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Computer-Aided Design AND APPLICATIONS

The Creation and Exploration of Human-Computer Interaction in New Media Art Image Representation

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Abstract. The current digital media art emphasizes the application of traditional human-machine innovative interaction in the field of art. In order to improve the transmission and other issues in the field of image art, this article explores and analyzes the combination of human-computer interaction in visual modelling under the influence of CAD. By combining the influence of high-end image visual modelling with CAD human-machine interaction, this article abstractly integrates and expresses the interactive system dependency for transmitting texture art images. In order to improve the transmission efficiency of image textures, this article analyzes the synthesis of video frames and abstract and intuitive creative tools. The research results provide a practical analysis of the artistic expression achievements of CAD human-computer interaction technology in the field of image art. This has played a creative role in enhancing human-computer interaction in the field of art.

Keywords: CAD; Human-Computer Interaction; New Media; Art Image
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1 INTRODUCTION

In recent years, China has focused on promoting the quality development of the Digital Culture Industry Bureau, and it is precisely this series of measures that have led to a continuous increase in people's attention to the digital cultural equipment of image devices [1]. At present, efforts are being made to explore the deep value influence of contemporary image installation art and to propose the development trend of contemporary image installation art, which has certain theoretical significance and practical value. With the advancement of technology, the concepts and forms of art are constantly updated, and contemporary image installation art has emerged. This allows the attendants to better integrate into it, reflecting interactivity and humanistic thinking [2]. Taking the interaction field in contemporary image installation art as the research object, this paper explores its interaction field from new perspectives, such as interaction development and expression. Unlike traditional art forms, contemporary visual installation art offers diverse interactive forms and sensory

experiences [3]. Today, contemporary visual installation art has played a crucial role in exhibition performances, cultural venues, and large-scale thematic extension platforms. With the high-quality development of China's digital cultural industry, contemporary image installation art is entering the public eye with a more vigorous posture. On the one hand, it is applied in the planning and arrangement of image installation art, such as technical support for the performing arts industry and interactive performance in stage art. To broaden the horizons of creators of image installation art, to view new situations with a comprehensive development perspective, and to provide knowledge updates for the long-term development of contemporary image installation art in today's society [4]. To provide more support for cultivating new formats in the digital cultural industry and assist in the high-quality development of the cultural industry [5]. Unlike traditional static installation displays, contemporary visual installation art integrates a large number of technological means into its own content and form with a new development concept, endowing the audience with a novel interactive experience. Therefore, it is necessary to explore the depth of the paper. The research of the paper will have certain theoretical significance and practical value. On the other hand, the artistic expression and immersive scene creation used in exhibition displays have a certain guiding significance. For example, providing relevant opinions and references on the digital high-quality services of cultural resources such as art galleries and museums, further deepening our understanding of digital cultural equipment and performing arts equipment [6]. The current focus of research is to explore the image style transfer of digital painting art in new media art, especially in the field of interactive image art. This interactivity not only enhances the audience's sense of participation but also enriches the connotation and expressive power of artistic works. This style transformation not only produces richer artistic effects but also has good interactivity and local controllability.

In this constantly evolving virtual world, new media art is expected to not only gradually replace traditional art forms, but also play a core role in the infinite metaverse of the future. The current research goal is to reshape image style through neural network technology in artificial intelligence while preserving the semantic information of the original image [7]. This method combines feature mapping of content images and style images while drawing on the advantages of traditional texture synthesis to generate richer multi-style target feature maps. Viewers can create unique artistic effects by interacting with the artwork and changing the style and texture of the images in real-time. In the context of the integration of artificial intelligence and the Internet of Things, this interactive image art not only optimizes the creative mechanism of new media art but also brings a new artistic experience to the audience [8]. The experimental results show that the image style transfer method based on feature synthesis can make the texture distribution of the image more reasonable while retaining more semantic structure content of the original image. By inverting these target feature maps back into the image, style transformation was successfully achieved while preserving the semantic structure content of the original image.

In the era of new media, interactive image art has attracted widespread attention with its unique charm. Some scholars have proposed an interactive recommendation method based on the Long Short Term Memory Model (LSTM) aimed at providing diverse, insightful, and real-time interactive suggestions for non-professionals [9]. This type of art form not only provides viewers with a viewing experience that is completely different from traditional art but also allows viewers to participate in the creation and interpretation of works through interactive mechanisms. In the interactive image art of new media, works are often presented in the form of multiple views and interactive types. By analyzing these vectors, our model can predict the interests and needs of users and thus propose the next step of interaction recommendations [10]. The core of this method is to capture the user's behaviour and visual state during the interaction with new media interactive image artworks and encode them into digital vectors. However, for public users who are new to interactive image art through new media for the first time, effectively interacting and exploring the data and stories behind works in depth is often a huge challenge. So far, the related research content in the field of contemporary image installation art and interaction is relatively cutting-edge. As a highly comprehensive art form, contemporary visual installation art includes disciplines such as design art and computer technology, involving knowledge of mathematics, music, biology, etc., and is usually completed through the cooperation of talents from multiple disciplines. This provides certain support

for exploring its interactive fields and trends to promote the high-quality development of the digital culture industry and also provides knowledge updates for the long-term development of image installation art in today's society. Combining contemporary image installation art with the development background of promoting high-quality services in China's digital cultural industry, and examining its interactive field from a new perspective [11]. The development of contemporary image installation art and its interactive field is closely related to the historical background. Based on a large number of practical cases, we believe that accurate and authentic cases will help improve the relevant theories and update knowledge of contemporary image installation art. Explore the profound value influence of contemporary image installation art and elaborate on the development trend of contemporary image installation art with constructive suggestions.

Further user research has shown that our method can significantly improve the interactive effect and experience of public users in new media interactive image art [12]. In this process, our interactive recommendation method can recommend relevant poems, background information, etc. based on user behaviour and interests, helping users to have a deeper understanding of poets and works. Meanwhile, this method can also stimulate user creativity and imagination, promoting deep interaction between users and their works. This can not only enhance the viewing experience of users but also promote the innovation and development of new media interactive image art. Under the background of NMA, video art is undergoing unprecedented changes. As a modern art form that combines digital technology, network technology and multimedia technology, NMA is attracting more and more artists and audiences with its unique charm. Compared with traditional artistic creation, NMA pays more attention to the application and innovation of technology and injects new vitality into artistic creation through digital means. CAD-based HCI technology, as a key technology in the creation of NMA, is promoting the development of NMA with its powerful functions and flexibility. CAD-based HCI technology provides artists with a brand-new creative way, which makes artistic creation not limited to traditional brushes and canvases, but through computer-aided design software to achieve more efficient creation. Artists can use CAD technology to draw, model and render accurately, thus creating more diverse artistic effects [13].

With the continuous progress of technology and the continuous expansion of the market, it is expected that by 2022, the market size of computer graphics and vision-related fields will further expand to 755.5 million yuan. The research focuses on the field of graphic visual communication, delving into the characteristics of graphic information, its historical evolution, and the closely related theoretical frameworks of cognitive psychology, semiotics, etc. Interface design is particularly important in the era of mobile media, as it directly affects the interactive experience between users and new media interactive image artworks. Designers are deeply integrating graphics and information through continuous technological innovation and artistic exploration, creating more diverse and interactive artworks. Especially in new media interactive image art, graphics can not only convey information but also involve the audience in the process of creating and performing works through mechanisms such as interaction and feedback. This trend is particularly evident in the field of interactive image art in new media. For example, how to better combine CAD technology with artistic creation and realize the perfect integration of technology and art; How to improve the usability of CAD technology so that more artists can benefit from this technology; And how to deal with the impact of the digital age on artistic creation.

This article presents the creation and execution of an interactive image artistry system utilizing texture transmission. By merging CAD technology with computer vision, the system automatically performs video splitting, texture synthesis and transmission, video abstraction, fusion, and other procedures based on input video, sample texture, and optical flow field data. The end result is a rendered video exuding a distinct artistic flair. Through our exploration and analysis, we aspire to advance NMA's progression and propagate the broader utilization of CAD-based HCI technology in artistic endeavours. A comprehensive study of this technology's application and evolution will enhance our comprehension of NMA's essence and breathe fresh life into its future advancements.

(1) This piece not only examines the role of CAD-based HCI technology in NMA but also illustrates the potential for seamless integration between the two through our system's practical design and deployment.

(2) Our interactive system facilitates an automated video processing sequence, encompassing video splitting, texture synthesis and transmission, video abstraction, the merging of texture layers with video frames, and ultimately, video encapsulation.

(3) The system incorporates groundbreaking video abstraction techniques to accentuate the artistic impact, seamlessly integrating the refined texture layer with the original video frame, cultivating a one-of-a-kind artistic aesthetic.

(4) Introducing optical flow field data into the system marks an innovative application approach. This data not only guides texture transmission and synthesis but also ensures texture continuity in dynamic visuals, elevating the overall artistic impression.

Initially, this article outlines the significance and backdrop of NMA and CAD-based HCI. It then elaborates on the practical applications and challenges of CAD technology in NMA's visual expression. Following this, it details the design and execution of an interactive image art system centred around texture transmission. Lastly, it offers a synopsis and anticipates the future evolution of CAD-based HCI within NMA.

2 RELATED WORK

Özdemir et al. [14], based on computer-aided design software, has delved into its application in environmental art and design teaching, with a particular focus on how new media interactive image art can bring innovation to this teaching field. Firstly, a clear concept definition was given for computer-aided design and environmental art design, and then how information technology can help improve the ability of environmental art design, especially the transformation brought about by the integration of new media interactive image art, was elaborated. Students have shown a strong interest in this novel art form, actively utilizing computer-aided design knowledge and new media interactive image art skills to participate in the practice of environmental art design. From the perspective of curriculum design, it analyzes the integration of new media interactive image art in environmental art courses and explores how to incorporate this art form into the teaching system effectively. Shandong et al. [15] aim to enhance environmental art and design capabilities through the application of information technology and explore the role and influence of new media interactive image art in it. At the same time, we also conducted in-depth research on the teaching methods of teachers, examining how they can use new media interactive image art to enrich teaching methods and improve students' learning interest and participation. Combined with the characteristics of interactive image art in new media, this paper analyzes how to fully tap into the potential of this software in environmental art design. In terms of the application of computer-aided design software, it deeply explores its advantages in environmental art colour design and 3D model design. In addition, we also focused on the learning situation of students. Through practical application, it has been found that new media interactive image art can not only stimulate students' interest in learning but also enhance their ability in environmental art colour and model design. The practical results show that by combining computer-aided design software and new media interactive image art, students' works are more vivid, interesting, interactive, and innovative.

With the emergence of a large number of free, open-source libraries, users can now train complex models with minimal code. In the context of interactive image art in new media, there is an urgent need for large-scale and representative datasets to support research. This greatly simplifies the tedious process of handcrafting complex interactions in the past. However, this convenience is also accompanied by a series of new challenges and potential pitfalls. This is because new media interactive image art is not only a display of technology but also a fusion of art and technology, which needs to consider multiple aspects such as user emotions, cognition, and behavior. Therefore, the UCD process proposed by Wang et al. [16] is not only a technical framework but also a user-centered way of thinking. In order to meet this demand, necessary adjustments have been made to the User

Centered Design (UCD) process, adding two key steps: first, data-driven system construction, and second, system user validation. These datasets not only require careful design to evaluate the interaction between users and models but also require clear indicators to define when our system can meet the needs of users in terms of artistic experience. Although the best practices for deep learning suggest rigorous testing on existing datasets. These steps ensure that when designing new media interactive image artworks, we always prioritize user experience and guide our design decisions through data. If we do not evaluate through actual use cases, it is difficult to know how the model performs in real-world scenarios, and we cannot determine whether users can smoothly adapt and enjoy interaction with the model. However, in the field of interactive image art in new media, further user research is needed to reveal more factors that affect user experience. New media interactive image art emphasizes real-time interaction and feedback between users and works, therefore, datasets need to be able to capture these subtle and important user behaviours. It guides us to pay more attention to user needs and experiences, thereby creating more engaging works in the field of interactive image art in new media.

Wang et al. [17] aim to stimulate the creative inspiration of designers further and significantly enhance their innovation ability in the field of new media interactive image art by improving existing computer graphics and image processing technologies. Optimizing interface design can better guide users to participate in the interaction and enhance the attractiveness and dissemination of works. In the context of interactive image art in new media, computer graphics have become not only an economically effective way of information transmission but also a key medium for establishing deep-level interaction between artists and audiences. Graphic information, with its intuitive and vivid characteristics, has radiated new vitality on new media platforms, bringing audiences an unprecedented visual experience. The experimental results show that graphics have unique advantages in the process of information transmission, and their intuitiveness and ease of understanding enable information to be transmitted to the audience more quickly and effectively. This means that the communication mode that integrates information and graphics has become a future development trend and will be widely applied in more fields, playing a greater role.

The research and application of interactive image art in new media have received increasing attention in recent years, among which the structural changes of social networks are of great significance for understanding the collaboration between artists, the dissemination of works, and audience interaction. Wang [18] aim to incorporate team-level tasks in the field of interactive image art in new media into task classification and perform graphical visualization to reveal network structure changes in team collaboration. This classification system not only considers the direct cooperative relationship between artists, but also covers multiple dimensions such as resource sharing, creative collision, and technical support. The interaction field in contemporary image installation art has been extended with the needs of the times and scientific and technological progress, and the exploration and expansion of the interaction field also demonstrates the de-territorialization of contemporary image installation art. Art and technology are constantly developing in the intersection and integration, and image installation art is gradually entering the public eye, which seems to be different from traditional art forms. The close integration of art and technology, the integration and symbiosis of fields, and the promotion of new formats in the derivative digital cultural industry. Contemporary image installation art, with its innovative modern techniques and multi-dimensional interactive ways and design expressions, has mobilized people's enthusiasm for interaction with it. Wang et al. [19] combined typical cases, starting from multiple perspectives, disciplines, and dimensions, and used comprehensive analysis methods to comprehensively explore the pioneering channels in the field of interaction in contemporary image installation art, and explore its deep value; Intended to broaden the horizons of image installation art creators.

The experimental results indicate that these visual views can effectively reveal the changes in the collaborative network structure in the field of new media art, and have been highly recognized by users. Through this study, can we better understand the team collaboration network structure in the field of interactive image art in new media. To verify the effectiveness and practicality of these visual views, an academic collaborative literature dataset was selected as a case study for analysis. Based

on the characteristics of artist collaboration networks in the field of new media art, it has established a task classification method suitable for this field.

The traditional art teaching method often leans towards imparting knowledge in cultural courses, neglecting the uniqueness of the art subject and the personalized needs of students, resulting in low teaching efficiency. Yang et al. [20] propose a teaching model based on new media interactive image art, which combines an intelligent classroom environment and aims to achieve visual teaching of pattern interaction. These design elements together create a dynamic and interactive learning environment, enabling students to actively participate in art learning. This not only improves teaching efficiency but also provides students with more personalized and diverse learning experiences. This model first constructs a rich and diverse teaching design, including the presentation of concept maps, real-time discussions between teachers and students, convenient note-taking areas, clear knowledge structure trees, as well as knowledge review and self-evaluation areas. Constructing a cognitive map through new media technology to help students establish a clear knowledge framework; Secondly, by guiding concepts, stimulate students' creativity and imagination. Finally, through interactive practice and feedback, consolidate students' learning outcomes and enhance their artistic literacy.

3 IMAGE ARTISTIC INTERACTIVE SYSTEM BASED ON TEXTURE TRANSMISSION

According to the source video provided by users and the different sample textures selected by users according to their personal preferences, the system can render artistic images with various unique artistic styles. Firstly, the multi-style texture layer is synthesized. Figure 1 shows the interactive system of image art.

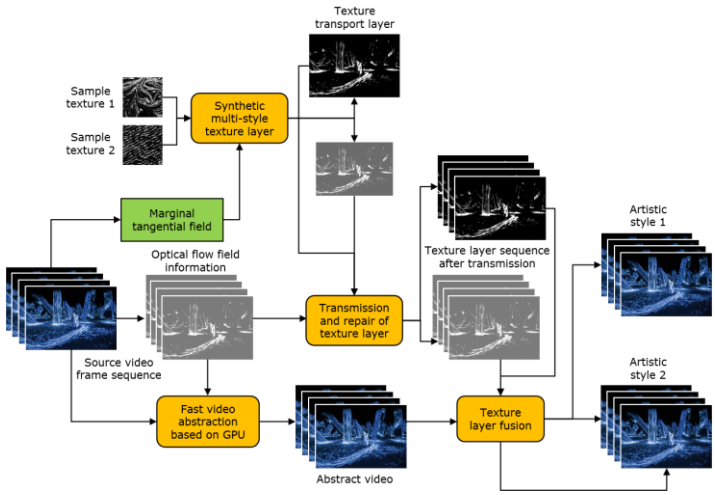

Figure 1: Interactive system of image artistry.

Creators imagine and predict the actual artistic effects when creating art, which is in contrast to the actual effects created by the audience. Because the audience's subconscious evaluation of the work during the experience period is the most authentic and informative. The interactive image installation artwork is a semi-open system, where the audience serves as the information source system to output body information. After information detection and collection, the artistic effect is finally presented by the media performance system. On the one hand, it is possible to observe the audience's on-site reactions, and the number of viewers can reflect the attractiveness of the work to the audience. On the other hand, it is possible to set up a feedback section on the work site, directly collecting the audience's suggestions and opinions on the work, as well as their own feelings. As it is

the first time to collect information, it also has more reference value. The interaction time and frequency of the audience can reflect their level of love for the work, and the emotional expression and language during the interaction can reflect the fit between the audience and the work. If the actual effect is close to the expected effect, it indicates that the audience has a basic understanding of the interaction with the work and can also have a basic understanding of the work.

Set the connected area as:

$$C_i \quad i = 1,2,\ldots,n \tag{1}$$

Let i stand for the i-th connected region, where n denotes the total count of connected regions. The width, height, and area of this connected region are symbolized as L_i, W_i, and S_i, respectively. These three parameters must satisfy the following criteria:

$$S_i \geq S_{\min} \cap S_i \leq S_{\max} \tag{2}$$

$$\frac{L_i}{W_i} \geq \left(\frac{L}{W}\right)_{\min} \cap \frac{L_i}{W_i} \leq \left(\frac{L}{W}\right)_{\max} \tag{3}$$

$$\frac{S_i}{L_i \times W_i} \geq \left(\frac{S}{L \times W}\right)_{\min} \tag{4}$$

If the connected region meets certain criteria—specifically, if its area falls within the range defined by $S_{\min}$ (minimum) and $S_{\max}$ (maximum), its length-width ratio does not exceed the limits set by $\left(\frac{L}{W}\right)_{\max}$ and $\left(\frac{L}{W}\right)_{\min}$, and its duty cycle is at least $\left(\frac{S}{L \times W}\right)_{\min}$ — then it qualifies as a candidate region. These candidate regions are identified through a rough segmentation process applied to known scene images and subsequently classified based on extracted shape features.

According to the total number of video frames and the resolution information (in this example, the video contains 480 frames, and the resolution of each frame is 1080×640), a three-dimensional grid structure is carefully constructed, and its size is set to (1080,640,480). This design ensures that every frame and pixel in the video can correspond to a dedicated block (as shown in Figure 2).

Within each block, the processing unit is further refined, and nine independent threads are created. These threads work together to select a 3D neighborhood forward and backward in time for the currently processed pixel according to the optical flow field information. This design enables each thread to focus on a specific neighbourhood in a video frame.

Subsequently, this thread will independently perform morphological opening and closing operations. Through parallel computing, not only is the processing speed greatly improved, but the morphological operation is also completed quickly.

Thanks to the powerful computing power of GPU and efficient parallel processing strategy, the system has shown excellent performance in processing this video. By making full use of the parallel computing ability of GPU, it not only optimizes the processing speed but also provides the possibility for real-time or near-real-time video processing applications.

Firstly, the system will analyze the sample texture and extract its feature vector. Then, for each frame in the video, the system will calculate the similarity between it and the sample texture to find the best matching area. Next, through the texture synthesis algorithm, the texture features of these matching areas are fused into the original frame to form a new texture layer. The traditional method for image binarization involves manually setting a threshold, denoted as T, and examining the relationship between the grayscale intensity $f\ x,y$ of a specific point x,y in the image, and this threshold T. The grayscale intensity of the binarized image would be determined as follows:

$$g\ x,y\ = \begin{cases} 255 & f\ x,y\ \geq T \\ 0 & f\ x,y\ \leq T \end{cases} \tag{5}$$

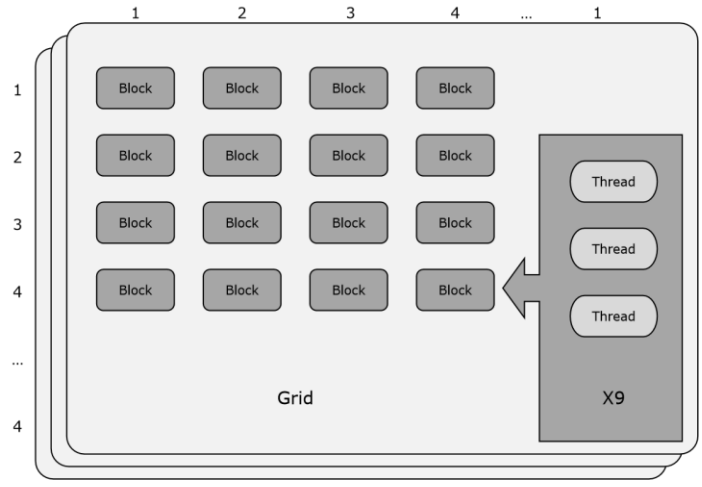

Figure 2: GPU-side thread allocation for video processing.

Compute the mean grayscale value:

$$\mu_T = \sum_{i=0}^{255} ih \ \ i \tag{6}$$

The node degree is determined by adding up all the values in each row of the similarity matrix. To create the degree matrix, referred to as D, all the degree values are placed along the diagonal, with zeros elsewhere. Definition:

$$D_{ij} = \sum\nolimits_{j=1}^{n} w \ \ i,j \tag{7}$$

To determine if a point designated as x,y, within the region that has been filled, we examine its pixel value against the initially given value. If a match is found, signifying that the point remains unfilled, we modify its colour or brightness. Following this, we inspect neighbouring pixels and recursively carry out this procedure to accomplish area filling.

In the process of texture synthesis, there may be some discontinuous or defective areas. In order to solve this problem, the system adopts a texture inpainting algorithm. This algorithm can automatically detect and repair these imperfect areas and ensure the continuity and naturalness of the texture layer. Let CB represent the current background image and F_n represent the n frame image of the sequence. This arrangement facilitates the computation of the different template DM for the n frame using the background difference method, as outlined below:

$$DM \ \ x,y \ = \begin{cases} 1, & if \left| F_n \ \ x,y \ - CB \ \ x,y \right| > T_a \\ 0, & else \end{cases} \tag{8}$$

T_a represents an adaptive threshold. The weighted sum of K Gaussian functions characterizes the distribution of each background pixel, and the corresponding probability can be determined using the following formula:

$$p \ \ X_t \ = \sum_{i=1}^{K} w_{i,t} \eta \ \ X_t, \mu_{i,t}, \sum\nolimits_{i,t} \tag{9}$$

At the time t, $w_{i,t}$ denotes the weight of the i-th Gaussian function. Meanwhile, the expectation and covariance matrix for the i-th Gaussian function at a time t is given as follows:

$$\mu_{i,t}, \sum_{i,t} = \sigma_k^2 I \tag{10}$$

Let's assume that the R,G,B channels are mutually independent, and η represent the Gaussian probability density function.

The K Gaussian functions are organized based on $w_{i,t} / \sigma_k$ criteria, and the initial B functions serve as the backdrop representation for this particular data point. B is determined using the formula provided below:

$$B = \arg\min_b \left(\sum_{j=1}^{b} w_{j,t} > T \right) \tag{11}$$

The threshold T serves to fine-tune the model's adaptability. An increase T corresponds to a rise in B, leading to a more extensive background model composed of multiple Gaussian functions. Conversely, a decrease B results in a reduced number of Gaussian functions within the background model.

After the texture layer is synthesized and repaired, the system enters the stage of video abstraction and texture layer fusion. The goal of this stage is to fuse the processed texture layer with the original video frame to form a unique artistic style. In order to emphasize the artistic effect, the system will abstract the original video frame. By extracting key features, simplifying details and enhancing colours, video frames are more in line with the aesthetic needs of artistic creation.

4 RESULT ANALYSIS AND DISCUSSION

4.1 Experimental Setup

In order to deeply verify the performance and effect of the image artistic interactive system based on texture transmission, a series of experiments were carefully planned in a high-performance computer environment. In this study, various types of videos covering natural scenery, urban landscapes and people's activities are selected as experimental data sets, and sample textures with different styles are prepared. Through careful pretreatment, careful texture selection, comprehensive system processing and rigorous result evaluation, it is expected to comprehensively test the naturalness of texture transmission, artistic effect and processing speed of the system in different video scenes. During the experiment, the processing time will be strictly monitored and recorded, the accuracy of texture transmission will be carefully compared, and artists and audiences will be invited to rate their satisfaction with the artistic effect. These evaluation indicators will provide us with valuable data support and help optimize the performance of the follow-up system, so as to achieve higher quality and efficiency in the field of NMA creation.

4.2 Experimental Results

In the field of NMA, the extraction of image information is a crucial link, which is directly related to the subsequent processing quality and artistic expression effect of artistic works. Figure 3 shows the extraction results of the original method, while Figure 4 shows the extraction results of this method. By comparing and analyzing these two pictures, we can clearly see the differences between the two methods of image information extraction.

The original method may retain more details of the original image in the extraction process, but it also introduces some unnecessary noise and interference information, which affects the subsequent artistic processing effect to some extent. The novel approach introduced in this article exhibits evident superiority in extracting image information, as opposed to traditional methods. As shown in Figure 4, the new method not only effectively extracts the key information in the image, but

also better suppresses the noise and interference, making the extraction results clearer and more accurate. This provides better basic data for the subsequent artistic treatment, which helps improve the final artistic expression effect.

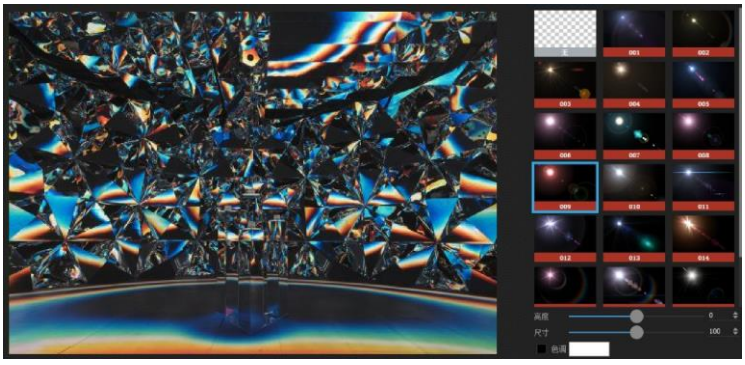

Figure 3: Extraction result of the original method.

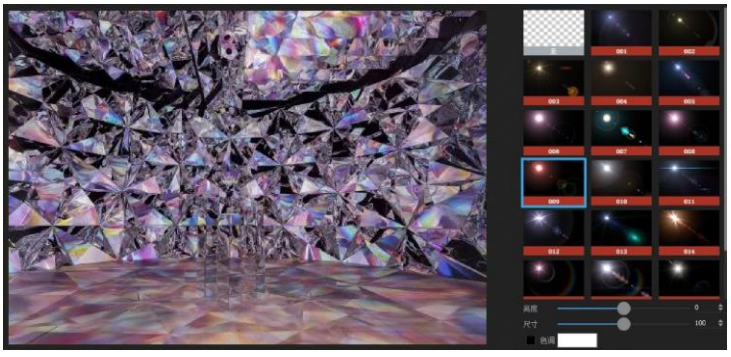

Figure 4: Extraction result of this method.

The new method pays more attention to the capture of image structure information in the extraction process and can outline the outline and edge of the image more accurately, thus retaining the main features of the original image. At the same time, the new method also uses advanced algorithms to further optimize and process the extraction results, ensuring the quality of the extracted data.

Figure 5 illustrates the comparison of errors among various algorithms on the training dataset. Notably, distinct algorithms exhibit different performances on the training data. Nevertheless, it is essential to be mindful that excessive fitting to the training data could potentially compromise the algorithm's ability to generalize on unfamiliar datasets.

To assess the generalization capabilities of the algorithm, an additional error comparison analysis was conducted on the test dataset, and the outcomes are presented in Figure 6. This error comparison primarily evaluates the algorithm's predictive capabilities for unknown data. When compared to conventional algorithms, the one introduced in this article demonstrates superior performance on the test dataset. The algorithm's error rate on the test dataset has decreased by approximately 15%, representing significant progress. This achievement indicates that the algorithm described in this article not only excels in fitting training data but also possesses stronger generalization skills for handling unfamiliar data.

In order to deeply explore the artistic effect of NMA images, 60 professionals with rich experience in the field of NMA creation were specially invited as the raters of this study. These professionals not only have profound artistic attainments but also have in-depth understanding and practical

experience in new media technology. Figure 7 shows the scoring results of the artistic content of the image. The scores of different works in artistry, innovation, technical realization and other dimensions.

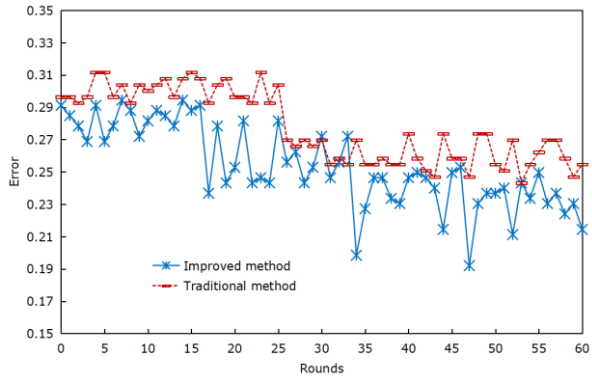

Figure 5: Error on training set.

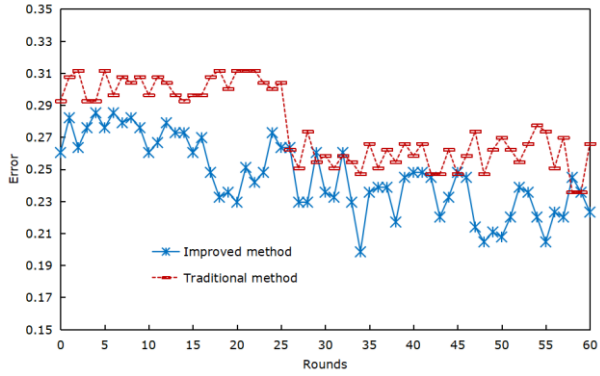

Figure 6: Error on test set.

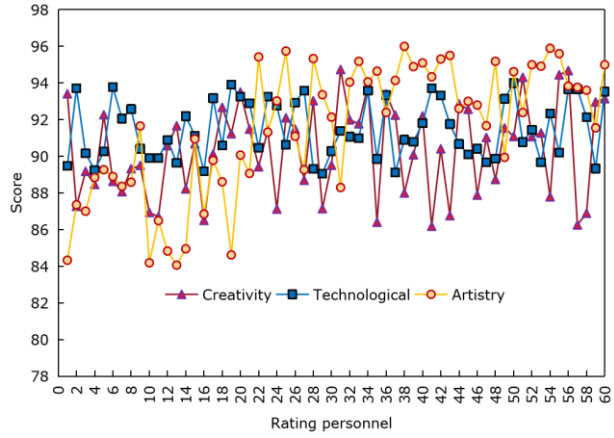

Figure 7: Image artistic content score.

High-rated works usually show strong creativity and uniqueness, which can bring novel artistic experiences to the audience. These works are excellent in theme selection, expression, and visual effects. Excellent works can often touch the emotions of the audience and resonate. Graders generally believe that works that can evoke emotional resonance are more artistic. High-scoring works perform well in technical applications and can skillfully combine new media technology with artistic creation to create unique visual effects and interactive experiences.

5 CONCLUSIONS

When delving into the transformative impact of CAD-driven HCI technology on NMA (New Media Art) creation, we cannot help but be amazed by the powerful potential of this technology. After a series of carefully designed experiments and in-depth analysis, we can clearly see that CAD-driven human-computer interaction not only greatly improves the efficiency of artistic creation but also greatly enriches the expression skills of artists, allowing audiences to enjoy a richer interactive experience. Our research focuses on utilizing CAD-driven HCI technology to provide artists with more precise operational tools and introducing innovative demonstration methods using NMA images. By constructing an interactive system centred on texture mapping, artists can more intuitively and vividly convey their creative concepts and visions, bringing an unprecedented artistic feast to the audience. The research results indicate that artworks using CAD-driven HCI technology are more visually active, have richer emotional depth, and greatly improve audience engagement. This technology not only enhances the multifunctionality of artistic creation but also opens up new paths for artistic innovation. It allows artists to explore various artistic styles and expressions freely, pushing the influence of NMA to a broader field.

In summary, CAD-driven HCI technology has shown great potential and value in shaping NMA images. Looking into the future, we have reason to believe that CAD-driven HCI will become an indispensable tool for NMA creation, providing artists with broader creative space and richer artistic expression methods.

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REFERENCES

[1] Chen, X.; Zeng, W.; Lin, Y.; Ai-Maneea, H.-M.; Roberts, J.; Chang, R.: Composition and configuration patterns in multiple-view visualizations, IEEE Transactions on Visualization and Computer Graphics, 27(2), 2020, 1514-1524. https://doi.org/10.1109/TVCG.2020.3030338
[2] Danchenko, N.: Acousmatic music: principles of graphic visualization, Bulletin of Kyiv National University of Culture and Arts Series in Musical Art, 3(1), 2020, 37-47. https://doi.org/10.31866/2616-7581.3.1.2020.204337
[3] Fan, M.; Li, Y.: The application of computer graphics processing in visual communication design, Journal of Intelligent & Fuzzy Systems, 39(4), 2020, 5183-5191. https://doi.org/10.3233/JIFS-189003
[4] Gresse von, W.-C.; Hauck, J.-C.; Pacheco, F.-S.; Bertonceli, B.-M.-F.: Visual tools for teaching machine learning in K-12: A ten-year systematic mapping, Education and Information Technologies, 26(5), 2021, 5733-5778. https://doi.org/10.1007/s10639-021-10570-8
[5] Guo, S.; Li, X.: Computer-aided art design and production based on video stream, Computer-Aided Design and Applications, 18(S3), 2020, 70-81. https://doi.org/10.14733/cadaps.2021.S3.70-81
[6] He, C.; Sun, B.: Application of artificial intelligence technology in computer-aided art teaching, Computer-Aided Design and Applications, 18(S4), 2021, 118-129. https://doi.org/10.14733/cadaps.2021.S4.118-129

[7] He, G.: Schema interaction visual teaching based on smart classroom environment in art course, International Journal of Emerging Technologies in Learning (IJET), 15(17), 2020, 252. https://doi.org/10.3991/ijet.v15i17.16441
[8] Ince, M.: Automatic and intelligent content visualization system based on deep learning and genetic algorithm, Neural Computing and Applications, 34(3), 2022, 2473-2493. https://doi.org/10.1007/s00521-022-06887-1
[9] Jin, H.; Yang, J.: Using computer-aided design software in teaching environmental art design, Computer-Aided Design and Applications, 19(S1), 2021, 173-183. https://doi.org/10.14733/cadaps.2022.S1.173-183
[10] Le, H.-V.; Mayer, S.; Henze, N.: Deep learning for human-computer interaction, Interactions, 28(1), 2020, 78-82. https://doi.org/10.1145/3436958
[11] Li, Y.; Qi, Y.; Shi, Y.; Chen, Q.; Cao, N.; Chen, S.: Diverse interaction recommendation for public users exploring multi-view visualization using deep learning, IEEE Transactions on Visualization and Computer Graphics, 29(1), 2022, 95-105. https://doi.org/10.1109/TVCG.2022.3209461
[12] Lu, Q.; Huang, J.; Sheng, K.: Analysis and visualization of group collaborative on social networks relationships, Journal of Computer-Aided Design & Computer Graphics, 33(2), 2021, 177-185. https://doi.org/10.3724/SP.J.1089.2021.18430
[13] Meng, W.; Huang, L.: Study on Design of interactive advertising in the environment of new media, Arts Studies and Criticism, 3(1), 2022, 93-97. https://doi.org/10.32629/asc.v3i1.711
[14] Özdemir, V.; Springer, S.; Yıldırım, A.: Thanatechnology and the living dead: new concepts in digital transformation and human-computer interaction, OMICS: A Journal of Integrative Biology, 25(7), 2021, 401-407. https://doi.org/10.1089/omi.2021.0100
[15] Shancong, M.-O.; Zhijia, X.-U.; Tang, W.: Product information modeling for capturing design intent for computer-aided intelligent assembly modeling, Journal of Northwestern Polytechnical University, 40(4), 2022, 892-900. https://doi.org/10.1051/jnwpu/20224040892
[16] Wang, Q.; Xu, Z.; Chen, Z.; Wang, Y.; Liu, S.; Qu, H.: Visual analysis of discrimination in machine learning, IEEE Transactions on Visualization and Computer Graphics, 27(2), 2020, 1470-1480. https://doi.org/10.1109/TVCG.2020.3030471
[17] Wang, X.; Cai, L.; Xu, Y.: Creation mechanism of new media art combining artificial intelligence and internet of things technology in a metaverse environment, The Journal of Supercomputing, 80(7), 2023, 9277-9297. https://doi.org/10.1007/s11227-023-05819-7
[18] Wang, Y.: Product design difference perception model based on visual communication technology, International Journal of Product Development, 26(1-4), 2022, 64-76. https://doi.org/10.1504/IJPD.2022.125329
[19] Wang, Z.; Wang, Y.; Sun, Y.: New media art design in commercial public space, International Journal of Computer Applications in Technology, 67(2-3), 2021, 244-251. https://doi.org/10.1504/IJCAT.2021.121534
[20] Yang, J.; Wang, C.; Jiang, B.; Song, H.; Meng, Q.: Visual perception enabled industry intelligence: state of the art, challenges and prospects, IEEE Transactions on Industrial Informatics, 17(3), 2020, 2204-2219. https://doi.org/10.1109/TII.2020.2998818