Deep Learning Based Image Migration Style Related Research

Ruiyang Zhao(✉)

Department of Communication Engineering, School of Information Engineering, East China Jiaotong University, Nanchang 330013, China
gc1974757084@gmail.com

Abstract. In recent years, image style migration techniques are generally used to simulate image styles by manual mathematical modeling. Deep learning, with its advantage of extracting high-level abstract features quickly, has been applied to extract stylized features and content features of images, and has become a mainstream technique in the field of image style migration. This paper introduces the image style migration methods of deep learning and GAN, and focuses on an in-depth analysis of the comparative research content of today's image migration style methods to find some of today's cutting-edge mainstream application scenarios and the shortcomings and deficiencies found, as well as an introduction to image style migration algorithms, and finally, it also gives some insight into the current problems and future research directions for deep learning-based image style migration. Finally, the current problems and future research directions of deep learning based image style migration are also summarized and prospected.

Keywords: Deep learning · Transfer style · GAN · Modeling

1 Introduction

Image style can be understood as the impression given to the image. The same image is in different styles, and the image will give people a different impression, such as Chinese style, classical style, post-modern style, etc. different, such as Impressionism and Abstraction. Image style transfer refers to the use of computer programs to integrate the content of Image 1 and the style of Image 2 to form a new unique Image 3, that is, Image 1 has the content of Image 2 and Image 2 has the style of Image 3.

This technology originated from the image texture generation technology before 2000. Researchers use complex mathematical models and formulas to classify and generate them, but manual modeling is time-consuming and labor-intensive, and the computing power of computers is not strong. Therefore, research on image style transfer techniques has been slow. In 2015, a study proposed an image style transfer method based on convolutional neural network, which can separate abstract features from the abstract expression of style, so that the style of the image changes, and the image style can be effectively carried out. Transfer for better results.

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2 Background Introduction

2.1 Deep Learning

Deep learning, as an unsupervised learning method, discovers the representation of data with distributed characteristics by combining basic features to form a more abstract hierarchical description. The term "deep learning" became a Google buzzword in 2016. It has great application scenarios in many fields such as AI (audio processing, natural language processing, robotics), as well as networks (search engines), biological information processing, automatic medical diagnosis, and finance.

Currently, the most common ones are DCI, DBN, RNN recurrent network and convolutional neural network. Then, using the deep credibility network of Boltzmann machine, the problem of learning speed drop and local convergence caused by the increase of network depth in BP network is solved. Recurrent neural network is a time series information analysis model with a certain memory function for the sequence that has been operated. The meaning of "cycle" is that the network performs the same processing on each unit in the sequence and can make full use of sequence information of any length. The convolutional neural network inputs the original image into the convolutional layer and the pooling layer, and then extracts the corresponding features from the convolutional and pooling layers.

2.2 Status of GAN Network

Networks GAN (Generative adversarial networks) is a generative model proposed in 2014. The system includes a generator and a classifier, which captures the likely distribution of actual data and produces new data. The discriminator is a binary classifier that distinguishes whether the input is an actual or generated sample. The structure of GAN is inspired by the zero-sum of two people in game theory (that is, the sum of the interests of both parties is 0, and the gain of one party is the loss of the other party). The optimal solution of GAN is a Minimax Game problem, and its optimal purpose is to achieve Nash equilibrium, so that the generator can estimate the distribution of data.

3 Comparative Research Content of Image Transfer Style Methods

How to describe and calculate style is a key issue in image style transfer. Due to the feature extraction of deep convolutional neural networks, CNN-based image style transfer algorithms can extract from abstract feature representations and use the statistical data of feature distribution to describe the style of images, thereby making image style transfer more flexible and effective.. This method can reflect the style of the image well, but requires a large number of parameter extraction networks, which is an urgent problem to be solved.

Based on the GAN image style transfer method, through the mechanism of adversarial learning, it provides a new way for style description. Aiming at the problems that traditional convolutional neural networks cannot represent complex shape features and have poor anti-noise ability, a novel GAN structure for texture classification and

its corresponding algorithm are proposed. For GAN, without the need for pre-set style calculation, the recognizer can implicitly calculate the style by matching the distribution of the image, thereby realizing the style transfer of the image. Using adversarial training to fit the distribution of image data can make the results of style transfer more realistic, reflecting the ability of GAN to understand and perceive image data. Compared with the style transfer method based on CNN, the quality of the images generated by GAN is better, but the controllability of the style transfer process is poor, and the training of the adversarial network is prone to problems such as gradient disappearance and model collapse, and has disadvantages such as difficulty in training.

3.1 Image Style Transfer Based on CNN

As a unique application of convolutional computational neural network in the field of computer vision application, style transfer fully demonstrates the superiority of convolutional computational neural network in the field of feature cognition, which can recognize features and improve the knowledge and understanding of features. In the acquisition process, the tediousness of acquiring features by manual methods is reduced [1].

CNN network is composed of multi-level neural network, which consists of input, convolution layer, excitation function, pooling layer and fully connected layer. The convolutional computational layer is also the main part of the level-variable eigenvalues of the CNN. Different features can be refined in different layers of convolutional computing nuclear fusion, and lower-level features, such as edges, curves, angles, etc., can be refined in lower-level convolutional computing layers, but at more levels, More complex features can be obtained using low-level features. At present, Softmax is the most used, because it has good generalization ability and can adapt to various network structures; but it also has certain defects, the calculation speed is slow and it is easy to fall into the local optimal solution. The pooling layer, as the downsampling operation after the feature extraction of the convolution kernel, is mainly used in feature dimensionality reduction. It improves the calculation speed by compressing the data and the number of parameters, and can control over-fitting and enhance the robustness of the network. With the continuous development of technology, the image style transfer technology has become more and more mature, but there are still some problems such as image distortion and lack of details [2]. Therefore, the research direction of CNN-based image format transfer technology is to obtain images with the best comprehensive matching rate and low loss rate.

3.2 Generative Adversarial Neural Network GAN

Deep learning based image style migration, in addition to the wide application of convolutional neural networks, generative adversarial neural networks are quite popular. The generative resistance neural network is mainly composed of two parts, one is the generator network and the other is the discriminator network. The job of the generator is to sample the noise from the random uniform distribution, and then output the synthetic data. When the computer is required to understand a type of thing, the generator is responsible for a large amount of data entry for this type of thing, and the discriminator

is to filter out the similarities, differences and authenticity points in several examples, and then judge the results. As a real sample, the common ground is retained and the final output of the model is constructed [3]. The job of the discriminator is to construct a new feature space based on the generated data, and then use this new feature space to classify the input. The experimental results show that the generative adversarial network has better performance than the generator. The higher the complexity of the data provided by the generator, the more accurate the structure of the final output model of the discriminator, and the more inclined it is to the real sample situation.

4 Overview of Domestic and Foreign Research

Tang Nian discussed the principle, effect and shortcomings of traditional mainstream style transfer technology from the application value of the mainstream style transfer technology in "Review of Neural Style Transfer Model", and proposed that the comprehensive ability of the model should be improved to ensure the quality of generation. The conclusions on the future development direction of improving the generation speed and generalization ability in the case of Sun Junmei et al. studied the performance of the online method based on image iteration and the offline method based on model iteration in "Comparative Study of Image Style Transfer Methods Based on Deep Learning", focusing on the evaluation of visual quality, stylization time, structural similarity, etc. The indicators are discussed, and it is believed that the method based on image iteration is suitable for the environment without time requirements and accurate parameters, and the method based on model iteration can complete any artistic style transfer task. Wang Qian also proposed to solve the research problem of style transfer with strong image style in "Research on Image Style Transfer Technology", and discussed the field of traditional image style transfer, from the research perspectives of optimizing convolution method, adjusting loss function, and preserving brightness features. The improvement of style transfer network is expounded, and it is concluded that the research on image style transfer in the field of computer vision plays a crucial role. In "Image Multi-Style Transfer Algorithm in Deep Learning", Shi Jianping proposed the basic concept of image style transfer, briefly introduced its early development and change process, and clarified that the image style transfer method is currently in a single style stage. A multi-style algorithm is proposed, and the steps of the algorithm are divided into three aspects: content reconstruction, style reconstruction, and neural network style transfer. The problems of single color and color overflow in a single style are solved through analysis.

5 Frontier Mainstream Application Scenarios and Found Shortcomings and Deficiencies

5.1 Mainstream Application Scenarios

Due to the continuous improvement of the algorithm and theory of image style transfer technology based on deep learning, its application in practical applications is more

extensive [4]. Currently, there are three major application areas for image style transfer technology based on deep learning technology:

Image Processing
Most of the images currently distributed on social networking sites are done so through software, and picture retouching is a popular technology. The traditional image processing technology can only perform relatively fixed image processing on the image, while the image style transfer based on neural network provides more imagination space for the design of image style. Through the analysis of text, a new method of text-based form transfer is proposed and used for image restoration; later, there is a new method, such as Prisma, which is the first to provide users with depth-based The mobile phone software of the picture format conversion service that I learned, it can convert pictures into high-quality works of art in a few seconds [5]; then, there are also several paid picture format transfer applications, which have achieved certain economic benefits. With these softwares, it is easy to create artworks with your own style without special expertise.

Video Processing
Special effects are ubiquitous in the film, television, animation and other entertainment industries. However, the production of film special effects requires both technical expertise and a great deal of manpower. If more artificial intelligence technology could be used, production costs would be significantly reduced. For example, the use of optical flow technology and deep neural network to realize the modeling of the film; on this basis, a method based on time compatibility loss is proposed to improve the consistency of each frame after the video format; then, related research established a time-based network model, which can include various types, can stylize online video in real-time, and conduct in-depth analysis of higher-level parameter spaces and discover a set of effective elements to realize the film scene. Impression.

Aids to Style Design
The transfer of picture style can be used as a good auxiliary means [6], such as: art painting, architectural art, clothing art, game scene design and so on. Although there is no relevant literature and successful examples so far, it will be an important research direction in the future.

From the current research situation, image format conversion techniques based on deep learning techniques are developing rapidly, but how to improve the efficiency and quality of the algorithm needs further exploration.

5.2 Weaknesses and Shortcomings

Parameter Adjustment
Both the image selection method and the model selection method require manual parameter adjustment, especially in the model selection method, a manual parameter adjustment is required after each parameter adjustment. Although the use of reconstruction-based image reconstruction algorithm can effectively solve the problem of parameter adjustment, and does not require independent training of different styles of models, the training process is more complicated, and the effect is not satisfactory [7]. The local smoothing

technique can improve the traditional reconstruction decoding algorithm, but it will lead to the loss of image texture, and the final result is similar to the color transfer of the image. How to find a simple and easy-to-control new method under the premise of ensuring image quality is the focus in the future. If the storage capacity of the model is not taken into account, improving the quality of image generation based on reconfiguration coding algorithms can effectively solve the parameter tuning problem.

Limitations of the Pre-trained Model
Using the VGG model for preview, it can be extracted from high-level abstract features, and then selected and optimized to achieve image style transfer. Currently, most of the deep learning-based image style transfer algorithms are implemented using the VGG model. Although VGG is a good convolutional neural network model with good feature extraction ability, due to its large scale and large amount of computation, and the initial design is not specially designed for image style transfer [8]. Therefore, starting from the traditional VGG model, developing a smaller and more effective feature extraction algorithm is an effective method to implement deep learning technology. Generative adversarial networks may overcome the limitations of the training mode, and its generation effect is better, and the algorithm based on distributed distribution has a good similarity with the correlation algorithm based on selection, and adopts the method of adversarial training when acquiring new features. method.

6 Conclusion

Two popular neural network models, the convolutional neural network model (CNN) and the generative adversarial network model (GAN), are analysed in detail on the basis of deep learning. This paper analyzes many aspects of these two models, and finds that with the continuous progress and development of society, the application fields of convolutional neural networks have become more extensive. Coupled with the development of artificial intelligence, convolutional neural networks have been used in many research directions. Shining brightly, users' demand for convolutional neural network models will increase day by day, and convolutional neural networks will still be a research hotspot in the field of deep learning for a long time in the future. Therefore, future research on convolutional neural network (CNN) and GAN is bound to continue, and will occupy the researchers' field of vision for a long time.

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