

A Comparative Research on AI-Generated Painting and Human Painting

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Abstract:

With the continuous progress of technology, AI is gradually deepening the field of painting, challenging the boundaries of traditional art creation. With the innovation of technology, art has gradually evolved from early murals, prints, and oil paintings to digital paintings, and technology has given art a wider space for development. This paper explores the differences and similarities between AI painting and traditional painting, comparing them in detail from four aspects: development history, creative process, and visual effect, and discussing the real-world value of AI painting. Although AI painting is highly favored by the commercial sector due to its significant advantages in terms of efficiency and cost, it is however unable to bring the emotional experience and depth that human creators have. As technology changes the world and painting changes the way we see the world, creators should think about how to co-exist with emerging technologies to create more valuable artworks.

Keywords:

AI-generated Painting, AIGC, Traditional Painting

1. Introduction

The interrelationship between art and technology has been a constant throughout the course of human history. The accelerated development of artificial intelligence algorithms has led to the widespread use of AI-generated content (AIGC) in the fields of art and music. Among the applications of AI in the field of art, AI-generated painting, or “AI Painting” for short, has been particularly impactful. Its efficient operation process, fast work generation capability, and satisfactory visual effects have effectively lowered the threshold of art creation, enabling more non-professionals to participate in art creation. This has resulted in a reduction in the costs associated with creation, as well as an expansion of the boundaries of artistic expression. Artists are using algorithms and data analysis to create new kinds of paintings. AI painting is changing art. It offers new possibilities but also challenges traditional painting. Some digital illustrators are at risk of losing their jobs because of AI Painting. This change has sparked discussions worldwide on the relationship between technology, art, and social responsibility. This paper looks at the similarities and differences between AI

painting and human painting, and their practical implications in the current social context.

2. History of Development

2.1. History of AI painting

AI Painting grew out of AIGC, a new generation of AI applications. It has three periods based on its development history.

In the first period, from 1950 to 1990, AIGC was still in its early stages. It could only do small experiments because of technical limitations. In 1950, Turing proposed a test to see if a machine is intelligent. In 1966, the world's first robot that could chat with people was created. It was made using a computer and could complete tasks by scanning and reorganizing keywords. This technology helped create the first version of AIGC.

In the second period, from 1990 to 2010, AIGC entered a phase of steady progress. 2007 saw the world's first novel written entirely by AI, *The Road*, written by an AI system at NYU. The novel is not very readable and suffers from typographical errors and confusing logic, its technical significance far outweighs its literary value. After entering the 21st century, AIGC has moved from technical experimentation to commercial practice, but limited by algorithmic bottlenecks, it can only provide template-generated content, and its openness and inclusiveness still need to be improved [1].

In the third period, AIGC has developed rapidly since 2010. The content is more varied and realistic. Since 2014, Goodfellow et al. have used deep learning algorithms, such as Generative Adversarial Networks (GANs), to help AIGC. In 2018, the first AI-created portrait, the *Edmund Portrait of Bellamy*, caused a stir. AIGC technology is now mature, and there is more cross-research between art and other fields. This has led to new ways of creating art and expressing it.

2.2. History of human painting

Painting is an essential part of the historical and cultural process of human beings. Since the primitive period, painting has been carrying human concepts, records communication, etc. It is a form of art that expresses the relationship between the self and the collective identity and objectively reflects the scientific, technological, and cultural progress of human society. Painting is roughly divided into four phases according to social history.

The first stage is the prehistoric and classical period. Rock paintings and cave murals from prehistoric times are the earliest known examples of art. People used natural pigments to paint their world. Over time, art in places like Egypt, Greece and Rome became more detailed. During the Han Dynasty in China, paper-making technology led to a new way of painting. By the Tang Dynasty, woodblock printing was popular. In the Renaissance, artists used perspective to make their paintings more realistic. These techniques gave the artists of the time more scientific support.

The second stage was the Industrial Revolution. The Industrial Revolution led to big advances in science and technology, especially in chemistry, botany and mineralogy. As these disciplines progressed, new, stable and colorfast pigments became easier to obtain. New optics led to new photography techniques that changed

how art was made. The Industrial Revolution changed architecture, design and the arts and crafts. Products were made faster and artwork was available to more people. People started painting factories, cities and the working class.

In the third stage, art moved away from traditional painting and canvas. New technology in electricity and sound led to the creation of cinema and television, changing how people saw reality. Photography made art more diverse. Artists used new techniques and ideas to create Impressionism, Cubism and other styles. While the visual arts kept getting better, artists started focusing on the idea behind the work, not just how it looked.

The fourth stage is the digital period. After the end of the 20th century, human society entered a new digital era. Digitization is the use of computer technology, audio-visual elements, and other information in digital form. This is then used to create digital applications based on real-world needs [2]. Computer graphics have also risen in popularity, providing creators with new creative tools and platforms. Adobe Photoshop can simulate traditional art media like oil painting and drawing. VR and AR technologies have expanded how art can be presented. Creators use digital tools to combine traditional and modern elements. Viewers can immerse themselves in virtual art worlds and enjoy unique visual and sensory effects.

3. Contrast the Practical Process of AI Drawing with Human Drawing

Artists and AI need to go through a complex process to create work. AI painting is based on computers processing lots of data, while human beings rely more on personal experience, skills and artistic training when creating works. AI painting and human painting are both ways of using human intelligence and technology to create art.

3.1. Comparison of creation process

The creation process is the step of turning ideas into images. It shows the creator's way of thinking, technical ability and emotional expression. AI painting and human painting are similar because they are both created by humans. AI painting is inspired by human artists and follows human artistic standards. But AI paintings are different from human paintings in the creative process. This paragraph compares digital painting with human painting.

Firstly, the AI painting creation process uses deep learning and generative modelling techniques. There are two main types of AI painting tools. Each has different characteristics and uses. One type uses cloud computing and large amounts of data and models, represented by the tool Midjourney. This type of platform is easy to use. Users can create images in different ways, including using text, existing images, or a mix of text and images. The user doesn't see the complex digitization process, only the image changing from blurry to clear (Figure 1). Another way to use data locally is Stable Diffusion. This tool lets users collect and process data locally, which requires some hardware resources. This method is complex and requires a lot of hardware, but it gives professional users more precise and personalized creative options.

Secondly, human painting is based on techniques and technology. Everyone has their own way of creating, but there are usually these steps: The first step is

inspiration. The creative subject may get ideas from the world around them, their own experiences, or feelings. The second step is collecting materials. This stage helps the creator understand the subject matter and get more materials. The third step is to draw the first draft. Once the creator has collected enough material, they use tools to draw the first draft to present the idea simply in the picture. The last step is to make changes. After the first draft is done, the author will make it better. This takes a long time and the author will make many changes until it is good (Figure 2).

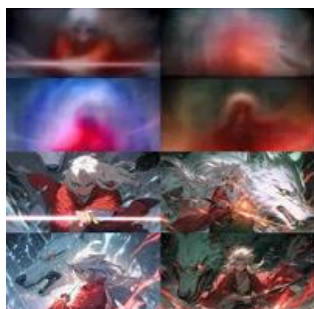


Figure 1. AI drawing generation process.
(Source: Lei Yuxi)



Figure 2. Digital Illustration, Drawing Process.
(Source: Lei Yuxi)

3.2. Comparison of Visual Effects

Paintings can show emotions, the theme and how the viewer feels. On 8 December 2022, Le Zhenwen painted Lu Xiaoman's unfinished manuscript, Summer Mountain Dwelling. The painting was put up for auction [3]. The two paintings used the same manuscript, but were created in different ways. One was drawn by a human, the other by AI. The auction of this painting is a "milestone" in AIGC technology.



Figure 3. AI painting and human painting.
(Source: Duoyunxuan)



Figure 4. Théâtre D'opéra Spatial. (Source: the Colorado State Fair's annual art competition)

Although the two Summer Mountain Dwelling paintings are created with different means, both successfully capture nature and harmony in Chinese landscape painting, presenting fascinating visual effects. The following analyses the visual effects of AI

paintings and human paintings through a specific comparison to provide new ideas for the inheritance and development of traditional art.

First, the visual expression of AI paintings is based on imitation and reproduction of other artworks. All of Lu Xiaoman's artworks, calligraphy, and letter writing were integrated, and numerous traditional Chinese landscape paintings were studied to finally generate a work that conforms to the style of Chinese painting (Figure 3a). This AI-generated Chinese landscape painting uses blue as the main colour, making it feel cool. The painting is light and elegant, with hazy outlines of mountains and rocks. The mountains have peaks, the trees are strong, and a river runs through the village. People stop by the riverbank. The whole painting shows landscapes that can be viewed, lived in and travelled in, confirming the harmony between man and nature advocated by traditional Chinese painting. What is more noteworthy is that the AI learned the characteristics of Lu Xiaoman's handwriting and generated a poem with the title. This is also an interesting combination of AI processing language and visual art. The shortcoming, however, is that the AI's handling of details, such as trees, rocks, and other picture elements, does not reach the level of finesse of human paintings, which exposes the limitations of the AI in reproducing elements that are more logical in nature. This work created by AI shows the typical characteristics of Chinese landscape painting as a whole, which provides us with a new direction in creating traditional art.

Secondly, human paintings are an intuitive form of artistic expression. Take the example of Le Zhenwen's continued painting of Lu Xiaoman's landscapes (Figure 3b). Le Zhenwen added details and a distant mountain view to Lu Xiaoman's draft. The mountains are outlined in soft greens and tawny, creating rich layers of colour. The waterfall is white, contrasting with the rocks and showing the water's clarity and flow. The picture is calm and peaceful, showing the beauty and harmony of nature. Every detail of the picture, be it the inscription or the content, reveals his respect and love for his forefathers and the art of painting, showing the sincere and profound spiritual world of a creator.

4. Significance of Comparative Painting

AI painting represents an emerging field of fusion of technology and creativity, expanding the scope of expression of traditional painting. These technologies have made art creation more efficient, but they have also brought about a profound reflection on the nature of art and the rights and interests of authors.

4.1. The Realistic Value of AI Painting

The AI painting process is different from the manpower and intuition that traditional painting relies on, and it is based on data-driven algorithms, breaking the traditional boundaries of art creation, and providing artists and designers with a broad creative space. Firstly, the application of AI painting significantly improves the efficiency of creation; AI tools can generate design sketches, providing creators with preliminary drafts and reducing the time spent on manual drawing. Taking Théâtre D'opéra Spatial (Figure 4) as an example, it successfully integrates AI drawing tools and digital painting software, and the work won the championship at the art fair held in August 2022 in Colorado, USA. In the field of commercial painting, many companies use AI software to quickly generate adverts or concept designs artwork without having to hire many designers. Statistically, Midjourney's fast mode can

generate an image in less than 50 seconds, and the game company's production time will be reduced by about 20-30% by using AIGC [4]. AI painting provides a platform for non-professionals to get started, and with simple operations and instructions, anyone can try and create their artwork. Secondly, the continuous development of AI painting also tests the limits of machine intelligence. The understanding of "beauty" and "ugliness" is unique to human beings, whether AI can truly "understand" the concept of beauty and "create" works of art is a question of, it is a question of whether AI can truly "understand" the concept of beauty and "create" works of art. Whether AI can truly "understand" the concept of beauty and "create" works of art is a human exploration of the boundaries of machine intelligence. Many consider art, aesthetics, and creativity to be the pinnacle of human ability: far from being something that can be replicated with technological advances, they are what are seen as the last obstacles that stand in the way of AI's continued progress [5]. Finally, the development of AI painting also provokes philosophical inquiry into the nature of art. It has challenged traditional ideas about creativity and originality, stimulating public debate about art, authors' rights, and machine creativity. In conclusion, the real-world value of AI painting lies not only in its practical application in art and commerce but also in its cultural and social impact as an emerging technology.

4.2. The significance of human painting

Painting is the artistic carrier of human history, which not only shows the change in human civilization but also shows the world beyond the text through the perspective of creators from ancient times to the present. Human paintings are a true reflection of the creator's emotions and inner world. Painting can resonate with the viewer and provoke thinking. From an aesthetic point of view, painting is the embodiment of the creator's aesthetic pursuit. Through continuous experimentation and innovation, a rich variety of styles and genres have been formed, reflecting mankind's continuous exploration and understanding of beauty. In human societies, paintings also often appear as vehicles for the expression of important historical events and social mores. They are celebratory, critical and subjective expressions that are entirely in the hands of their creators and have an impact on both individuals and society.

It has been shown that "the tasks that will be replaced by AIGC are usually regular and repetitive". Regular tasks are relatively easy for computers to imitate because they follow clear, predefined rules. For tasks with a repetitive nature, machine can learn to produce more perfect results from many repetitive instances as the output samples increase [6]. In contrast to tasks with well-defined rules, such as algorithms or data processing, drawing is not regular and repetitive, making it difficult for drawing to be completely replaced by AI technology. Each creator has his or her unique style, technique, and perspective, which makes painting a form of expression rooted in experience, and individuality. Each attempt at painting, even with the same subject or object, may produce different results depending on the situation, or mood.

5. Conclusions

With the continuous progress of human science and technology, the integration of AI and art is in a wave full of potential and opportunities, and this intermingling is a double-edged sword for both art and technology. This paper discusses the similarities and differences between AI painting and human painting in terms of development history, creative process, visual effect. which not only witnesses the rise of AI

painting technology but also re-recognizes the irreplaceable value of human beings in creative thinking.

AI painting has undoubtedly broadened the way humans explore art, and at the same time triggered in-depth thinking about the definition of art, the rights of creators and the originality of works. In the face of the new wave of AI painting, we need to look at its relationship with human painting in a dialectical way. For the public, the continuous improvement of AI painting provides a more convenient way for people to create art. On the other hand, we should safeguard the rights and interests of the creators and respect the profound thoughts they express in their artworks.

Overall, AI painting can be used as a tool to assist artistic creation, but it should not be regarded as a substitute for human creativity and artistic perception. The course of history tells us that the birth of any new medium cannot completely replace the old one. Photography will not replace realistic painting, the emergence of television has not replaced cinema, and the continuous enrichment of information on the Internet has not replaced the practical feelings given by offline exhibitions. What we expect in the future is not only a simple combination of technology and art but a new era in which culture, emotion and technology coexist harmoniously. In this context, the aesthetic concepts of traditional art and modern technology will work together to shape a broader and more vibrant real world.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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