractiveness of advertisements, and optimize the communication effect and market benefit of advertisements. The research includes the following innovations;

(1) This article proposes to apply machine vision technology to the dynamic adjustment of advertising art design. By analyzing the audience's visual habits, machine vision can provide designers with valuable feedback and guide them to adjust graphic elements.

(2) In this study, CAD real-time rendering algorithm is introduced into the field of advertising art design, and combined with machine vision feedback. Designers can render in real-time in a CAD system according to the feedback data provided by machine vision.

(3) This method combines the characteristics of machine vision and CAD technology, which can help designers better understand the visual needs of the audience and promote the progress of advertising graphic design.

This article first discusses the application and potential of machine vision technology in advertising art design; Then, how to effectively integrate the feedback data of machine vision into a CAD system to realize the dynamic adjustment of design is studied. Finally, the experiment verifies the superiority of improving the aesthetic feeling of advertising art design.

2 RELATED WORK

In the optimization of advertising visual effects, depth estimation is an important step in understanding image and video content. It can help us recover three-dimensional scenes from two-dimensional images, which is crucial for understanding and interpreting advertising visual content, as well as for precise advertising placement. In recent years, machine learning and binocular stereo vision technologies have shown great potential for in-depth estimation of advertising visual images. Poggi et al. [8] explore how to utilize the synergy of these technologies to improve the accuracy and robustness of depth estimation in advertising visual images. Machine learning is a data-driven technique that can learn the inherent patterns and patterns of data through training models. In-depth estimation of advertising visual images, machine learning can be used to learn and predict the depth information of in images. In addition, Generative Adversarial Networks (GANs) can also be used to generate advertising images with specific depth information. In today's digital age, the advertising industry is facing unprecedented challenges and opportunities. Effectively attracting the audience's attention and improving advertising's dissemination effect are urgent problems that the advertising industry needs to solve in optimizing advertising visual effects. By using process content generation technology, the universality of advertising visual effects in machine learning can be further improved, thereby enhancing the dissemination effect of advertising. Risi and Togelius [9] explored how to use process content generation technology to improve the universality of advertising visual effects in machine learning. Machine learning is a data-driven technique that learns the inherent patterns and patterns of data through training models, enabling prediction and analysis of new data. In the optimization of advertising visual effects, machine learning technology is used to achieve accurate advertising placement and personalized recommendations. By classifying advertising images, identify elements such as themes, objects, and scenes in the images for subsequent visual effect optimization. Automatically detect key elements in advertising images, such as products, characters, backgrounds, etc., to facilitate accurate advertising placement and personalized recommendations.

Traditional advertising promotion methods often rely on manpower and traditional marketing strategies; however, this approach is often inefficient and ineffective. To address this issue, Shi and Sun [10] proposed a machine vision feedback-based advertising promotion system that combines CAD (computer-aided design) and cloud computing technology to achieve more accurate and intelligent advertising promotion. The machine vision feedback system is the core part of this system. By using advanced image recognition and deep learning techniques, the system is able to extract useful information from various images and videos, such as product or service features, brand identification, etc., and classify and recognize them. In addition, the system can also optimize and adjust advertisements in real-time based on user feedback and behavior. Cloud computing technology provides powerful computing and storage capabilities for this system. By using cloud computing technology, this system can handle large amounts of data and complex computing tasks

while ensuring system stability and availability. In addition, the elastic scalability of cloud computing of the system under different load conditions. The advertising promotion system based on machine vision feedback combines CAD-assisted design and cloud computing technology to achieve intelligence and automation of advertising promotion. This system can extract useful information from a large number of images and videos, design and optimize advertisements, and achieve efficient computing and storage through cloud computing technology. Through this approach, we can improve the accuracy and effectiveness of advertising, while reducing labor costs and achieving more efficient advertising promotion. The application of CAD technology in the advertising industry is becoming increasingly widespread. Especially in visual communication design, CAD technology can draw advertisements in real-time, providing designers with more creative possibilities and flexibility. Sultana et al. [11] explored the application of real-time CAD drawing in visual communication practices for rural advertising. CAD real-time rendering has significant advantages in advertising visual communication design. Firstly, it can improve design efficiency, allowing designers to create and modify advertising designs more quickly to meet market demand and consumer feedback. Secondly, CAD technology can provide precise drawing and layout, making advertising design more refined and accurate. In addition, real-time CAD drawing can also achieve advertising design in various media, including flat, three-dimensional, dynamic, and other forms, making advertisements more vivid and engaging. In the practice of advertising visual communication in rural areas, CAD real-time drawing technology has been widely applied. Designers use CAD software to digitize and draw elements such as rural landscapes, characters, and activities, creating advertising visual effects with rural characteristics. These advertisements usually focus on freshness, nature, and health, highlighting the beautiful rural environment and rich cultural resources, and attracting the attention and interest of urban residents.

Machine learning has achieved significant results in many fields, including the advertising industry. Machine learning models can analyze large amounts of data, provide in-depth insights, and help advertising designers better understand the needs and behaviors of the audience, thereby optimizing advertising art design. Sutton et al. [12] explored the applicability of machine learning models in the field of visual feedback in advertising art and design science. Through clustering algorithms, machine learning can divide the audience into groups based on their interests, behaviors, and preferences. This helps designers better understand the target audience and provide them with advertisements that better meet their needs. Predictive models can help designers predict key indicators such as click-through rates and conversion rates of advertisements. Through machine learning algorithms, designers can predict future trends and reactions based on historical data and user behavior, thereby optimizing advertising design. By utilizing the cross-media characteristics of machine learning models, it is possible to create advertising designs across multiple media. For example, precise advertising can be placed on different platforms such as social media, mobile applications, and television to improve the effectiveness of advertising dissemination. With the popularity of mobile devices, mobile application advertising has become increasingly important. Computer-aided design technology can help designers create more interactive and attractive mobile application advertisements to enhance user engagement and retention. Virtual reality technology provides a new way of presentation for advertising visual communication. Computer-aided design technology can help designers create realistic virtual reality scenes, making advertisements more vivid and engaging. Wang [13] analyzed the interactive art new media advertising under computer assistance and its impact on visual innovation. Designers can use computer-aided design software to transform creativity into actual advertising works and can also adjust based on real-time feedback to achieve the best visual effects. In the context of new media, the interactivity of advertising visual communication has become particularly important. Computer-aided design technology can help designers create interactive advertisements, such as interactive games, virtual reality, etc., allowing users to interact with advertisements, thereby enhancing their sense of participation and experience. Through computer-aided design technology, designers can create personalized advertisements based on user behavior and preferences. These advertisements can target different audience groups to achieve more precise marketing and promotion.

The enhancement of underwater advertising images is an important issue in underwater visual applications. Such as light refraction, scattering, and absorption, the visual effect of underwater advertising images is often poor, making it difficult to achieve ideal promotional effects. Therefore, how to improve the visual quality of underwater advertising images has become a challenging issue. Zhou et al. [14] aim to improve the visual and promotional effects of underwater advertising images. Research on underwater image enhancement is gradually increasing. Some of these studies focus on image denoising, deblurring, and color correction. These studies have, to some extent, improved the quality of underwater images, but there are still some issues. For example, denoising algorithms may remove important details from an image, and color correction algorithms may not be suitable for all situations. Therefore, a more effective method is needed for underwater advertising images. Digital advertising has become an indispensable part of modern society. In order to meet people's increasing demands for advertising creativity and effectiveness, Zou et al. [15] proposed digital advertising. This platform can combine advertising content with display devices through dynamic visual recognition technology, bringing viewers a more interactive and visually impactful advertising experience. Dynamic visual recognition technology is a technique that utilizes real-time processing and analysis of image and video data. It can achieve recognition and tracking of target objects by extracting and matching feature points in the image. Visual recognition technology can be used to identify key elements in advertising content and link them with display devices to achieve richer display effects. The software mainly includes image processing algorithms and linkage control programs. Image processing algorithms are used to extract feature points from images and perform matching and recognition. The linkage control program controls the actions and effects of the display device based on the recognition results, achieving interaction with advertising content. The platform also provides a user interface to facilitate user management and control of the platform. Users can upload advertising content through the interface and monitor the display effect of advertisements in real time.

3 DYNAMIC ADJUSTMENT OF ADVERTISING ART DESIGN AND CAD REAL-TIME RENDERING ALGORITHM

By analyzing a large amount of audience visual data, machine vision technology can help designers understand the visual habits of the audience, thereby providing targeted guidance for advertising graphic design. Machine vision technology can automatically analyze the attractiveness and influence of graphic elements in advertisements, providing designers with objective design feedback. By combining augmented reality (AR) technology, machine vision can achieve real-time interaction between advertisements and audiences, improving the fun and engagement of advertisements. Machine vision technology can also monitor the display effect of advertisements in real time, automatically adjust graphic elements to adapt to different display environments and audience groups, and improve the dissemination effect of advertisements. CAD technology is a technique that utilizes computer software for graphic design and drawing. Drawing and design tools that can help designers efficiently complete advertising graphic design. Moreover, the template and library functions of CAD can also improve the reusability and consistency of design. The real-time rendering function of CAD software allows designers to preview the final effect of graphics in real time during the design process, thereby adjusting design elements and parameters in a timely manner. CAD software supports 3D modeling and animation functions and enhances the visual impact of advertisements. CAD software supports multiplayer collaboration and cloud storage, facilitating real-time communication and feedback between designers, clients, and team members.

Combining machine vision technology with CAD software can bring greater innovation to advertising art design. Designers can use machine vision technology to analyze audience visual habits and preferences, feed data back into CAD systems, and achieve dynamic optimization of advertising graphics. Developing an intelligent design system that combines AI technology to generate and optimize advertising graphics automatically can improve the creative level of designers. By conducting in-depth research on the principles and application methods of these two technologies, and combining them with practical cases for practical verification, more effective design tools, and

the rise of technologies such as computer graphics and machine vision has provided new possibilities for advertising art design. With the diversification and personalization of consumer demand, advertising needs to be more creative and attractive in order to resonate and attract the audience's attention. Through computer graphics technology, designers can create and modify in virtual environments. As an important branch of AI, machine vision aims to study how to enable computers to acquire, analyze, and understand information in digital images and videos. In advertising art design, real-time rendering technology can help designers preview and adjust design effects in real-time. The purpose of this study is to explore the application effect of real-time rendering algorithms for advertising art CAD based on machine vision feedback in advertising art design.

This section will provide a detailed introduction to the design and implementation of advertising art design dynamic adjustment and CAD real-time rendering algorithms. This algorithm combines the advantages of machine vision technology and CAD software and can dynamically adjust advertising graphic design based on audience visual feedback data and perform real-time rendering through CAD software. Firstly, it is necessary to collect visual feedback data from the audience, including viewing time, eye tracking, facial expressions, etc. These data can be automatically collected and analyzed through machine vision technology. In order to improve the accuracy and reliability of data, this study adopted various data collection devices and methods. Identify audience visual habits and preferences, as well as their reactions to different graphic elements, through machine learning algorithms and statistical analysis methods. These features can be used to guide the dynamic adjustment of advertising graphic design. The principle of advertising art image rendering is shown in Figure 1.

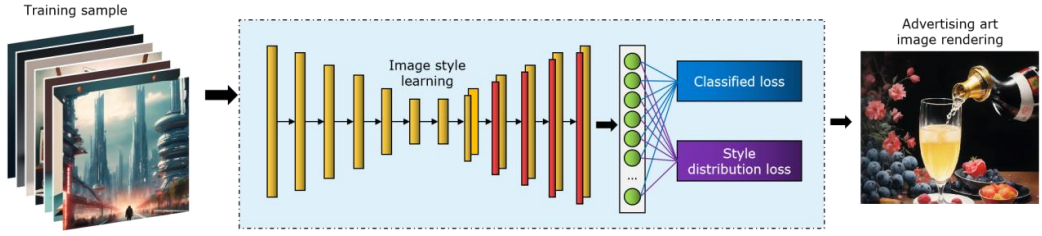

Figure 1: The principle of advertising art image rendering.

The random distribution strategy adopted by the algorithm of Bin[19] ensures the fast and high-quality realization from gray image or color image to stippling. This article also gives an algorithm and strategy for drawing stippling from the 3D solid model. The algorithm and strategy first construct 3D particles on the visible surface of a 3D solid, then project the particles on the observation plane and draw stippling according to the setting of the point model. In fact, this method involves scanning the projection of the 3D model in the screen space and then filling it with heart according to the rectangular area. See Figure 2 for different density functions and stippling effects generated under these density functions.

Automatically adjust graphic elements in advertisements based on audience preferences and reactions. Design appropriate animations and interactive effects based on audience interaction data and feedback. This study integrates dynamic adjustment strategies into CAD software to achieve real-time rendering of advertising graphics.

$$\nabla f\ x,y\ = \left[G_x, G_y\right]^T = \left[\frac{\partial f}{\partial x}\frac{\partial f}{\partial y}\right]^T \tag{1}$$

$$\left|\nabla f\ x,y\ \right| = \ G_x^2 + G_y^2\ ^{1/2} \tag{2}$$

$$\phi\ x,y\ = \arctan\left(\frac{G_y}{G_x}\right) \tag{3}$$

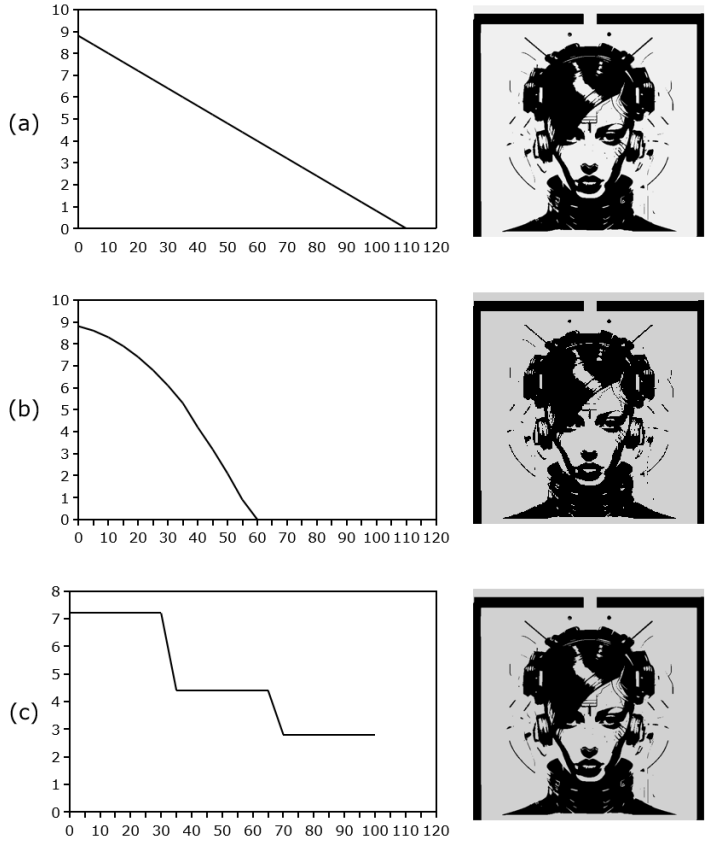

Figure 2: Different density functions and stippling effects generated under these density functions.

For advertising art images, the amplitude $\left|\nabla f\ x,y\right|$ of the gradient of the above formula can be replaced by a differential and used as the value of each pixel of the formed image:

$$\left|\nabla f\ x,y\right| = \left\{\left[f\ x,y\ - f\ x+1,y\right]^2 + f\ x,y\ - \left[f\ x,y+1\right]^2\right\} 1/2 \tag{4}$$

Remember that the probability of a random event is $P\ E$, so the amount of information it contains is:

$$I\ E\ = \log\frac{1}{P\ E} = -\log P\ E \tag{5}$$

The source symbol set defines B as the set b_i of all possible symbols, where each element b_i is called the source symbol, and the probability that the source generates symbol b_i is $P\ b_i$.

The self-information of the single symbol b_i generated by the source is:

$$I\ b_i\ = -\log P\ b_i \tag{6}$$

If the source generates k symbols, the symbol b_i will generate $kP\ b_i$ times on average. If the average information output by each source is recorded as $H\ u$, then:

$$H\ u\ = \sum_{i=1}^{n} P\ b_i\ \cdot I\left[P\ b_i\ \right] = -\sum_{i=1}^{n} P\ b_i\ \log P\ b_i \tag{7}$$

$H\ u$ is called the entropy of the source.

The expression of maximum pooling is as follows:

$$P_{\max}\ X\ = \max\ X_i \tag{8}$$

The expression of average pooling is as follows:

$$P_{ave}\ X\ = \frac{1}{N} \sum_{i=1}^{N}\ X_i \tag{9}$$

Where X_i is the pixel value of the local area; N is the quantity of pixels in the local area.

Choose appropriate colors for rendering based on the theme and style of the advertisement. Designers need to consider factors such as contrast, saturation, and color psychology between colors to create harmonious color combinations. During the rendering process, designers also need to adjust colors based on actual effects to achieve the best visual effect. Set appropriate light source types and positions according to the needs of the scene. Shadow processing can enhance the 3D and spatial sense of objects. Common shadow processing methods include shadow mapping, ray tracing, and so on.

Map 2D texture maps to the surface of 3D objects to enhance their details and realism. Add special effects to the image as needed to enhance the visual impact of the advertisement. Through post-processing, designers can fine-tune and improve the rendering results. The principles of advertising art image rendering involve multiple aspects such as color application, lighting and shadow processing, material and texture mapping, and post-processing. Designers can create more attractive advertising works by mastering these principles and technical methods proficiently and applying them in practical operations.

4 EXPERIMENTAL RESULTS AND ANALYSIS

4.1 Dataset and Experimental Design

A publicly available advertising image dataset was used to verify the effectiveness of the algorithm proposed in this article. This dataset contains 600 advertising images with different styles and themes, covering multiple fields such as food, electronic products, and clothing. These images have different complexities, colors, and lighting conditions to test. Select six representative advertising images and use the gradient filtering algorithm, ACO algorithm, and the algorithm proposed in this article for image rendering. Compare the performance differences of the three algorithms in image rendering quality by calculating the PSNR value of the rendering results. Using the same advertising image, compare the running time of three algorithms under different iteration times. By recording the running time of each iteration, analyze the time complexity of the algorithm to evaluate its performance under high-precision multiple iteration requirements.

In order to implement the above algorithm, this study used Python as the main programming language, combined with OpenCV and TensorFlow libraries for machine vision data processing and machine learning algorithm implementation. Through the analysis and comparison of experimental

data, it was found that advertising works that have been dynamically adjusted and rendered in real-time have significantly improved audience attractiveness and information dissemination effectiveness. The real-time rendering function of CAD ensures that the final effect of graphics can be previewed and adjusted in real-time during the design process. Partial samples of the selected dataset are shown in Figure 3.

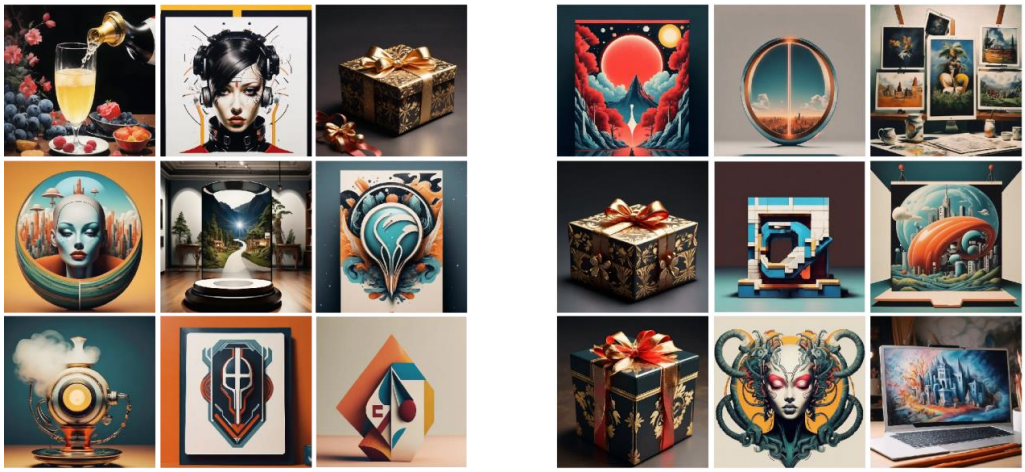

Figure 3: Partial sample of data set.

4.2 Experimental Results and Analysis

From the test results in real scenarios (Figure 4), it is not difficult to see the excellent performance of the proposed method in image dehazing and detail preservation. Traditional dehazing methods often lose some details during the dehazing process, resulting in blurred images. The method in this article successfully preserves more details while removing fog.

Figure 4: Comparison of rendering effects of advertising art images.

Through the processing of the method in this article, the visual effect of the image has been significantly improved. The image after defogging has a stronger visual impact and can better attract the attention of the audience. Compared with traditional rendering methods, the optimized model in this article adopts precise modeling using CAD technology and natural lighting shading using ray tracing technology, which can better simulate the reflection effect in the real world.

In order to demonstrate the advantages of the real-time rendering method for advertising art CAD proposed in this article, comparative experiments were conducted with traditional rendering methods, and the results were obtained as shown in Figures 5 and 6.

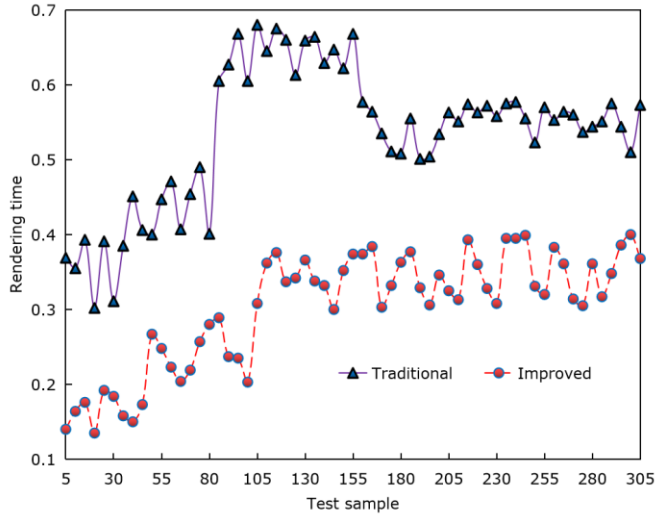

Figure 5: Rendering efficiency of different methods.

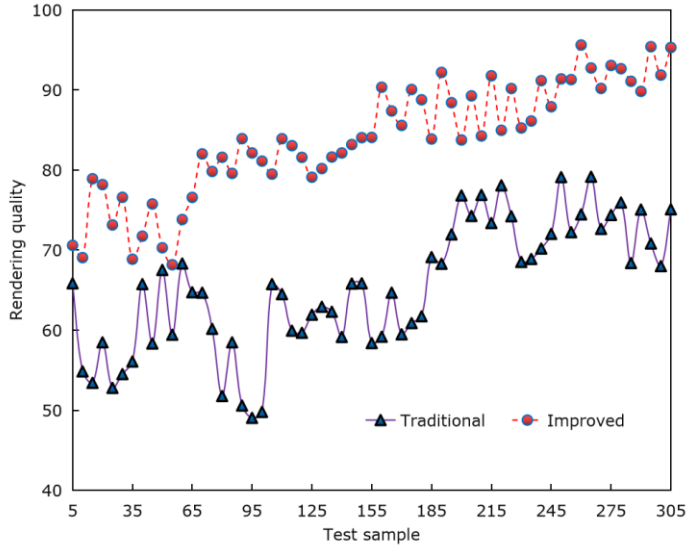

Figure 6: Rendering quality of different methods.

Figure 5 shows the comparison between the optimized model and the traditional method in rendering efficiency. Compared with traditional methods, the optimized model in this article has obvious

advantages in rendering time. The method in this article realizes the high efficiency of the rendering process by optimizing graphics processing flow, reducing unnecessary calculations, and using hardware acceleration. This advantage enables designers to complete the rendering of advertising works more quickly.

Figure 6 shows the comparison between the optimized model and the traditional method in rendering quality. Compared with the traditional methods, the optimized model in this article has obviously improved the rendering quality by more than 10%. This method also strengthens the processing of material and texture mapping, which makes the objects in advertising works more detailed and realistic. Compared with traditional rendering methods, the real-time rendering method of advertising art CAD proposed in this article shows obvious advantages in rendering efficiency and quality. These advantages enable designers to render high-quality advertising works more quickly and efficiently, thus enhancing the artistic value and communication effect of advertisements.

This article compares the PSNR value of the proposed algorithm with that of the traditional image rendering processing algorithm. The running time of the proposed algorithm and the existing algorithm is compared under different iterations. As shown in Table 1 and Figure 7, this article uses six different images to compare the performance of the proposed algorithm with the existing gradient filtering algorithm and ACO algorithm in image rendering. Among the three algorithms, the gradient filtering method is relatively simple, and its image rendering effect is relatively poor. The ACO algorithm will diverge due to wrong learning, so the image rendering effect of the sixth image ACO algorithm is lower than that of the gradient filtering algorithm.

Iterations	*Gradient filtering algorithm*	*ACO algorithm*	*This algorithm*
1	26.9	27.4	28.5
2	26.5	26.9	27.2
3	27.2	28.9	29.9
4	31.3	32.0	31.2
5	8.9	16.3	16.8
6	17.8	15.7	19.4

Table 1: Comparison of PSNR of image rendering with different algorithms.

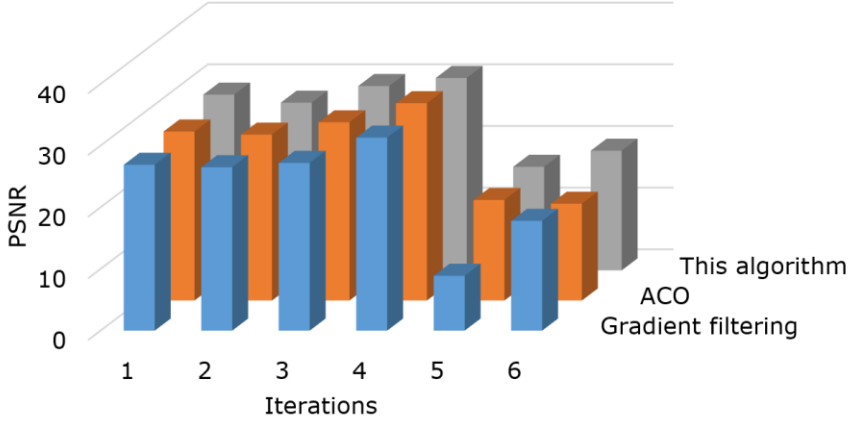

Figure 7: PSNR of image rendering with different algorithms.

As shown in Table 2 and Figure 8, compare the running times of three algorithms under different iterations using the same image. As the quantity of iterations increases, the running time of all three algorithms shows an increasing trend, but not an exponential increase, indicating that the

computational complexity required for iterations is gradually decreasing. Among the three algorithms, the ACO algorithm requires the longest running time and each iteration requires a new learning process, resulting in the highest complexity. The initial iteration time is higher than that of gradient filtering, but the complexity of subsequent iterations is significantly reduced due to the reduced running time of clustering iterations with each iteration. At the 32nd iteration, the required time was lower than that of the gradient filtering algorithm, indicating that the algorithm proposed in this article is suitable for high-precision image rendering needs with multiple iterations.

Iterations	*Gradient filtering algorithm*	*ACO algorithm*	*This algorithm*
1	0.07	0.11	0.09
2	0.11	0.19	0.15
4	0.16	0.28	0.25
8	0.26	0.55	0.33
16	0.38	0.86	0.39
32	0.79	1.45	0.62

Table 2: Comparison of image rendering running time of different algorithms.

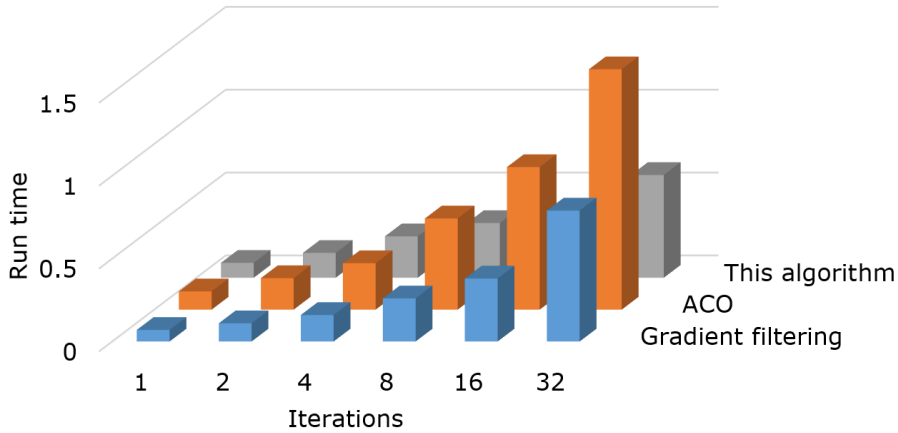

Figure 8: Running time of image rendering with the same algorithm.

By comparing the PSNR values of the proposed algorithm with traditional image rendering algorithms, it is found that our algorithm has significant advantages in image rendering performance. Although the gradient filtering method is simple, its rendering effect is relatively poor, while the ACO algorithm, although its performance is similar to the algorithm in this article, may lead to algorithm divergence due to incorrect learning, resulting in an unstable rendering effect in some cases. Although the initial iteration time is slightly higher than that of the gradient filtering algorithm, the complexity of subsequent iterations is significantly reduced due to the reduced running time of clustering iterations with each iteration. In actual advertising art design, designers need to iterate and adjust multiple times to achieve the best results, so the efficient performance of algorithms can improve the work efficiency of designers. The machine vision feedback can dynamically adjust according to the audience's visual habits and preferences, making advertising graphic design more in line with the audience's tastes and expectations. This feature makes advertising work more targeted and can better convey the core message of the advertisement.

5 CONCLUSION

The emergence of computer information technology has greatly enriched the expression and content of advertising art design, making advertising art present a colorful color. This article studies the dynamic adjustment and CAD real-time rendering algorithm of advertising art design based on machine vision feedback, in order to provide a novel solution for advertising art design. Through comparative experiments on algorithm runtime, the algorithm proposed in this article demonstrates lower time complexity. Although the initial iteration time is slightly longer than the gradient filtering algorithm, the complexity of subsequent iterations is significantly reduced due to the optimization of clustering iteration. This proves the efficiency advantage of the algorithm proposed in this article, which is particularly suitable for high-precision image rendering needs with multiple iterations. The validation experiment of the dynamic adjustment strategy has confirmed that the algorithm proposed in this article can automatically adjust and render based on the audience's machine vision feedback, thereby significantly improving the beauty and attractiveness of advertising works. This feature makes advertising more in line with audience expectations. This algorithm can meet the high-precision and iterative requirements of advertising art design, improving the visual quality of advertisements.

This study validates the effectiveness of dynamic adjustment strategies based on machine vision feedback in advertising art design. In the future, more complex machine vision can be further explored to capture and analyze audience visual habits and preferences more accurately, providing more intelligent and personalized guidance for advertising design.

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