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Digital Art Creation and Visual Communication Design Driven by Internet of Things Algorithm

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Abstract. The Internet of Things (IoT) can provide designers with more accurate design data and more efficient design tools, thus helping them to better achieve their design goals. This article introduces the basic principle and characteristics of IoT algorithm, including data acquisition, data processing and data transmission. This article discusses how to apply IoT algorithm to computer-aided digital art image processing, including image feature detection, image classification and recognition. Through experiments and comparison of various methods, it is confirmed that the method in this article has good performance in dealing with image matching tasks. The method in this article can obtain good reconstruction results when processing different types and quality images, showing strong generalization ability. Moreover, the method in this article also has fast processing speed and high user satisfaction, which can meet the requirements in practical application. The human-computer interaction realized by IoT technology can enable designers to interact and cooperate with computers more directly, thus creating more innovative and personalized works.

Keywords: Internet of Things; Digital Artistic Creation; Computer-Aided; Visual Communication
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1 INTRODUCTION

With the continuous growth of sci & tech, the fields of digital art and visual communication (VC) design are undergoing unprecedented changes. Computer-aided design (CAD) has greatly changed designers' creative methods and design processes. However, although the application of CAD has brought revolutionary changes in many aspects, in the field of digital art creation and VC design, designers often rely too much on preset templates and traditional creative methods, resulting in the lack of innovation and individuation of works. Digital signal processing is a process of converting analog signals into digital signals and performing various processing on digital signals. CNN can be used for tasks such as image filtering, image enhancement, and object detection in digital signal processing. For example, in image filtering, CNN can automatically learn the parameters of the filter to achieve efficient filtering of images. Digital circuit design is the foundation for manufacturing digital systems. Traditional digital circuit design methods require manual selection and connection of circuit components, while CNN can be used for automated design. Bangari et al. [1] By transforming circuit design problems into optimization problems, CNN can automatically learn and optimize circuit parameters, improving circuit performance and stability. Digital circuits are widely used in various digital systems, such as computers, mobile phones, smart homes, etc. CNN can be used for fault detection, performance evaluation, and optimization in digital circuit applications. For example, by using CNN to classify the output signals of circuits, automatic detection and localization of circuit faults can be achieved. In order to overcome this problem, this study aims to propose computer-aided digital art creation and VC design driven by Internet of Things algorithm.

IoT refers to the network for remote information transmission and intelligent management of articles through the Internet. In recent years, IoT technology has developed rapidly, and its application in various fields has become more and more extensive. In digital art and VC design, IoT technology can provide designers with more creative inspiration and richer material resources. Blikharsky et al. [2] reviewed the development and application of digital image correlation methods in the study of stress-strain states of reinforced concrete structures. By organizing and analyzing relevant literature, the background of digital image related methods and their application in the study of stress-strain states of reinforced concrete structures were introduced. And discussed its advantages and disadvantages, scope of application and limitations, as well as future development directions and challenges. Reinforced concrete structures have a wide range of applications in engineering, and their stress-strain state directly affects the performance and safety of the structure. Therefore, it is particularly important to conduct accurate, rapid, and non-destructive testing and evaluation of the stress-strain state of reinforced concrete structures. Moreover, IoT can also provide designers with more accurate design data and more efficient design tools, thus helping them better achieve their design goals. Traditional CAD design methods often require designers to spend a lot of time and energy to manually adjust various parameters and data, while using IoT algorithm can hand over these tedious tasks to computers, thus saving a lot of time and energy. Cultural relics often suffer from severe damage and corrosion due to their age. Color balance edge guided digital restoration technology can utilize computer image processing technology to perform virtual restoration of cultural relics, restoring their original appearance and details. Under the influence of natural environment and human factors, murals are prone to problems such as color degradation and peeling. Color balance edge guided digital restoration technology can achieve precise restoration of murals through high-precision scanning and image processing. Ciortan et al. [3] used high-precision scanning equipment to scan murals and obtain digital images of them. Then, color balance technology is used to analyze and process the digital image, adjusting parameters such as hue, saturation, and brightness to ensure that the repaired area remains consistent with the original color. Next, using edge guidance technology, the contour and texture direction of the repaired area are determined based on the edge information in the mural, ensuring that the repaired area matches the original shape and texture. Finally, output the repaired digital image in physical form to complete the restoration of the mural.

Moreover, because IoT algorithm can automatically process and analyze a large quantity of data, it can provide more accurate design data and more efficient design tools. Digital reality has become a highly anticipated frontier field. Digital reality technology can simulate various phenomena in the real world, providing humans with more accurate, convenient, and diverse services. In the research and application of digital reality, model-based methods play an important role in supervised learning. Dahmen et al. [4] explore a model-based approach for supervised learning from synthetic data in digital reality. In the field of intelligent transportation, supervised learning on a large amount of synthesized data can train models that can accurately predict traffic flow. This can help traffic management departments better plan traffic routes and improve traffic efficiency. In addition, with the continuous development of deep learning technology, the application of models based on deep neural networks in digital reality will also become increasingly widespread. These models can better handle complex nonlinear relationships and achieve breakthroughs in more fields. Traditional CAD design methods often rely on preset templates and traditional creative methods, which leads to the lack of innovation and individuation of works. Dhaya [5] proposed a secure and robust image watermarking scheme based on lightweight CNN. This scheme has fast training speed, low computational complexity, and strong anti-attack performance. The experimental results show that this scheme can achieve reliable extraction of copyright information and identity authentication while resisting common image processing operations. The proposed lightweight CNN secure and robust image watermarking scheme has certain advantages and disadvantages. In terms of advantages, this scheme adopts a lightweight CNN model, which has fast training speed and low computational complexity; At the same time, this scheme has strong robustness against attacks and can maintain the integrity and recognizability of the watermark under various common image processing operations. Using IoT algorithm can break this limitation and provide designers with more creative inspiration and richer material resources.

The image point cloud digital surface model is a three-dimensional model constructed from image data obtained by drones. Specifically, it obtains multi angle photos of the plantation through a high-resolution camera mounted on the drone. By utilizing computer vision technology and 3D reconstruction algorithms, these photos are transformed into a 3D point cloud model. This model can clearly present the surface morphology, structure, and plant growth status of the plantation. Fareed and Rehman [6] use computer vision technology to extract plant features from images, such as the shape, color, and size of leaves. These characteristics can be used to determine the growth and health status of plants. The processed image data is transformed into a 3D point cloud model using a 3D reconstruction algorithm, which can clearly present the surface morphology and structure of the plantation. In the constructed point cloud model, the rows of the plantation are extracted using methods such as region growth algorithm to obtain the growth status of each row of plants. For example, various sensor data obtained through IoT technology can be used to generate unique works of art; The man-machine interaction realized by IoT technology can enable designers to interact and cooperate with computers more directly, thus creating more innovative and personalized works. Usually, devices such as laser scanners or optical microscopes are used to obtain 3D morphology data of object surfaces. These data are usually stored in the form of point clouds. After obtaining the 3D morphology data of the object surface, it is necessary to extract its features. Feature extraction refers to extracting feature information related to the surface of an object from point cloud data, such as height, slope, curvature, etc. Common feature extraction methods include Gaussian filtering, edge detection, morphological processing, etc. Frischer et al. [7] achieved the diagnosis and evaluation of object surfaces by analyzing the extracted feature information. For example, by comparing the height differences of different regions, surface unevenness or defects can be detected. By analyzing the curvature distribution, the roughness or texture characteristics of an object's surface can be evaluated.

Computer-aided digital art creation and VC design driven by IoT algorithm have many advantages and potentials. This method can not only improve the efficiency and accuracy of design, improve the innovation and individuation of design, and promote the cross-integration of design and other fields, but also provide designers with broader creative space and more diverse creative methods. This article will introduce in detail how to use IoT algorithm to improve the use of CAD in digital art creation and VC design. Firstly, the basic principle and characteristics of IoT algorithm are introduced, including data acquisition, data processing and data transmission. Secondly, it discusses how to apply IoT algorithm to digital art image processing, including image feature detection, image classification and recognition. Finally, explore how to use IoT algorithm to improve the efficiency and effect of digital art creation and VC design. The research has the following innovations:

(1) In order to improve the experience of CAD in digital art creation and VC design, this article studies how to apply IoT algorithm to digital art image processing, including image feature detection, image classification and recognition.

(2) By using the technologies of data collection, data processing and data transmission of IoT, we can better tap the creative inspiration and material resources in digital art and VC design, and improve the efficiency and accuracy of design.

(3) Designers can use various sensor data obtained by IoT technology to generate unique works of art, or interact and cooperate with computers more directly through human-computer interaction, thus creating more innovative and personalized works.

(4) In the traditional CAD design method, designers often only consider the initial stage of design, but ignore the sustainability of design. The use of IoT algorithm can enhance the sustainability of the design.

Firstly, this article introduces the theoretical basis of IoT algorithm and digital art creation; Then the optimization of computer-aided digital art image processing is realized by combining IoT algorithm; The feasibility of applying this algorithm in artistic creation CAD system is tested by experiments. Finally, the results and contributions are summarized.

2 THEORETICAL AND TECHNICAL BASIS

With the continuous development of technology, computer-aided art design and production have become an important technical means in the field of art. As one of them, video streaming technology has the characteristics of real-time, interactivity, and dynamism, bringing more possibilities for art design and production. Guo et al. [8] explored computer-aided art design and production based on video streaming, and analyzed its application and advantages in modern art creation. Computer assisted art design and production refers to the process of using computer software and hardware technology to design, produce, modify, and render artistic works. Video streaming technology can achieve precise color restoration and detail representation, ensuring the accuracy and quality of artistic design and production. Through interactive control technology, designers can dynamically adjust and modify videos, achieving more flexible and innovative design effects. Video streaming technology can be integrated and applied with other computer technologies, such as virtual reality and augmented reality, expanding the application fields and forms of artistic design and production. Traditional discharge detection methods mainly rely on electrical parameter measurement and sound detection, but these methods often cannot accurately identify the start and end times of discharge, and are susceptible to environmental noise interference. In recent years, with the development of spectroscopy and digital image processing technology, people have begun to explore the use of spectroscopy and digital image technology for discharge state diagnosis. Guo et al. [9] introduced a discharge state diagnosis colorimetric method based on spectra and digital images, and analyzed its application in discharge detection. The visible light field mainly utilizes the light signal generated by discharge for detection. In the field of infrared light, the thermal effect generated by discharge is used for detection. In the field of ultraviolet light, the arc phenomenon generated by discharge is mainly used for detection. However, these methods often only detect specific types of discharge phenomena and are susceptible to environmental factors.

In the teaching of environmental art design, the application of computer-aided design software is becoming increasingly widespread. It can not only improve design efficiency, but also help students better understand and master design concepts and skills. Jin and Yang [10] discussed the application of computer-aided design software in environmental art design teaching, and analyzed its advantages and disadvantages, providing reference for teachers to better utilize these software to improve teaching quality. Students can use computer-aided design software to conceptualize and design schemes, which can more intuitively display the design scheme and facilitate modifications and adjustments. During the construction drawing design phase, students can use software such as AutoCAD to draw detailed construction drawings, including plans, elevations, sections, etc. This not only improves design efficiency, but also reduces errors and errors. Using software such as 3ds Max can create exquisite renderings, including effects for various indoor and outdoor scenes. This not only helps students better understand the design scheme, but also improves their aesthetic ability. In art and design education in universities, the application of computer-aided technology can not only improve students' design efficiency, but also cultivate their innovative thinking and practical abilities. Jin et al. [11] aim to explore how to innovate art and design education models in universities based on computer-aided technology, in order to better cultivate art and design talents with high innovation and practical abilities. Computer aided design software can provide precise dimensions and shapes, avoid human errors, and make designs more accurate. Through computer-aided design software, team members can easily share and modify designs, improving team collaboration efficiency. Computer aided design software can simulate real design environments, allowing students to learn and understand design concepts in practical operations, and cultivate innovative thinking.

In today's information society, computer-aided technology has penetrated into various fields, including the field of graphic design and visual aesthetics. Computer assisted technology, with its unique advantages, provides more possibilities for graphic design and also opens up new ideas for designers. In terms of visual art creation, computer-aided technology provides designers with rich image processing software and painting tools. This software has powerful image processing functions that can help designers achieve precise color matching, graphic drawing, and modification during the creative process, thereby improving the quality and efficiency of visual art creation. Computer assisted technology has also played an important role. By using software such as CAD, Lin and Liu [12] can quickly create 3D models and layout and render virtual scenes. This makes the display design more realistic and vivid, bringing an immersive experience to the audience. By using image processing software such as Photoshop, photos can be beautified to enhance brand image; By using animation production software such as Flash, vivid and interesting animated advertisements can be created to attract the attention of the audience. Liu and Yang [13] explored how to use computer-aided design software in practical teaching to cultivate students' innovative thinking and practical abilities. In the landscape design of a certain university, teachers require students to use CAD software for modeling and rendering. By hands-on operation of the software, students not only master skills but also stimulate innovative thinking. At the same time, the teacher also encourages students to learn and discuss with each other in the team, improving their teamwork ability. CAD software can not only improve the efficiency of design, but also help students better understand design concepts and achieve innovation. The aim is to explore how to effectively introduce computer-aided design software into environmental art design teaching, in order to cultivate students' innovative thinking and practical abilities. Ma et al. [14] proposed a universal image fusion method based on Swin Transformer. Firstly, we divide the input image into multiple small blocks and use Swin Transformer for feature extraction. Then, we fuse the extracted features and use the fused features to reconstruct or enhance the target image. In the experiment, we used different datasets and experimental scenarios to verify the performance of this method, including medical image fusion, remote sensing image fusion, etc. The experimental results show that the general image fusion method based on Swin Transformer can achieve better fusion results than traditional methods. In medical image fusion, this method can better preserve the detailed information in the original image; In remote sensing image fusion, this method can improve the resolution and clarity of the image. In addition, this method also has good generalization performance and can adapt to different datasets and experimental scenarios.

Fruit market sales are another important task in fruit image processing, with the aim of increasing fruit sales and sales through image processing technology. Convolutional neural networks also have great potential in fruit market sales. Naranjo et al. [15] proposed a fruit market sales method based on convolutional neural networks, which uses multiple convolutional and pooling layers to extract image features and fully connected layers for price prediction. The experimental results indicate that this method can predict the price of fruits based on their characteristics, thus providing valuable reference for fruit sales. This article reviews the application of convolutional neural networks in fruit image processing, including fruit classification, quality detection, and market sales. Convolutional neural networks have powerful image processing capabilities and high accuracy in fruit image processing, and have become an important research direction in this field. Roszkowiak et al. [16] introduced a clustering kernel splitting method based on recursive distance transformation in digital pathological images and demonstrated its application in EURASIP image and video processing. Through experimental verification, this method can effectively segment and recognize cluster nuclei in images, providing more accurate and reliable information for pathological diagnosis. The core idea of this article is to use recursive distance transformation to process digital pathological images, and use the obtained distance map for clustering kernel segmentation and recognition. Recursive distance transformation is an effective image processing method. It can calculate the distance between image pixels to obtain a distance map of the image, thereby better capturing the structural information of the image. Digital art history is an extension and supplement to traditional art history. It uses digital technology to store, display, and analyze art works, providing more possibilities for art research. Museums, as art exhibition and collection institutions, have also begun to attempt to apply digital technology to exhibitions and collections. Westerby and Keegan [17] explore the relationship between digital art history and museums, using the online academic collection catalog of the Chicago School of Visual Resources Arts as an example. By analyzing the online academic collection catalog of the Chicago School of Visual Resources Arts, we found a close connection between digital art history and museums. Firstly, digital technology provides more possibilities for the collection and protection of museums. For example, through high-resolution scanning and photo capture technology, artworks can be converted into digital images for permanent preservation and display.

3 COMPUTER-AIDED DIGITAL ART IMAGE PROCESSING DRIVEN BY IOT ALGORITHMS

IoT refers to the network for remote information transmission and intelligent management of articles through the Internet. IoT algorithm is an algorithm designed for the data characteristics and application requirements in IoT. Its basic principle is to realize the intelligent management and control of goods by collecting, processing and transmitting the data in IoT. IoT devices can collect all kinds of data in real time, such as environmental parameters such as temperature, humidity, pressure and illumination, as well as the operating state of the devices themselves. These data are transmitted through the Internet, which provides the basis for subsequent data processing. Its collected data needs a series of processing and analysis, such as data cleaning, data classification, data mining and so on. These processes can help us extract valuable information from massive data and provide support for intelligent management and control. Real-time information exchange is needed between IoT devices to realize remote control and status monitoring of devices. Therefore, the stability and security of data transmission is an important feature of IoT algorithm.

Digital artistic creation and VC design refer to artistic creation and design by computer. Computer graphics is a science that studies how to use computers to generate images. In digital art creation, computer graphics technology can help artists create various wonderful visual effects, such as 3D modeling, rendering, animation and so on. Digital image processing is a technology to enhance, repair and synthesize images by mathematical methods. In VC design, digital image processing technology can help designers improve the quality and expressiveness of images, such as image restoration and color adjustment.

Human-computer interaction is a technology to study how to exchange information efficiently between people and computers. In digital art creation and VC design, human-computer interaction technology can help designers interact and cooperate with computers more directly, thus improving the efficiency and accuracy of creation. For example, through touch screen, mouse, keyboard and other devices, designers can operate computers more intuitively to create and design. In the computer-aided digital art creation and VC design driven by IoT algorithm, various related technologies need to be used. The realization methods of data acquisition technology include selecting suitable sensors and designing efficient data acquisition circuits. In order to collect the temperature and humidity of the environment, you can choose to use temperature sensors and humidity sensors. These sensors can collect environmental parameters in real time and transmit them to the computer for processing through the data acquisition circuit.

The realization methods of data processing technology include data cleaning, data preprocessing, data mining and so on. When dealing with a large quantity of environmental data, it is needed to clean and preprocess the data first to remove invalid and incorrect data and normalize the data. Then, data mining technology can be used to discover the patterns and laws in the data, so as to provide support for subsequent decision-making. The realization methods of data transmission technology include designing network protocols and formulating data transmission protocols. In the data transmission between IoT devices, it is needed to design appropriate network protocols and data transmission protocols to ensure the stability and security of data. Moreover, we need to consider how to optimize the data transmission speed and reduce the network delay.

The realization methods of computer graphics technology and digital image processing technology include using programming language and image processing library. In the creation of digital art, we can use programming languages such as Python and image processing libraries such as OpenCV to achieve various visual effects. The image quality directly affects the accuracy of digital art image processing. In the process of processing, it may be interfered by noise, occlusion, illumination and other factors, which will lead to the decline of image quality, thus affecting the accuracy of subsequent tasks such as feature detection and classification. In the process of feature detection, it may be affected by image resolution, color space, texture and other factors, resulting in inaccurate or erroneous features. In the process of classification, it may be influenced by factors such as the similarity between classes, the difference within classes, the quantity of training samples, etc., which makes the classifier unable to accurately distinguish different image classes.

Digital art image processing needs a lot of data for training and testing. However, due to the complexity of data collection and labeling, it may lead to insufficient data or low data quality, thus affecting the generalization ability and accuracy of the model. The analysis process of uncertain factors in digital art image processing is shown in Figure 1.

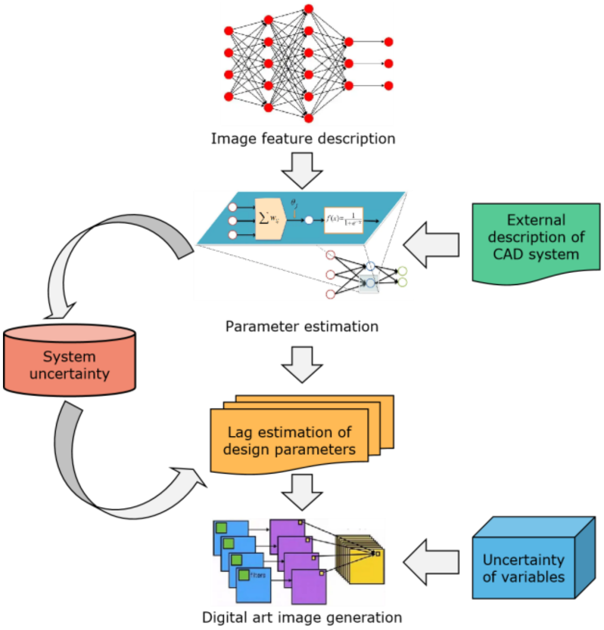

Figure 1: Analysis process of uncertain factors in digital art image processing.

Histogram equalization algorithm can effectively improve the contrast and brightness distribution of images. In digital artistic image processing, histogram equalization algorithm can enhance the image with dim color or insufficient contrast to make it brighter and brighter, thus improving the artistic effect of the image. The histogram equalization algorithm is realized by Python and OpenCV libraries. Firstly, the image needs to be converted from RGB color space to gray space, and the histogram equalization of the image is carried out by using the equalizeHist function in OpenCV library. The processed image will have more uniform brightness distribution and higher contrast. For color image enhancement, if the three primary colors are directly processed separately, it is easy to cause the magnification of each component to be different, resulting in color distortion. For this reason, the linear proportional relationship between the three primary colors of a color image is used. In order to maintain the image color information, based on this idea, combined with the algorithm proposed in this article, an image color enhancement algorithm is given, and Figure 2 is its schematic flow chart.

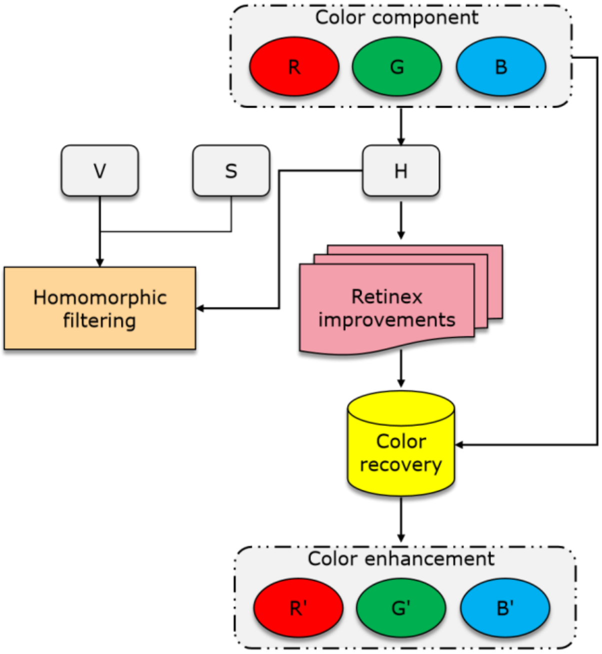

Figure 2: Flow chart of image color enhancement algorithm.

Mean filtering is a simple linear filtering method. This method is very effective for removing random noise, especially salt and pepper noise. In order to suppress noise, the smoothing function can be convolved with the image function:

$$G(x,y,\sigma)=\frac{1}{2\pi\sigma^2}\exp\left(\frac{x^2+y^2}{2\sigma^2}\right) \tag{1}$$

In order to get a better photo group $V(p)$, it is filtered by the following formula:

$$\left|V^*(p')\right|\left(1-g^*(p)\right)<\sum_{p\in U(p)}\left(1-g^*(p)\right) \tag{2}$$

M represents a solid model, then the spatial indicator function used in surface reconstruction is:

$$\Phi(p)=\begin{cases}1, & p\in M\\ 0, & p\notin M\end{cases} \tag{3}$$

When counting histograms, statistics are performed by assigning thresholds to gray-scale pixels:

$$p(\alpha_i)=\begin{cases}\frac{p}{h} & h_i>p\\ \frac{h_i}{h} & h_i<p\end{cases} \tag{4}$$

Where $p(\alpha_i)$ represents the occurrence probability of the i th gray value, and h represents the total quantity of pixels. α_i is the background gray level.

The support vector machine (SVM) classifier is trained by using the image features and corresponding labels in the training set. SVM is a binary classifier, which can learn decision function by learning positive examples and counterexamples in data sets. During the training process, SVM will try to find a hyperplane to separate different images. This hyperplane is the decision function. The performance of SVM classifier is tested by using the image features and corresponding labels in the test set. By inputting the images in the test set into the trained SVM, the prediction results of the classifier can be obtained, and the prediction results are compared with the real labels to evaluate the accuracy and robustness of the classifier. If the test results are not satisfactory, we can adjust the parameters of SVM or adopt other optimization methods to improve the performance of classifier. SVM is used to learn the decision function:

$$f(x)=\sum_{i=1}^{n} w_i k(x,x_i)+b \tag{5}$$

Where:

$$k(x_i,x_j)=x_i,x_y \tag{6}$$

The objective function of the kernel function is:

$$\min_{w,\varepsilon,b}\left\{\frac{1}{2}\|w\|^2+c\sum_{i=1}^{n}\varepsilon_i\right\} \tag{7}$$

When the (H,S,V) value is given, the corresponding (R,G,B) primary colors are:

$$(R,G,B)=\left(R^{'}+\lambda,G^{'}+\lambda,B^{'}+\lambda\right) \tag{8}$$

Among them, $\lambda=V-C$.

In the process of homomorphic filtering calculation, the value of homomorphic filtering function $H(u,t)$ will directly affect the accuracy of the final transformation calculation. Combining the characteristics of homomorphic filter function, a Butterworth homomorphic filter is designed, where the expression is:

$$H(u,t)=(\gamma_H-\gamma_L)\left[\frac{1}{1+[D_0/D(u,t)]^{2\pi}}\right]+\gamma_L \tag{9}$$

Where L represents the smoothing order of the filter; D_0 represents the frequency of stopping filtering; $D(u,t)$ represents the distance from point (u,t) to the initial point of discrete cosine transform (DCT) transformation.

Multi-scale is a quantity of different Gaussian function parameters c, and the sum of different reflected brightness obtained by weighting different scales can be output by multi-scale Retinex algorithm:

$$R_{MSR,i}=\sum_{n=1}^{N} w_n R_{n,i} \tag{10}$$

Where N is the quantity of scales, generally $N=3$; $R_{n,i}$ represents the reflection brightness of the n th scale of the i th channel, $R_{MSR,i}$ is the reflection brightness obtained by multi-scale weighting of the i th channel, and w_n is the weight of the n th scale, usually $w_n=1/N$.

4 ALGORITHM TESTING AND ANALYSIS

4.1 Test Platform

The experiment aims to explore the performance of image matching method based on deep learning on different data sets, and analyze its effectiveness through experimental results. The training set contains 10,000 images, each of which comes from a different data set with different resolutions and contents. These images cover a variety of types, including natural scenery, portraits of people, physical products and so on. The test set contains 5000 images, also from different data sets. These images are different from the images in the training set in content, resolution and type to ensure the performance of the model on unknown data. The operating environment of the test platform is shown in Table 1.

Structure	*Content*	*Parameter*
Software	System	Windows 10
	Tool	OpenCV
Hardware	Processor	Intel Core series
	Memory	8 GB
	Hard drive	512 GB

Table 1: Test platform operating environment.

4.2 Result Analysis

The success rate of VC in this method is obviously higher than the other two methods (Figure 3). The proposed method adopts a comprehensive information processing method, which not only considers the visual characteristics of the image, but also combines the semantic information of the image. This comprehensive processing method helps to understand the image content more comprehensively, thus improving the success rate of VC.

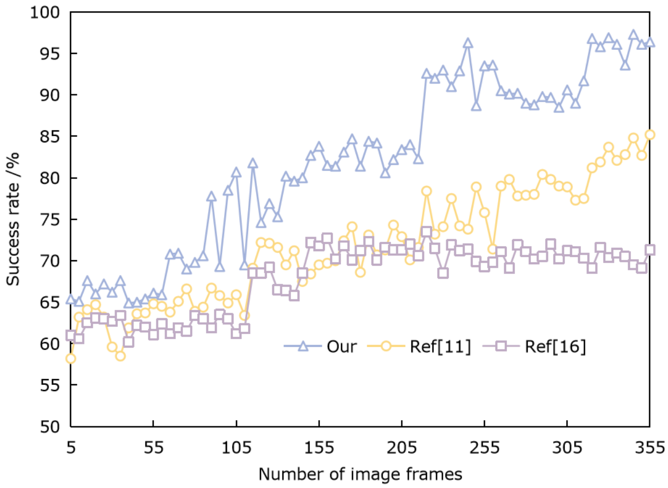

Figure 3: Comparison chart of VC success rate.

This method adopts an end-to-end training mode, which means that the whole VC system is trained together from beginning to end. This training mode ensures the close cooperation between all parts, and makes the whole system work more efficiently, thus improving the success rate of VC.

According to the research questions and data characteristics, six sample groups were selected for reconstruction, and the results are shown in Table 2. These six sample groups are extensive and diverse in input characteristics and target variables to ensure the validity of the test. Before reconstruction, the original data is preprocessed. Pretreatment includes missing value filling, abnormal value processing, data standardization, etc. to ensure the accuracy and consistency of data. According to the prediction results of the model, the samples in the test set are reclassified or scored. The reconstructed test set is merged with the original test set to form a new sample group. The reconstructed six samples are combined into a large sample group for subsequent analysis and testing.

Sample serial number	*Size/(mm×mm×mm)*	*Resolution ratio /dpi*	*Vein*	*Color matching*
1	*60×60*	*180*	*Level and smooth*	*Deeper*
2	*110×110*	*350*	*Level and smooth*	*Deeper*
3	*160×160*	*380*	*Level and smooth*	*Deeper*
4	*200×200*	*221*	*Deep texture*	*Normal*
5	*260×260*	*231*	*Deep texture*	*Normal*
6	*300×300*	*266*	*Deep texture*	*Normal*

Table 2: Sample reconstruction results.

The time required for image processing in this method is obviously less than that in two conventional methods, and the time required for image processing has not changed significantly with the increase of image size. Figure 4 shows the variation of image processing time with size.

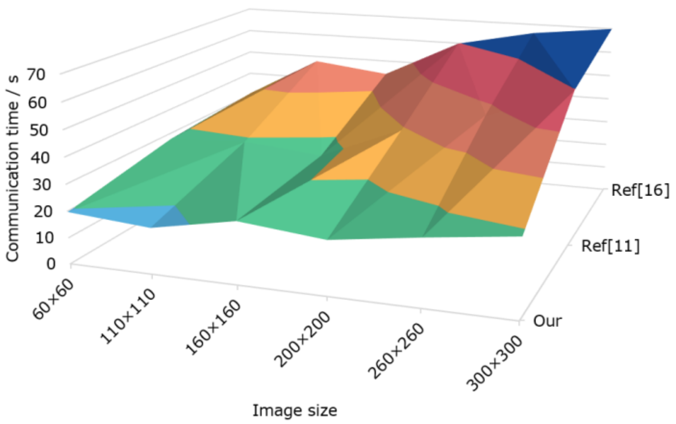

Figure 4: The change of image processing time with size.

In this article, the algorithm design is optimized, and an efficient algorithm structure and calculation flow are adopted. This optimized design enables the algorithm to use computing resources and memory more efficiently when processing images, thus reducing the processing time. The algorithm adopts the idea of parallel computing, and distributes image processing tasks on multiple computing cores or GPUs at the same time. This parallel computing method can make full use of computing resources and improve processing speed. The algorithm is also optimized in memory management, and an efficient memory allocation and release strategy is adopted. This optimized memory management method can reduce memory fragmentation and idleness and improve memory utilization. The algorithm uses data compression technology to compress image data to reduce the amount of data processed. To sum up, the optimization of this method in the time required for image processing is mainly attributed to the optimization design of algorithm optimization, parallel computing, memory management and data compression. These optimization measures enable our method to maintain efficient and stable performance when processing large images, and it is obviously superior to the conventional methods.

From the results of Figure 5, the artistic CAD systems based on different methods are almost the same in the accuracy of three-dimensional reconstruction of illustration images. This shows that this method is not significantly better or worse than the traditional method in terms of geometric accuracy of the reconstructed model. Judging from the evaluation results of user satisfaction in Figure 6, the system constructed by this method has obvious advantages. This shows that the artistic CAD system using this method has a significant improvement in user experience, intuition, ease of use and overall satisfaction compared with the traditional method.

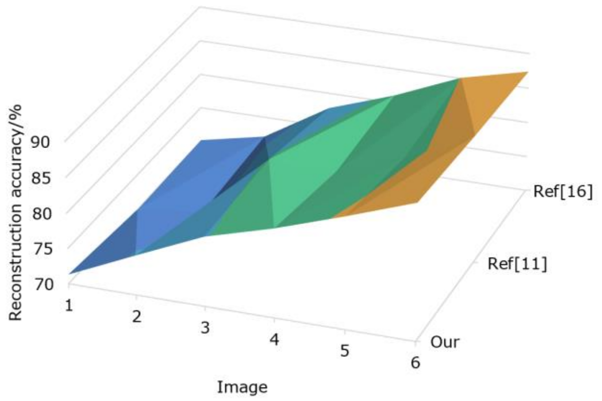

Figure 5: Comparison results of reconstruction accuracy.

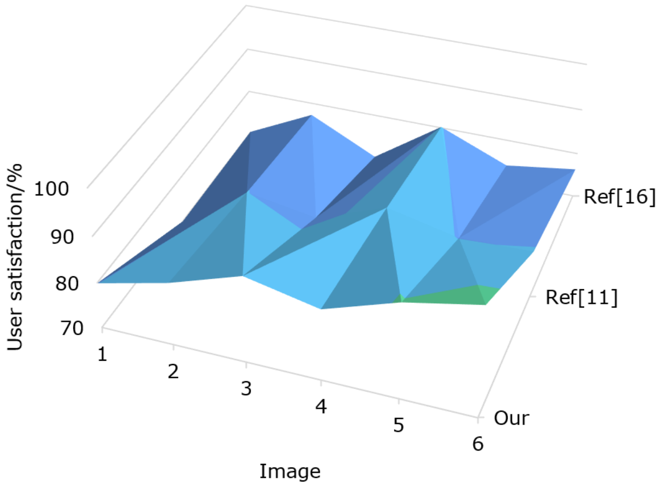

Figure 6: Comparison results of user satisfaction.

The system based on this method adopts a user interface design that is more in line with users' habits and expectations, making users feel more comfortable and easier to use. Fast processing speed can reduce the waiting time of users and improve the user experience. The system adopts a more stable algorithm, which makes it difficult to appear anomalies or errors in the process of processing, thus improving the satisfaction of users. Moreover, the system provides more complete or richer functions to meet the different needs of users. To sum up, although the reconstruction accuracy of the art CAD system based on this method and the traditional method is almost the same, this method has obvious advantages in terms of user experience, ease of use and overall satisfaction.

Figure 7 shows the comparison of the matching results between the proposed method and the traditional method. As can be seen from the figure, this method has obvious advantages in matching results.

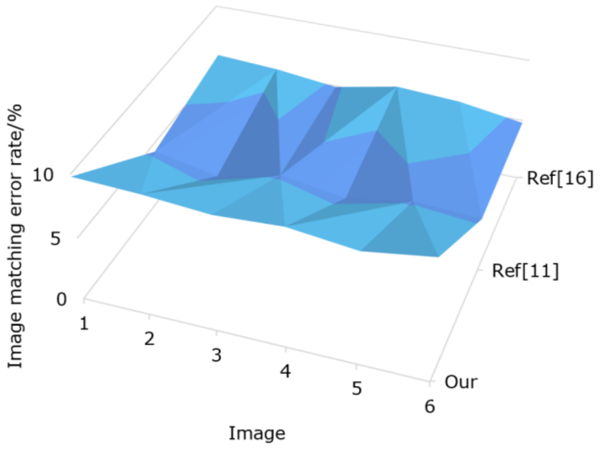

Figure 7: Comparison of matching results of the algorithm.

This method adopts a more effective feature detection method, so that the key features of the image can be better captured in image matching. These key features help to determine the similarities and differences between images, thus improving the accuracy of matching. By considering more contextual information, we can better understand the overall structure and semantic information of the image, thus improving the accuracy of matching. This advantage may come from more effective feature detection, more optimized algorithm, more sufficient consideration of context information and more detailed parameter adjustment.

5 CONCLUSIONS

In the field of digital art creation and VC design, designers often rely too much on preset templates and traditional creative methods, resulting in the lack of innovation and individuation of works. Traditional CAD design methods often require designers to spend a lot of time and energy to manually adjust various parameters and data, while using IoT algorithm can hand over these tedious tasks to computers, thus saving a lot of time and energy. In order to improve the experience of CAD in digital art creation and VC design, this article studies how to apply IoT algorithm to digital art image processing, including image feature detection, image classification and recognition. In image reconstruction, this method adopts deep learning technology, which can better learn and extract image features, thus improving the reconstruction accuracy. The results show that the proposed method can obtain better reconstruction results when dealing with different types and qualities of images, showing strong generalization ability. In terms of user satisfaction, this method adopts a user interface design that conforms to users' habits and expectations, making users feel more comfortable and easier to use. In addition, this method also improves the accuracy of matching by optimizing the algorithm and considering the context information, and further improves the user satisfaction.

In image matching, context information reflects important significance in determining the similarity and difference between images. Future research can try to explore how to make better use of contextual information for image matching, for example, by introducing attention mechanism. In real scenes, images are often not isolated, but associated with data of other modes. In the future, we can try to fuse images with other modal data to achieve more comprehensive and accurate image matching.

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