Research on Visual Arts of Artificial Intelligence Based on Style Transfer

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Abstract: With the coming of deep learning era, image style transfer has quickly become one of the hot directions in the field of artificial intelligence research. As an effective combination of computer science and art, style transfer algorithm endows computer art with the ability of re-creation. Deep-learning artificial intelligence has different metaphysical sources from the works of human artists, the former comes from the given limited sample range, while the latter comes from the free will of human artists, and this understanding also involves the demonstration of spiritual philosophy at a deeper level. This paper will focus on the possibility of diversified expression of visual arts with the assistance of artificial intelligence related technologies. Combining with style transfer, this paper explores the characteristics of intelligent visual art under the background of deep learning, and seeks its advantages of combining with artistic expression, so as to create a new expression form of artificial intelligence visual art creation based on style transfer.

1. Introduction

Painting art is one of the most important artistic expressions of human beings, which not only contains various professional creative techniques, but also carries artists' thinking about life and exploring the unknown. Style transfer makes computers have the ability of artistic re-creation by learning some samples and data of artistic works created by human beings, which is often used to generate works with specific artistic styles [1]. Since the mid-1990s, the theory of studying the artistic style of works has not only been studied by a large number of scholars in the art field, but also attracted the attention of many computer science researchers.

In the development tide of artificial intelligence in recent 70 years, researchers' unremitting pursuit and exploration of artificial intelligence related technologies have greatly excavated and promoted the creativity of machines. Among them, deep learning algorithms have given computers great potential, and deep learning algorithms are constantly extending and expanding human intelligence by simulating human cognitive style. Looking at various works, it is not difficult to find that there are many lines and various forms of expression [2]. Under the rendering of different line styles, works with the same content may have different artistic appeal and different suitable occasions. Compared with music and language, images are the most difficult to be symbolized and formalized. However, due to the rapid development of image recognition technology in recent years, it is possible for artificial intelligence to create visual arts (such as painting).

2. Transfer Learning and Style Transfer

2.1 Transfer Learning

Simply put, transfer learning is a machine learning method, which reuses a pre-trained model in another learning task. If we want to train a deep neural network to identify different breeds of cats and dogs, if we use imageNet data set to train directly, we need millions of labeled image data, massive GPU resources and training time. Choose to use migration learning. You can use the classification network pre-trained by big companies like Google or Microsoft, and you only need to train individual neural network layers to achieve the same purpose. In this case, only thousands of pictures are needed, and the training can be completed in a short time by using an ordinary workstation. However, when using transfer learning, the pre-training network has little gap with the current task, and when the task gap is too large, the learning effect will be very poor [3].

2.2 The Realization of Style Transfer

Transfer of artistic image style. It mainly includes three parts: style texture feature extraction, target image content extraction, and a new picture composed of style and content. The content and style of a picture are not completely irrelevant. When the content of one picture has the style of another picture, there is no picture that can perfectly match the content and style at the same time.

For the expression of image style and content in convolutional neural network can be separated, the two expressions can be manipulated independently to produce new, sensible and meaningful pictures [4]. In the process of synthesizing pictures, the minimized loss function includes content loss function and style loss function, which can adjust the coordination between content and style to produce visually appealing pictures. The overall realization idea is as follows:

(1)Generate a picture randomly, and the content of this picture can be generated from the original content picture, thus speeding up the training speed.

(2)Calculate the content loss function between the generated picture and the content picture as follows:

$$L_{content}(\vec{p}, \vec{x}, l) = \frac{1}{2} \sum_{i,j} \left(F_{ij}^l - P_{ij}^l \right)^2$$

(1)

(3)Calculate the style loss function between the generated picture and the style picture as follows:

$$L_{style}(\vec{a}, \vec{x}) = \sum_{l=0}^{L} w_l E_l$$

(2)

(4)The loss minimization function is:

$$L_{total}(\vec{p}, \vec{a}, \vec{x}) \alpha L_{content}(\vec{p}, \vec{x}) + \beta L_{style}(\vec{a}, \vec{x})$$

(3)

We regard the style of lines as a collection of basic paths and style lists. The basic path describes the position and general direction of the line. The style list contains the deviation vector formed by the corresponding points of the actual path and the characteristic path along the arc length parameters, and the information of the visual parameters changing along the arc length. As shown in Figure l.
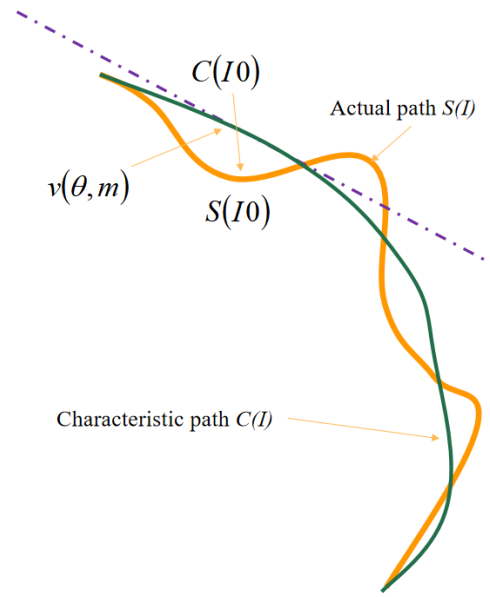
Fig.1 Line Model

In which and are arc-length parametric curves representing the actual path and characteristic path of a line, is a style difference vector composed of corresponding points of two curves, which points from point to and is represented by binary, whereand are polar angles and polar diameters of position vectors in polar coordinate system established by taking as the pole and the tangent line of the curve passing through this point as the polar axis.

3. The Combination of Artificial Intelligence Technology and Visual Art Creation

Visual art creation needs to break through the inherent expression space in the past. With the help of more diversified expression media, the creative forms of contemporary visual artists are constantly explored and tried from traditional single to more diversified integration, which broadens more possibilities of contemporary visual art creation.

3.1 Urgent Needs of Visual Art Creation

First of all, in the initial stage of visual art creation, the designer's input in finding inspiration and preliminary investigation is very important for the establishment of the overall creation. This means that before the start of visual art creation, designers need to use a lot of time and energy to collect, sort out, locate and analyze data for different creative themes, so as to inspire designers' creative ideas and stimulate them to generate creative inspiration.

Secondly, because the theme of visual art creation is infinite and the style of expression is gradually diversified, it also impels and requires designers to practice the keen ability of capturing visual elements in their daily work and life, in addition, they should always keep a business thinking to collect, accumulate and sort out materials with certain reference value, and be good at exploring and exploring things with potential such as creation and reprocessing.

In addition, it is not difficult to find out in the daily creative process of the author and the vast number of design practitioners that there are many simple and repetitive steps in the actual work content. It seems that these tasks only need simple adjustment, and it seems that there is no need for designers to carry out creative processing again, but only these subtle changes also need to spend time and energy to carry out repeated processes of "adjustment-comparison-readjustment" [5].

3.2 The Combination of the Two

Due to the increase of data volume, the improvement of computing ability and the emergence of new machine learning algorithms in recent ten years, the theory and technology of artificial intelligence have become increasingly mature. At present, the scientific research on artificial intelligence mainly depends on machine learning. As a machine learning technology, with the continuous development in recent years, deep learning has been widely concerned in the society, and has been deeply applied in image processing fields such as image segmentation, target detection and biological image recognition [6]. If we can promote the communication, discussion and practice between art and computer science, we may be able to try to use the technical advantages of artificial intelligence to solve some demands on creative efficiency and creative forms in visual art creation.

Science and art play a complementary role in human development, both of which contain creative thinking and seek solutions to problems. A new form of visual art that meets the needs of the intelligent age may be born with the development and application of deep learning technology. This will also remind artists in the intelligent age that while grasping the traditional visual arts and culture, they also need to know the basic related technologies and development trends, so as to actively explore new art forms and better adapt to the new creative path.

4. Research on Artificial Intelligence Technology and Visual Art Creation

4.1 Animation Special Effects Style Transfer

The style transfer algorithm based on artificial intelligence is based on Caffe as the network platform, with the help of mainstream models, to design special effects of style transfer animation. Caffe is a deep learning framework. It is a clear, readable, fast and open source artificial intelligence network. It is different from traditional style migration algorithms such as texture synthesis, SVM (Support Vector Machine), histogram matching, and automatic sample collection.

First, the video is converted into a single frame. With the help of MATLAB technology platform, the film to be migrated is preprocessed. That is, continuous videos are processed in a single frame, classified according to shots and stored as JPG format files. Secondly, carry out video style migration. With the help of Caffe artificial intelligence network and model, the style transfer algorithm is used to classify the film video frames, and make the animation special effects of style transfer. Generally, 24 frames or 48 frames are selected as a cycle for migration design. Thirdly, set about animation color correction. In the style transfer of movies, sometimes there will be flicker problems. The essence of flicker is that the brightness or hue of adjacent frames have changed obviously, and this inconsistent and flickering visual experience can be seen when playing continuously. Using color balance for algorithm correction can remove flicker and get the best animation effect. Finally, the single frame is synthesized into animation. After continuous cyclic migration and color correction of video frames, the AVI format is synthesized with the help of MATLAB technology platform, and the whole animation is completed, so as to watch visual effects.

4.2 Creativity and Artistic Evaluation in Artificial Intelligence Art

Some scholars believe that creativity is necessary for human progress, and "creativity is the key factor driving civilization forward" [7]. Art is the embodiment of human creative thinking, and creative thinking is the most complex and difficult ability of human intelligence to be formalized by computer. So what kind of ability is creativity in art? Can it be formalized? Can artificial intelligence have a certain degree of creativity?

Computer experts believe that intelligent computers can get a certain degree of creativity by designing programs and deep learning. Let's look at the creative part involved in the creative confrontation network (see Figure 2). The innovation of creative confrontation network lies in that it sets two standards in the discriminator, one is "whether it is art" and the other is "what style type the generated art belongs to". These two standards are set to be antagonistic, that is, it is necessary to generate images belonging to the art category, but also to set images that are different from the established style, that is, blurred artistic style [8].
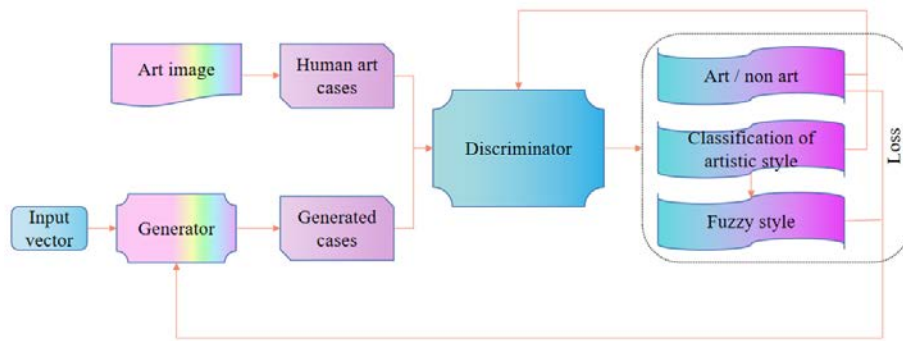

Fig.2 Schematic Diagram of Creative Confrontation Network Program

We can see that the creativity-against-network program uses learning deviation (that is, deviating from the established style to the maximum extent) and distinguishing artistic standards (deviating from the artistic scope to the minimum extent) in terms of innovation. In other words, innovation is a breakthrough and deviation from the original rules within the established scope. Creativity versus network painting is a work of art, and it has certain artistic characteristics such as intention, visual structure and communication.

4.3 Artificial Intelligence Technology Participates in Visual Art Creation

After artificial intelligence technology intervenes in traditional visual art creation, it is necessary to transform visual images into data, and then input these image data into the network model program of deep learning, and then output the results by the machine. Imagine, if the computer production mode is used to compare traditional visual art, even the modern intelligent visual art creation method, it will be transformed into the logical mode of "input → operation → output" according to the computer production mode, as shown in Figure 3.
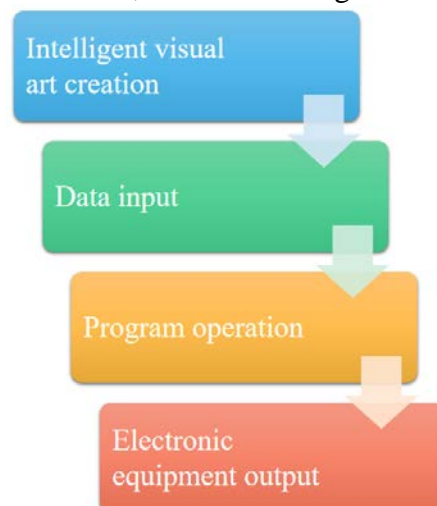
Fig.3 Intelligent Visual Art Creation Logic

At the same time, after sorting out and analyzing the creative process of many practical cases in the previous article, it is not difficult to find that the intelligent visual art creation now follows the creative principle of "seeking inspiration → preliminary investigation → preliminary scheme → presentation of works", and the actual creative process after visualization is shown in Figure 4.
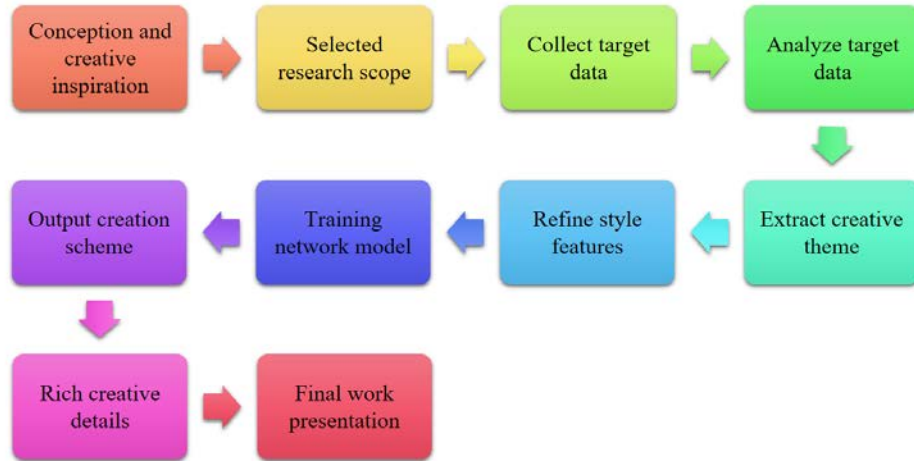

Fig.4 Artificial Intelligence Technology Participates in Visual Art Creation Process

Intelligent visual art creation relies on the call and operation of database, thus shaping a new path of visual art creation. The database is more like an artistic gene bank containing infinite themes and visual elements, and computer programs rationally allocate them to create stimulating and infectious actual visual forms.

5. Conclusion

The elements of artistic concept and the principle of deep learning artificial intelligence determine their incompatibility. Accordingly, the works of human artists and artistic artificial intelligence have different metaphysical sources. Artificial intelligence works should be attributed to natural beauty, not artistic beauty. Secondly, aesthetic emotion. In the future, artificial intelligence art will develop in two aspects. On the one hand, it will continue to imitate the style and content of human art, that is, it will study from the aspects of visual perception, creativity, art evaluation and standards, and create works similar to human art. With the improvement of hardware performance and the development of artificial intelligence technology, transfer learning technology will have more applications in art creation and film and television industry. For example, art style transfer technology can be used to transfer the artistic style of a shot film by frame, and film and television works with artistic effects can be produced.

6. Acknowledgment

References

[1] Shi T, Zou Z, Yuan Y, et al. Fast and Robust Face-to-Parameter Translation for Game Character Auto-Creation. Proceedings of the AAAI Conference on Artificial Intelligence, vol. 34, no. 2, pp. 1733-1740, 2020.

[2] Huang W, Ren J, Yang T, et al. Research on urban modern architectural art based on artificial intelligence and GIS image recognition system. Arabian Journal of Geosciences, vol. 14, no. 10, pp. 1-13, 2021.

[3] B Kong, J He, L Sun. Network Audio-visual Intelligent Media Architecture Based on Artificial Intelligence. Radio and television technology, vol. 046, no. 006, pp. 42-45, 2019.

[4] Chen X, Xu C, Yang X, et al. Gated-GAN: Adversarial Gated Networks for Multi-Collection Style Transfer. IEEE Transactions on Image Processing, vol. 28, no. 2, pp. 546-560, 2019.

[5] Zhang Xiaotong, Li Yuelin. Thematic Structure of Artificial Intelligence Policy and Planning:Based on Co-occurrence Network Analysis of Subject Words. information and documentation services, vol. 040, no. 004, pp. 44-55, 2019.

[6] REN Yanwu. Analysis on the Liability for Damage in Artificial Intelligence Application. Journal of Luoyang Institute of Technology , no. Social Science Edition), vol. 034, no. 001, pp. 48-55, 2019.

[7] Hou Guodong, Min Xu, Zhang Fei. Creation of artistic style images based on transfer learning. Southern Agricultural Machinery, vol. 050, no. 023, pp. 173-174, 2019.

[8] Tao Feng. Research on Visual Arts of Artificial Intelligence. Literary Contention, vol. 000, no. 007, pp. 73-81, 2019.