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Computer-Aided Design AND APPLICATIONS

Digital Media Artistic Creation Based on Generation Confrontation Network and Internet of Things

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Abstract. As a new art form, digital media art (DMA) has gradually become an indispensable part in the art field. The purpose of this study is to promote the growth of DMA by applying the technologies of Generative Antagonistic Network (GAN) and Internet of Things (IOT). By simulating the process of human creation, GAN can generate digital media works of art with high fidelity. IOT can be used to create interactive devices and participatory art of DMA, providing a deeper interactive experience between audience and works. In this article, GAN and IOT technologies are applied to computer aided design (CAD) of DMA. The results show that this method has obvious advantages in color contrast, image texture richness, edge contour clarity and color authenticity, which verifies its important application value in DMA CAD design. Therefore, GAN and IOT technologies have broad application prospects in the creation of DMA and audience interaction, providing new ideas and methods for the future growth of DMA.

Keywords: Generating a Countermeasure Network; Internet of Things; Digital Media Art; Computer Aided Design
DOI: https://doi.org/10.14733/cadaps.2024.S13.150-164

1 INTRODUCTION

DMA, as a brand-new art form, has gradually become an important part in the art field. DMA combines elements of digital technology, media and art, and creates many unique and expressive works. The Internet of Things sensor network refers to a network that collects and processes various information through various sensors, achieving mutual communication and information exchange between objects. Deep learning in smart homes, deep learning algorithms can automatically adjust indoor temperature and lighting by analyzing the behavior habits and environmental factors of family members, providing a more comfortable living environment. In intelligent transportation, deep learning algorithms can predict the probability of traffic congestion and accidents by analyzing information such as road traffic flow and vehicle trajectories, providing scientific basis for traffic

management departments. Generative adversarial networks (GANs) can generate brand new works of art based on simple descriptions or a small number of samples provided by users, effectively solving the bottleneck problem of inspiration and creativity in artistic creation. GANs can automatically learn and optimize, reducing the time and cost of artistic creation, and improving creative efficiency. With the increase of datasets and the increase of model complexity, GANs can generate more diverse and diverse works of art. Andronie et al. [1] analyzed patients' medical records and genetic data through deep learning algorithms. Predict the probability of disease occurrence and treatment effectiveness, in order to provide doctors with better diagnosis and treatment plans. DMA was born in the background of digital age, and it exists in digital form by means of information technology such as computer, multimedia and network. Data center RPC is a technology used to optimize data center communication. It makes communication between different machines more efficient and reliable by converting remote procedure calls into internal communication. The advantage of RPC is that it can significantly reduce network latency, improve data transmission speed, and also provide transparent remote services. Therefore, data center RPC has been widely used in distributed systems. In order to gain the working principle and behavior of GAN, Colyer [2] adopts a visual approach to observe the samples and network structure generated by GAN. Through visualization and analysis, we can find that the samples generated by GAN can deceive the discriminator to some extent, and the generated network structure also has some interesting characteristics, such as certain neurons in the generator corresponding to specific image features. These findings can help us better understand the principles and mechanisms of GAN. DMA has gradually become an important branch of contemporary art with its unique creative methods and forms of expression. However, the creation and expression of DMA are also facing some challenges. The creation of DMA requires the creator to have certain digital technology and artistic accomplishment, which requires continuous study and practice to master.

With the continuous increase of medical IoT data, how to ensure data security and privacy protection. The image encryption and decryption network based on deep learning is a method that utilizes deep learning technology to encrypt and decrypt images. This technology achieves the encryption and decryption process of images through the learning and training of neural networks. Compared with traditional encryption techniques, image encryption and decryption networks based on deep learning have higher security, efficiency, and flexibility. Ding et al. [3] utilized a large number of annotated medical image datasets to train deep learning models with the ability to encrypt and decrypt images. By adjusting model parameters and improving model structure. Implement the trained model in code and develop a DeepEDN network with image encryption and decryption capabilities. Encrypt the transmission of medical device data through the DeepEDN network, effectively preventing data leakage and unauthorized access. In terms of monitoring patient vital signs, the DeepEDN network can encrypt monitoring data to ensure that patient privacy is protected. The DeepEDN network can help doctors protect patient privacy during on-site diagnosis and treatment, while enabling doctors to obtain real patient data through decryption processing, improving diagnosis and treatment accuracy. Moreover, the creation of DMA needs a lot of time and energy, and it needs to be scrutinized and adjusted repeatedly from creativity, design to production. The interactivity and participation of DMA is also a difficult point. How to make the audience interact and participate more deeply with the works and improve the expressive force and appeal of the works is also an important problem that the creators of DMA need to solve. Geng and Du [4] conduct in-depth analysis of production data through machine learning algorithms to identify factors that affect production efficiency and quality. Further optimize the production process, improve production efficiency and quality. By analyzing equipment operation data through machine learning models, predict the possible failure time and location of the equipment, and carry out maintenance and replacement in advance to avoid production losses caused by sudden equipment shutdown. Machine learning technology can automatically analyze product quality data, identify factors that affect product quality, and provide feedback to the production department to adjust production parameters in a timely manner to improve product quality. The Internet of Things and machine learning have complementarity in intelligent manufacturing. The Internet of Things technology provides a large amount of data sources for intelligent manufacturing, and machine learning improves production

efficiency and product quality by analyzing this data. The combination of the two can achieve intelligent innovation and further improve the level of intelligent manufacturing. The purpose of this article is to discuss how to apply GAN and IOT to the creation of DMA in order to promote the growth of DMA.

The generator generates new data samples by learning data distribution, and the discriminator judges whether these samples are true or not. In the creation of DMA, GAN can be used as a powerful automatic creation tool to help creators quickly generate high-quality DMA works. The use of video streaming technology can quickly edit and adjust the visual effects. In animation production, video streaming technology can help designers achieve smoother character movements and richer scene effects. Through video streaming technology, advertising designers can quickly edit and synthesize short advertising videos, providing stronger support for advertising effects. By using video streaming, art or design achievements are dynamically displayed, allowing students to have a more intuitive understanding of the details and characteristics of the art or design achievements. Applying virtual reality technology to art and design education enables students to experience the production process and effects of artistic works or design achievements through virtual reality, thereby enhancing their learning interest and participation. Guo and Li [5] use video streaming technology to seamlessly connect multiple video clips, creating smoother and richer visual effects, which reduces production costs. Computer can help designers reduce labor and material costs to a certain extent. IOT can provide more interactivity and participation for DMA, helping them better master artistic skills. Secondly, artificial intelligence can analyze students' painting works, evaluate their skills and styles, and provide targeted suggestions to promote their continuous improvement in painting skills. Finally, through artificial intelligence technology, students can gain a richer visual experience, such as experiencing different painting styles and artistic contexts through virtual reality technology. He and Sun [6] can use artificial intelligence technology to classify and retrieve art works, such as according to different classification standards such as artistic style, theme, and era, making it easy for students and teachers to quickly find the necessary work materials. Secondly, through artificial intelligence technology, art works can be digitized and reproduced, such as through 3D scanning and printing technology to replicate and reproduce classic works, allowing students to more truly experience the charm of art works. Finally, artificial intelligence in art exhibitions, such as achieving intelligent management and display of art works through intelligent devices and sensor technology, improving exhibition effectiveness and quality. In natural gas and other pipeline networks, pressure data is the key to ensuring the safe operation of pipelines. However, due to equipment failures, human operational errors, and other reasons, the pressure data in the pipeline network may be abnormal or lost. This not only affects the normal operation of the pipeline, but also may cause safety accidents. Therefore, the restoration of hierarchical pressure data in pipeline networks has important practical significance. Hu et al. [7] generated fake data through a generator to simulate pressure changes in a pipeline network. Finally, use discriminators to identify the generated data to determine whether it is true and reliable. For the collected raw pressure data, first perform denoising and filling operations. The denoising operation is mainly to remove noise and outliers from the data. The filling operation is to fill in missing values to ensure data integrity. When performing denoising and filling operations, some common processing methods can be used, such as median filtering, interpolation, etc. Through IOT, the audience's behaviors and emotions can be interacted with digital media works of art in real time. This interactive installation art can improve the audience's participation and make the works change and adjust according to the audience's reaction. IOT can provide an open platform for digital media works of art, and performance of works through mobile phones, tablets and other devices.

Environmental art design refers to the process of planning, designing, and optimizing a specific environment. The traditional manual design method is inefficient, while computer-aided design software quickly and accurately, achieve complex design operations. When creating a 3D model in AutoCAD, users need to master basic commands and operations, such as creating basic graphic elements such as boxes, cylinders, and spheres, as well as performing operations such as moving, rotating, and scaling. At the same time, users also need to be familiar with the interface and toolbar of AutoCAD in order to quickly find the required commands. In addition, users also need to

understand how to set advanced operations such as materials and lighting to enhance the visual effect of 3D models. Jin and Yang [8] teach in stages to help students gradually master the basic functions and operating methods of the software. For example, in the early stages, basic software operations and the use of drawing tools can be taught; In the mid-term stage, advanced functions and application skills can be taught; In the later stage, students can engage in independent design and creation. In the layout design of medical terminal interfaces. Firstly, determine optimization objectives, such as operational efficiency, visual effects, etc. Li et al. [9] conducted a series of experiments. Firstly, invite multiple medical staff to conduct simulation operations and collect their feedback. Then, the experimental data is organized and analyzed to compare the performance of layout schemes before and after genetic algorithm optimization in terms of operational efficiency, visual effects, and other aspects. The experimental results show that the optimized medical terminal interface layout through genetic algorithm has significantly improved operational efficiency and visual effects. However, some shortcomings were also exposed during the experimental process. For example, the insufficient number of experimental samples may affect the accuracy of experimental results. In addition, during the experiment, it was also found that some medical staff have differences in certain operating habits, and further optimization of the plan is needed to meet the needs of more users. A medical terminal interface layout design scheme is proposed by combining user needs with genetic algorithms. Through experimental verification, this scheme has significant advantages in improving operational efficiency and visual effects. This participatory art can stimulate the creative enthusiasm of the audience and make the works more diverse and creative. Combining GAN with IOT can further expand the performance field of DMA and the creative ideas of creators.

GAN can learn a large quantity of image data distribution through training and generate images with high fidelity. These images can be used as the material of DMA works or directly used for the performance of works. The characters generated by using GAN can have specific styles and characteristics, which provides more possibilities for the creation of digital media works of art. For example, GAN can be used to transform words into images, or to synthesize words with other elements to create unique expressions. The complexity and dynamism of the marine environment make data collection equipment susceptible to interference, leading to a decrease in data quality. Secondly, the interpretability of deep learning models is low, making it difficult to accurately explain complex ship motion behaviors. In addition, the training and inference computation of deep learning models are large, and they require high computational resources, which limits their promotion in practical applications. Liu et al. [10] effectively processes a large amount of ship trajectory data. Secondly, deep learning can learn the inherent laws and representation levels of data, which enables it to more accurately predict the future trajectory of ships. In addition, deep learning also has strong pattern recognition capabilities, which enables it to effectively recognize and predict various complex ocean traffic patterns, it collected a large amount of ship trajectory data from a certain sea area and evaluated the proposed deep learning model using a five-fold cross validation method. GAN can transform one style of data distribution into another style of data distribution through transfer learning. In SNEGAN, Ma et al. [11] used a generator to convert the nodes and edges of the network into high-dimensional vector representations, which not only contain the feature information of the nodes but also the structural information of the network. Then, we use a discriminator to judge whether this vector representation conforms to the real network structure. Through this adversarial training approach, SNEGAN can generate more representative node vector representations, thereby more effectively processing complex networks with rich feature information. To verify the effectiveness of SNEGAN, we conducted experiments on various types of network datasets. The experimental results show that SNEGAN can better handle complex networks with rich feature information and achieve better performance compared to traditional network embedding methods. Specifically, SNEGAN performs better than traditional network embedding methods, and recommendation systems. In addition, we also conducted ablation experiments and robustness analysis on SNEGAN, and the results showed that SNEGAN has good robustness and scalability. This enables DMAists to learn from and integrate different artistic styles to enrich the expressive force and appeal of their works. In this article, GAN and IOT technologies are applied to the CAD design of DMA, aiming at exploring new creative ideas and methods and promoting the growth of DMA. Through this

research, we can further improve the quality and expressiveness of digital media works of art; Moreover, it can provide more creative ideas and possibilities for creators, so that they can explore the connotation and expression of art more deeply with the help of scientific and technological strength. The research includes the following innovations:

In this article, the internal mechanism and algorithm principle of GAN are studied, and its application strategy in digital media CAD design is discussed The application method and realization technology of IOT in DMA are studied, and how to effectively combine it with GAN is discussed. Through simulation experiments, this article analyzes the practical application effect of GAN and IOT in DMA creation, and evaluates and optimizes it.

The main structure of the study is as follows:

Firstly, this article introduces the application of GAN and IOT in DMA creation; Then, the image enhancement algorithm of DMA based on CAD design of DMA; Then the effectiveness of the algorithm for DMA creation is verified by experiments. Finally, the research work and contribution of this article are summarized.

2 RELATED WORK

Collaborative edge computing is a new cloud computing model, which pushes computing tasks from the cloud to the edge of the network, and processes a large amount of data generated by IoS devices in a close distance. By processing data close to the data source, CBC reduces network latency and improves the system's response speed and robustness. In the secure social Internet of Things, CBC can better adapt to dynamic and distributed IoS device environments, providing more efficient and real-time intrusion detection services. Nie et al. [12] used GAN's approach to train a generator capable of generating "normal" data and a discriminator capable of identifying "abnormal" data. When the discriminator can accurately distinguish between "normal" and "abnormal" data, this model can be used to detect intrusion behavior in the IoS system. Compared with traditional intrusion detection methods, our method can more effectively detect various types of network intrusions, including but not limited to DDoS attacks, malware propagation, sensitive information leakage, etc. In addition, our method also has a lower false positive and false negative rate, which can provide more reliable security guarantees for IoS systems. Digital media art provides a rich creative space. Its unique visual effects and expressive power can be utilized to enhance the visualization and interactivity of the vibration frequency density meter. This not only enhances the attractiveness of the device, but also helps users better understand and interpret measurement results. Olivynyk and Taranenko [13] introduced the relevant content digital media art vibration frequency density meters. In the computer-aided design system of digital media art vibration frequency density meters, the core components include interface design, interaction design, and data transmission. The main purpose of interface design is to provide an intuitive and easy-to-use graphical user interface, allowing users to easily control and operate the vibration frequency density meter.

Interaction design focuses on how to achieve effective communication between users and computers, allowing users to quickly transmit instructions and receive feedback. In terms of data transmission, computer-aided design systems need to efficiently process and transmit various data, including parameters such as vibration frequency and density. Sugita et al. [14] used a combination of literature review and case analysis to conduct in-depth research, as well as the market and complexity of open innovation technology. At the same time, through on-site investigations and questionnaire surveys, we also conducted an understanding and analysis of the creative process and innovative practices of digital media artists. Firstly, digital media provides artists with more ways of expression and a wider audience, allowing them to express their ideas and creativity more freely. Secondly, digital media helps to improve the creative efficiency of artists and the dissemination effect of their works, further expanding the influence of art; Finally, digital media has broken the traditional channels of artistic dissemination and power structures, allowing more ordinary people to participate in artistic creation and appreciation. Wang et al. [15] conducted research on the wick patterns. Firstly, as a traditional pattern with profound cultural connotations and aesthetic value, the wick

pattern has been widely used in traditional handicrafts and modern consumer goods. Secondly, style conversion technology provides new possibilities and innovative space for the creative design of wick patterns, which can help designers introduce modern elements while maintaining traditional styles, making the patterns more rich and vivid. Finally, by applying style conversion technology, it is possible to achieve the representation of multiple styles in one pattern, providing designers with more choices. Based on the above conclusions, this article believes that the creative design and development of wick patterns based on style conversion technology has important application value and broad development prospects, and is worthy of further in-depth research and practice in related fields. Creative thinking plays a significant role. In the creative process, creative thinking can help designers obtain unique creativity and form unique artistic styles. In addition, creative thinking can also encourage designers to continuously explore new forms and techniques of expression, improving the artistic value of their works.

At the same time, creative thinking also helps cultivate students' innovation and problem-solving abilities, enabling them to better cope with challenges in their future career. Wang [16] believes that in order to cultivate creative thinking, digital media art and design education needs to adopt multiple methods and means. Firstly, interdisciplinary learning is the key to cultivating creative thinking. Students need to extensively explore knowledge in different fields, such as computer science, art and design, psychology, etc., in order to broaden their horizons and inspire inspiration. Secondly, teamwork is another effective way to cultivate creative thinking. By communicating and collaborating with others, one can stimulate and learn from each other, achieving collision and fusion of thinking. In addition, artistic innovation is another important way to cultivate creative thinking. Students need to constantly try new ideas and techniques in practice, unleash their imagination and creativity, and create unique works of art. Space computing technology is the foundation for achieving, with the main purpose of effectively integrating virtual information with the real world by collecting, processing, and analyzing spatial information in the real world. Space computing technology includes multiple aspects such as spatial positioning, spatial geometric transformation, and spatial data structure. Spatial computing techniques in computer graphics can improve the realism and interactivity of virtual information, enabling users to interact more naturally with the virtual environment. Yuan et al. [17] aim to explore the application of computer-aided design and computer graphics in spatial augmented reality human-computer interaction. Firstly, a brief introduction is given to the human-computer interaction of spatial augmented reality, explaining its importance and research background. Taking a building augmented reality project as an example, designers can draw architectural drawings using CAD software and then use CG technology to create a 3D model. In augmented reality applications, these models can be superimposed onto real scenes, allowing users to see virtual building objects in the real world. Designers can also use techniques such as gesture recognition and speech recognition to allow users to interact with virtual models, achieving real-time feedback and adjustments. In digital media art majors, blended online and offline teaching can better meet students' learning needs and improve learning efficiency.

Flash graphic animation design is an important teaching content in the field of digital media art. It combines knowledge from various aspects such as the basic principles of animation design, graphic and image processing techniques, and creative ideas. In the teaching of Flash graphic animation design, the blended online and offline teaching mode can help students better master animation design skills and improve teaching quality. In the field of digital media art, Teachers can create corresponding teaching videos, PPTs, and other teaching resources based on the teaching content designed by Flash flat animation, and upload them to the online platform. With the advent of Industry 4.0, IIoT is receiving increasing attention. However, in the process of processing and analyzing industrial data, traditional deep learning models often cannot achieve ideal results due to data imbalance and bias issues. To address this issue, Zhou et al. [18] introduces a bias perception module, and DBC-GAN can weight samples of different categories based on their importance, thereby improving classification accuracy. In addition, DBC-GAN can also combine collaborative filtering technology to improve the generalization ability of the model by learning from a large amount of unlabeled data. In regression tasks, DBC-GAN can achieve regression prediction of samples by learning the intrinsic features of the data. By introducing bias information, DBC-GAN can differentiate

samples of different categories according to actual needs, improving the accuracy of regression prediction. In addition, DBC-GAN can also be combined with collaborative filtering technology to improve the stability of regression prediction. Zhu [19] has created highly creative and expressive visual effects, thereby giving audiences a deeper understanding and understanding of digital media art. In game design, creative thinking is even more indispensable. Game designers need to use their imagination to create a rich and diverse game world, characters, and plot, while constantly adjusting and optimizing based on player feedback to create a more attractive and playable gaming experience.

3 GAN-BASED DMA IMAGE ENHANCEMENT ALGORITHM

3.1 Application of GAN in DMA Creation

(1) High-quality image generation

GAN can learn a large quantity of image data distribution through training and generate images with high fidelity. These images can be used as the material of DMA works or directly used for the performance of works. For example, paintings generated by GAN can be used as digital art collections, and can also be used to design digital illustrations and posters. In the creation of DMA, GAN's ability to generate high-quality images provides more possibilities for the creators. Creators can generate the materials they want through GAN, which can save a lot of time and energy. The images generated by GAN can be displayed and traded as digital art collections, which broadens the application field of DMA works.

(2) Text generation

Words generated by using GAN can have specific styles and characteristics. For example, GAN can be used to transform words into images, or to combine words with other elements to create unique expressions. In the artistic creation of digital media, GAN's ability to generate words provides more creative space for the creators. Creators can generate the text materials they want through GAN, so they can get more inspiration and creativity. The characters generated by GAN can be displayed and traded as digital art collections, which broadens the application field of DMA works.

(3) Style conversion

GAN can transform one style of data distribution into another style of data distribution through transfer learning. This enables DMAists to learn from and integrate different artistic styles to enrich the expressive force and appeal of their works. Creators can transform one artistic style into another through GAN, which can get more inspiration and creativity. GAN's style transformation can be used in digital illustrations, posters and collections, which broadens the application field of digital media works of art.

3.2 The Application of IOT in the Creation of DMA

(1) Interactive installation art

Through IOT, the audience's behaviors and emotions can be interacted with digital media works of art in real time. This interactive installation art can not only improve the audience's participation, but also make the works change and adjust according to the audience's reaction. On the one hand, the audience can participate in the works in real time through IOT, which can improve the attraction and appeal of the works. On the other hand, IOT can make corresponding changes and adjustments according to the audience's behaviors and emotions, so as to gain more inspiration and creativity.

(2) Participatory art

IOT can provide an open platform for digital media works of art, and the audience can participate in the creation and performance of works through devices such as mobile phones and tablets. This participatory art can not only stimulate the creative enthusiasm of the audience, but also make the works more diverse and creative. In the creation of DMA, the participatory art of IOT provides more opportunities for the audience to participate and interact. Audiences can communicate and cooperate with creators through IOT to jointly complete the creation and performance of works. This can not

only stimulate the creative enthusiasm and interest of the audience, but also gain more inspiration and creativity.

In the CAD design of DMA, GAN can reflect positive significance in the image enhancement of DMA. GAN network includes generator G and discriminator D, as shown in Figure 1. The generator is dedicated to learning the real sample data distribution in the task requirements, so as to generate sample data generated by texts, images and the like. The discriminator can be regarded as a binary classifier, which receives real data and generated sample data as inputs and outputs a confidence score, which can be used to distinguish the quality of generated samples. The goal of the discriminator is to identify the false data generated by the generator and make the generated sample score as low as possible. The dynamic game process between generator G and discriminator D can be transformed into the process of solving the following minimax objective function:

$$\min_G \max_D E_{x\sim p_r}\left[\log D(x)\right]+E_{\tilde{x}\sim p_g}\left[\log\left(1-D(\tilde{x})\right)\right] \tag{1}$$

$$\max_D V(G,D)=E_{x\sim P_r}\left[\log D(x)\right]+E_{x\sim P_g}\left[\log\left(1-D(x)\right)\right] \tag{2}$$

Then solve the following equation for generator G:

$$\max_D V(G,D)=E_{x\sim P_g}\left[\log\left(1-D(x)\right)\right] \tag{3}$$

At the same time make the output confidence of the generated sample as low as possible. The two models are independent of each other during training.

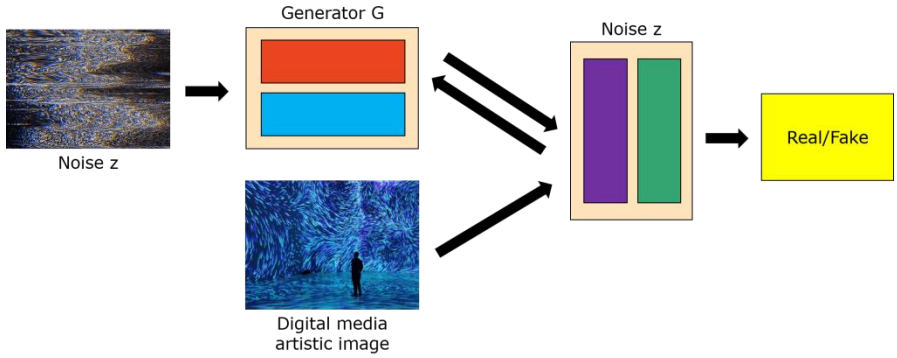


Figure 1: Generate adversarial network model.

Let the digital artistic image be x, the target image be y, and the random noise be z. The generator of this model will map the random noise to the target image y under the condition of blur, and its formula is expressed as:

$$G:\{x|z\}\rightarrow y \tag{4}$$

x stands for the input blurred image set, and the image set y stands for the target image corresponding to the blurred image, that is, the clear image. z stands for random noise. The function of the generator is to generate a clear image from a blurred image. It can be concluded that the optimization objectives of this model are:

$$G^*=\arg\min_G \max_D \Im_{cGAN}(G,D)+\lambda\Im_{L1}(G) \tag{5}$$

The process of training the discriminator D is essentially to minimize the cross entropy between the expected output and the actual output. The loss function of the discriminator can be defined as:

$$L_D(\theta_D,\theta_G)=-\frac{1}{2}E_{x\sim P_{data}(x)}[\log D(x)]-\frac{1}{2}E_{Z\sim P_z(z)}[\log(1-D(g(x)))] \tag{6}$$

Which obeys prior distribution $P_z(z)$; $E(\cdot)$ stands for expected value. When the generator G is fixed, the above formula is minimized to achieve the optimal solution. When the function is continuous, the above formula can be transformed into the following form:

$$\begin{aligned} L_D(\theta_D,\theta_G)&=-\frac{1}{2}\int_x P_{data}(x)\log(D(x))dx-\frac{1}{2}\int_z P_z(z)\log(1-D(g(z)))dz \\ &=-\frac{1}{2}\int_x [P_{data}(x)\log(D(x))+p_g(x)\log(1-D(x))]dz \end{aligned} \tag{7}$$

For any non-zero real number a and real number b, and when the real number y belongs to the interval from 0 to 1, the following formula is the minimum point at $\frac{a}{a+b}$:

$$-a\log(y)-b\log(1-y) \tag{8}$$

Therefore, when the generator G is given, the loss function of the discriminator D takes the minimum value at the following formula, which is the optimal solution in this case:

$$D_G^*(x)=\frac{P_{data}(x)}{P_{data}(x)+P_g(x)} \tag{9}$$

As shown in Figure 2, the generator inputs a motion blurred image, down-samples it to obtain a multi-scale image, the generator network extracts the feature information by using the residual block, and then generates the corresponding enhanced image by using the deconvolution network. The whole algorithm can be simplified into two stages. In the training stage, the training data set is preprocessed, and data enhancement operations such as scale transformation, random rotation and random vertical and horizontal flipping are mainly carried out. Then, the processed data set is input into the multi-scale network for training. In the testing stage, it is necessary to download the trained network model first, then use the test data set for testing, and finally compare it with the clear images in the test data to evaluate the model performance.

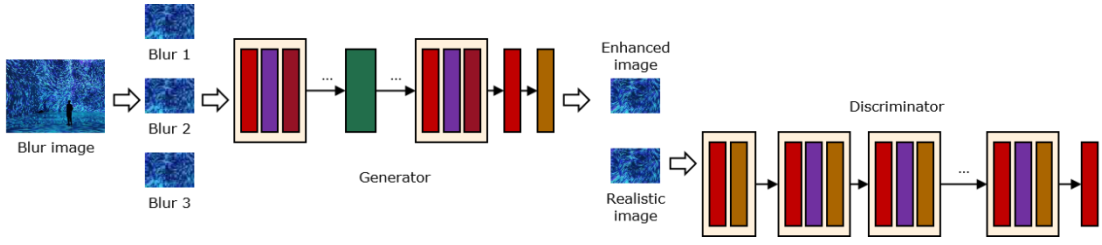


Figure 2: Multi-scale network structure.

In order to further improve the performance of deep learning network, this article proposes an innovative adaptive channel attention adjustment method. This method adaptively adjusts the weight of each feature channel by adding the channel attention module after the residual block structure. The channel attention module can learn the dependencies between channels through the network, so as to adaptively adjust the features channel by channel. The proposed channel attention mechanism enables the network to determine the weight of each characteristic channel independently, greatly reducing the need for manual tuning. Moreover, through the learning and

processing of global information, the channel attention mechanism can identify and utilize useful features more effectively, and further improve the performance of the network.

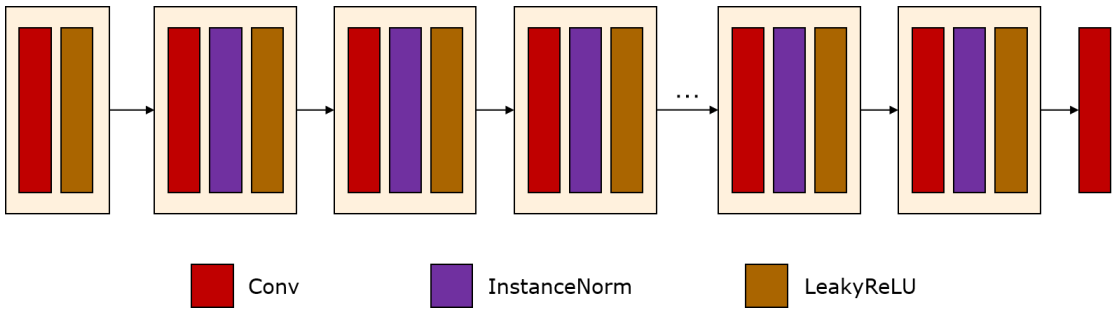


Figure 3: Discriminator network structure.

The full convolution network structure is used in the discriminant network of the model. As shown in Figure 3, the discriminant network includes both instance standardization and LeakyReLU activation function, and the negative slope α of LeakyReLU is set to 0.2. Compared with the traditional network structure, this structure can better adapt to all kinds of complex feature data and make the network more generalized. In addition, by adaptively adjusting the channel weights, this method can effectively alleviate the over-fitting problem and further improve the robustness of the network. The structural parameters of the discriminator network are shown in Table 1.

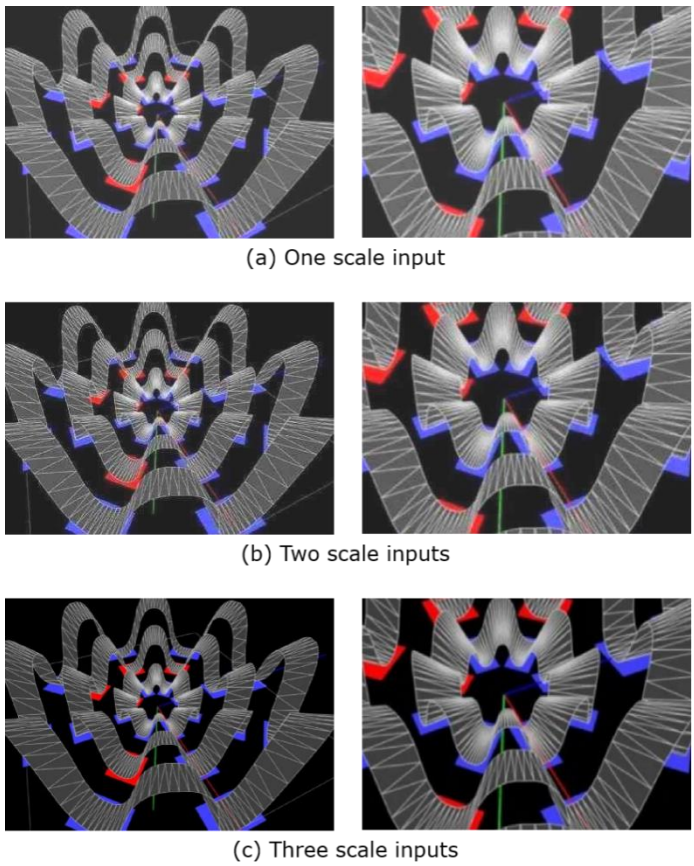
Convolution layer	Step length	Convolutional kernel size	Number of channels
Conv-1	2	5	64
Conv-2	2	5	128
Conv-3	2	5	256
Conv-4	1	5	512
Conv-5	1	5	1024
Conv-6	1	5	1

Table 1: Discriminator network structure.

The main feature of image translation is to map the input image to the output image. The problem that needs to be considered is that the input image and the output image are different in appearance, but the underlying structural information of the image has not changed much. Therefore, it can be approximately considered that the input and output are roughly the same in certain structural information. Without increasing network parameters, the parallel hole convolution module is added to improve the ability of capturing large-scale features by increasing the receptive field, and at the same time obtain multi-scale context information, which can be well applied in the problem that images need global information or capture multi-scale context information. Finally, the feature map channel selection module is added to enhance the weight of useful feature channels, suppress useless features, determine the content that needs to be focused on on each layer of feature map, and recalibrate features to improve the performance of the network. Take the image to be enhanced as input and enter the trained generator. The generator will generate a new image according to the input noise vector. The generated image is evaluated by using constant PSNR and SSIM.

4 EXPERIMENTAL RESULTS AND ANALYSIS

Open Images is a large image data set, which contains more than 9 million pictures from the Internet, with more than 600 categories. This data set can help this study to carry out extensive image recognition and classification training for the model, so as to improve the generalization ability and robustness of the model. In order to measure the advantages and disadvantages of network models with different scales, from left to right, models with one scale (256×256), two scales (128×128, 256×256) and three scales (64×64, 128×128, 256×256) are input respectively, and the processing results of blurred images correspond to the graphs respectively. 300 epoch are trained in all three models for comparison. From the figure, it can be seen that the images enhanced by models (a) and (b) all have problems such as unclear edges and insufficient detailed texture information. And (c) the blurred image restored by the model has clearer edges and richer detailed texture information. The three scale input models pay more attention to the contour and other features of the image in the small scale, and pay more attention to the detailed features of the image in the large scale, and extract the fuzzy image features in stages from coarse to fine, so the best model effect is obtained.



(a) One scale input

(b) Two scale inputs

(c) Three scale inputs

Figure 4: Contrast diagram of enhancement effect at different scales.

Different features of blurred images can be extracted and utilized more by inputting models with multiple scales than by inputting models with a single scale, thus performing better in edge sharpness and detail texture information retention. Using three scales of input at the same time, we can extract different features of blurred images in stages from small to large, so as to have better performance in enhancing the quality of images. When using multi-scale model, it is necessary to consider how to

effectively combine the information of different scales, which may require in-depth research and optimization of the model architecture and training methods.

Record the assessment result value of each picture in Open Images and draw an image, as shown in Figure 5, which is the numerical diagram of Open Images data set under the PSNR assessment index. From the figure, it can be seen that there are 10 abnormal pictures in the picture generated by using L1 loss function and retaining BN layer configuration, which shows that the network trained under the same conditions using this combination is not stable compared with other configurations. Observing other lines, it can be found that the PSNR assessment result value is the best in most pictures on BSD data set using L1 loss and removing BN layer configuration.

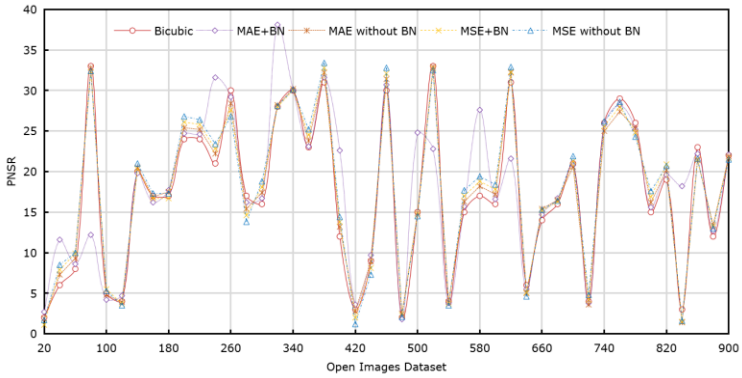


Figure 5: PSNR index assessment results of OpenImages data set.

See Figure 6 for the assessment results of SSIM indicators. There is not much difference in SSIM index among the methods. This shows that all the methods are quite good at maintaining the structure of the image. Nevertheless, it can be seen that the configuration of using L1 loss and removing BN layer still shows some advantages on BSD data sets.

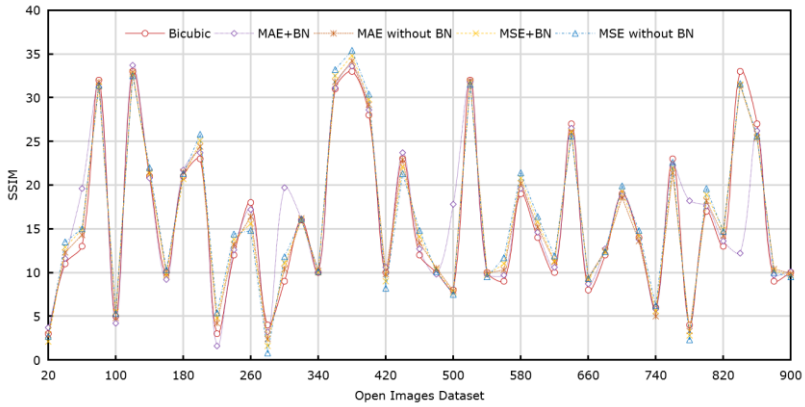


Figure 6: SSIM index assessment results of open images data set.

The results show that if L1 loss function is used, removing BN layer may help to improve the performance and stability of the network when generating pictures. Of course, this needs further experiments and investigations to verify. Moreover, it also reminds us that the choice of network architecture and loss function needs to be adjusted and optimized based on the actual task requirements and data sets.

Different methods are used to test Open Images, and the enhanced details of each method can be seen more intuitively by enhancing the local enlarged renderings of the images. It can be clearly seen from Figure 7 that the color contrast of this method is closest to the clear image compared with the image color information of other methods. To sum up, the image texture information enhanced by this method is richer, the image edge contour is clearer, and at the same time, the color is more real and natural, which is closest to the clear image.

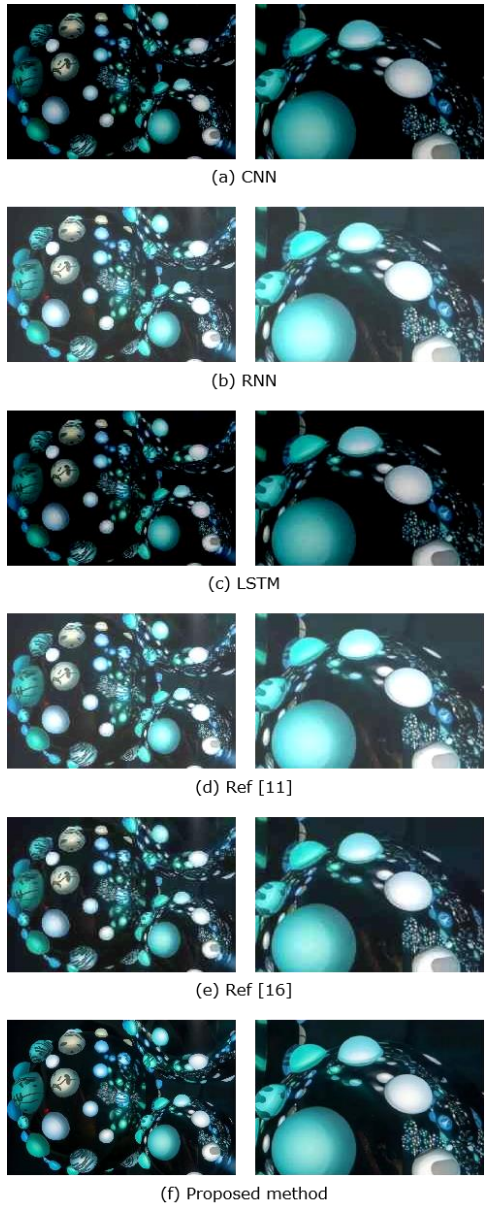


Figure 7: Comparison of enhancement effects on GOPRO data sets.

By comparing the image enhancement renderings of different methods, we can see that this method performs best in color contrast, image texture richness, edge contour clarity and color authenticity.

This result proves the effectiveness and superiority of the method proposed in this article in image enhancement. Using this method to test Open Images data set can improve the image quality more effectively and provide more accurate input data for subsequent image analysis and computer vision tasks. After training and testing, this algorithm can be applied to DMA creation. For example, images generated by GAN can be displayed and traded as digital art collections, and can also be applied to digital illustrations, posters and collections. In addition, GAN can also be combined with other technologies, such as VR/AR technology, 3D printing technology, etc., to innovate the CAD design means of digital art works, so as to create richer and more diverse DMA works.

5 CONCLUSIONS

Under the background of digital age, DMA is leading the growth of artistic innovation with its unique charm and potential. In this article, GAN and IOT technologies are applied to the CAD design of DMA, aiming at exploring new creative ideas and methods, which is of great significance to promoting the growth of DMA. By comparing the actual effects of various image enhancement methods, we can see that the method proposed in this article has obvious advantages in color contrast, image texture richness, edge contour clarity and color authenticity. This result shows that this method not only shows high effectiveness and superiority in the field of image enhancement, but also verifies its important application value in DMA CAD design. With the support of GAN and IOT, the creative way and expression form of DMA have been greatly expanded and innovated. The method in this article provides a brand-new design idea and tool for designers, which makes the artistic creation of digital media richer and more delicate. Through the research on the application of GAN and IOT in CAD design of DMA, the effectiveness of GAN and IOT in image enhancement and artistic creation is verified.

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