

# The Development and Impact of AI-Generated Content in Contemporary Painting

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**Abstract.** The paper examines the evolution and impact of generative artificial intelligence (AI) technology in the field of painting, tracing its ascent from the early 21st century. It highlights pivotal developments in AI-generated content (AIGC), starting with Harold Cohen's "AARON" program in the early 1990s, progressing to Yang Zhiping's introduction of generative adversarial networks (GANs) in 2000, and culminating in Robbie Barrat's innovative applications in 2018. These milestones underscore the swift progression and vast potential of AIGC for both technical innovation and artistic expression. This analysis delves into the current landscape of AIGC in painting, identifying key technological advancements such as deep learning, GANs, style transfer, adaptive algorithms, and augmented reality. These technologies have elevated artistic creation to unprecedented levels. However, AIGC also confronts significant challenges, including issues related to copyright and intellectual property, artistic ethics and originality, technical constraints, market acceptance, and socio-ethical and legal concerns. To address these challenges, the paper proposes several solutions: clarifying legal standards, establishing authorization mechanisms, fostering hybrid creative models, enhancing the diversity of training data, promoting public education and outreach, and developing professional training and ethical guidelines.

**Keywords:** Artificial Intelligence Painting; Generate Adversarial Network; Deep Learning; Copyright Issue.

## 1. Introduction

At the beginning of the 21st century, the rapid advancement of artificial intelligence technology gave rise to a new form of artistic creation known as AIGC—AI Generated Content. This innovation marks a significant trend following PGC (Professionally Generated Content) and UGC (User-Generated Content) [1]. AIGC extends beyond merely showcasing technology; it is profoundly redefining the creation, display, and consumption of painting. The evolution from traditional to digital art, and now to art autonomously generated by computers, highlights the limitless possibilities and novel approaches at the intersection of art and technology [2].

Central to AIGC technology is the deployment of complex algorithms that emulate the creative process of a human artist. This involves learning an artwork's style, the artist's skills, and emotional expression to create entirely new pieces [3]. This technology not only democratizes art creation, enabling broader participation, but also diversifies and personalizes artistic styles.

However, the impact of AIGC on the painting sector has been profound. It influences various art concepts, transforms audience experiences, disrupts the art market, and poses new legal and ethical questions. Artists are increasingly collaborating with AI to produce unique artworks, challenging traditional notions of what constitutes "art" and diversifying artistic expression. Concurrently, AI's role in art creation raises significant issues regarding originality, authorship, and ownership, necessitating fresh legal and ethical interpretations [4].

Thus, the development and influence of AIGC in the realm of painting are multi-faceted and interdisciplinary, intersecting technology, art, law, and business. This article aims to explore AIGC's ongoing unique role in painting, examining its implications and potential as a symbol of the future convergence of science, technology, and art.

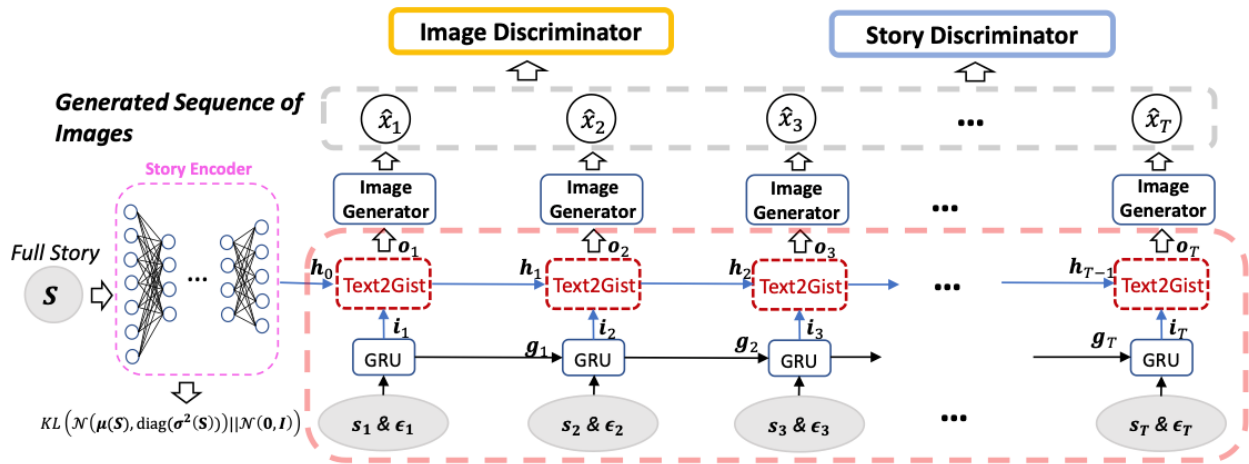
## 2. History of Aigc's Development in the Field of Painting Art

The development history of AIGC in the field of painting art can be traced back to the late 20th century to the early 21st century, with the rapid development of computer technology and artificial intelligence, people began to try to use algorithms and deep learning to create art works [5]. Here are some important milestones in the history of AIGC's development in the field of painting art.

Early 1990s: In the early 1990s, artist Harold Cohen began building a computer program called "AARON" that controlled a robotic arm to draw works. AARON's ability to create abstract works of art by self-learning and imitating the behavior of artists is regarded as one of the representative works of early AIGC.

Early 2000: With the development of deep learning and neural network technology, AIGC made new breakthroughs in the field of painting. In 2007, Yang Zhiping proposed the concept of generative adversarial networks (Gans) [6]. This technology enables computer systems to automatically generate realistic images, laying a technical foundation for the development of AIGC. Figure 1 is the framework diagram of GAN network.

2010: AIGC began to achieve more extensive applications in the field of painting particles.



**Figure 1.** The framework of StoryGAN [7].

In 2015, a work generated by AIGC, "Portrait of Edmond Bellamy," fetched a high price at Sotheby's in London and attracted a lot of attention. This event marked AIGC's emergence on the art market. The Figure 2 is the exhibition of the work "Portrait of Edmond Bellamy".



**Figure 2.** Portrait of Edmond Bellamy [7].

2018: Artist Robbie Barrat uses neural networks to generate a series of abstract art works that are shown in exhibitions around the world. His works show the diversity and innovation of AIGC in artistic expression and artistic style, which has aroused more people's wide attention and discussion on AIGC drawings [8].

2020 to present: With the continuous maturity and popularization of AIGC technology, more and more artists and researchers have begun to explore the application of AIGC in the field of painting art. Some scientific research or art institutions also began to launch competitions and exhibitions about AIGC art, further promoting the development and exploration of AIGC in the art world [9].

The development history of AIGC in the field of painting art is a process of continuous exploration and innovation [10]. From the early experimental research to the current commercial application, AIGC has become a science, technology and art form in the field of painting that attracts much attention. With the continuous progress of artificial intelligence technology and the continuous attempts of creators,

The future development of AIGC in the field of painting art is full of infinite possibilities and imagination.

### **3. Current Situation of Aigc in the Field of Painting**

AIGC in the field of painting is now a dynamic and progressive picture. It brings together the innovation of science and technology, the exploration of literature and art, and the discussion of social ethics. With the rapid advancement of artificial intelligence technologies, especially deep learning and generative adversarial networks, AIGC has not only become a new tool and method of artistic creation, it has also challenged the value system and aesthetic standards of the art world.

AI painting can integrate and create multiple different artistic styles, or even styles of different historical periods and cultural characteristics, with an unconventional thinking mode, and obtain a highly innovative "new style", thus promoting the further improvement of human creative ability.

In terms of technology, AIGC brings an unprecedented capacity for innovation to the field of painting. By allowing AI to learn the characteristics and painting techniques of art works on a large scale, AIGC has been able to create art works that approach or even exceed the level of human artists. These AI-generated paintings are of such high quality and varied in style that many ordinary viewers have difficulty distinguishing between the works of machine and human artists.

In the process of artistic creation, AIGC becomes a powerful assistant to artists. Artists can engineer AI data and combine their creativity with AI's technical capabilities to create a new form of art. By working with AI, artists will not only be able to find new forms of visual representation, but will also be able to incorporate more experimental and interactive experiences when painting with machines.

However, the rise of AIGC in the field of painting has also brought with it a series of ethical and legal issues. The originality and copyright ownership of AIGC art works have become the focus of widespread discussion in modern times. If a work is created by an AI alone, does the ownership of the work belong to the developer of the AI, the author of the art created by the AI, or the AI itself? Moreover, what is inspired and what constitutes plagiarism when AIGC imitates and borrows from existing works of art?

In the field of business and marketing, the rapid development of AIGC in the field of painting has also caused changes. With the expansion of the digital art market and the popularity of non-homogeneous tokens (NFTS), art works produced by AIGC are beginning to be bought and sold as a new type of asset, bringing new vitality and challenges to the art market. But it has also led to new models of how works of art are valued, collected and invested.

The current state of AIGC in the field of painting is a dynamic and complex style. It is the product of the convergence of technology and art, as well as social, legal and economic factors. The future development direction of AIGC in the field of painting will be diverse and unpredictable. It may not only continue to expand the boundaries and possibilities of art, but also may trigger people's profound thinking about the nature and value of artistic creation. With the continuous progress and application of new technologies, AIGC will continue to meet new challenges in artistic creation, copyright ownership, marketing, etc., which will promote the art of painting into a new era.

## **4. Technical Innovation of AIGC Painting**

In the field of painting, AIGC's technological innovations have led to many exciting developments. Here are some of AIGC's key technical innovations when it comes to painting.

### **4.1. Deep Learning**

Deep learning is one of the core techniques of AIGC when painting. Through deep neural network learning and training, AIGC can simulate and understand the artist's creative process, from line, color to composition and other aspects of the painting imitation. The application of deep learning technology enables AIGC to create works of art that go beyond people's imagination.

### **4.2. Generative Adversarial Network (GAN)**

Generative Adversarial network is another important technical innovation of AIGC, which consists of two neural networks, a generator and a discriminator. The generator is responsible for generating the image, while the discriminator is used to evaluate the similarity of the generated image to the real image. Through this adversarial learning, AIGC can continuously optimize the generated works of art, making the works more realistic and artistic.

### **4.3. Style Transfer Technology**

Style transfer technology is a technology that integrates different artistic styles. AIGC can use this technique to learn and apply a variety of artistic styles, making paintings both diverse and personalized. Through style transfer techniques, AIGC can create innovative and artistic works.

### **4.4. Adaptive Algorithm**

AIGC uses adaptive algorithm so that the machine can constantly adjust and improve the art works according to the user's feedback and preferences. This algorithm can make the paintings generated by AIGC more in line with the user's aesthetic standards and enhance the individuation of the paintings.

### **4.5. Augmented Reality Technology**

The application of augmented reality technology enables the paintings generated by AIGC to be combined with the real world, presenting a richer and more vivid art experience for the audience. Through augmented reality, the audience can interact, adjust and optimize the works generated by AIGC, making art creation more flexible and interesting.

## **5. Artistic Manifestation of AIGC Painting**

The development of AIGC in the field of painting is both the result of technological progress and the expression of the continuous exploration of artistic creation. With the development and maturity of AI technology, AIGC's artistic representation in painting has shown remarkable characteristics of diversification, personalization and innovation.

### **5.1. The Artistic Representation of AIGC in Painting Is Gradually Developing in A More Detailed and Realistic Direction**

Thanks to advanced technologies such as deep learning and generative adversarial networks, AIGC is able to notice and draw the smallest details of the picture to create high-quality artwork. The degree of detail and fidelity of these works often makes it impossible for the average person to know whether the work is human or not. AI painter Albert, for example, has been widely praised for his meticulous detail and true use of color. This technological advancement not only improves the level of creation of AIGC, but also broadens the scope of its use, from still life painting to landscape painting, and then to portrait painting, AIGC is increasingly widely used in the field of painting.

## **5.2. AIGC Shows Strong Personalization and Innovation in Painting**

By learning a large number of works of art, AI can simulate and innovate different artistic styles. For example, style transfer technology enables AI to transform a painting in a modern style into an impressionist or abstract style. More importantly, AIGC is able to combine different styles to create new forms of artistic expression, making each work unique. This personalized way of creation not only enriches the form of artistic expression, but also provides a broader space for artists to create.

## **5.3. The Artistic Expression of Aigc In Painting Is Paying More and More Attention to the Interaction with the Audience**

The introduction of virtual reality (VR) and augmented reality (AR) technologies has enabled AIGC's artwork to be displayed in a virtual space. The audience can participate in the art creation process through various devices. For example, some exhibitions employ VR technology, allowing visitors to wander through a virtual gallery and even change the style and content of the work in real time through gestures and voice commands. This interaction not only enhances the audience's sense of participation and experience, but also lowers the boundary between the creator and the audience, making artistic creation more vivid and interesting.

## **5.4. AIGC Constantly Challenges and Expands the Boundaries of Art When Painting**

Traditional painting is often subject to the artist's painting skills and personal perspective. But AIGC can break through these limitations and explore a wider range of artistic fields. For example, AI can combine scientific data to create works that reflect grand themes such as climate change and biological evolution. These works not only have artistic beauty, but also provoke the audience to think about scientific and social issues. In addition, the combination of AI and other art forms, such as music, dance, etc., has also given birth to new forms of artistic expression, such as audio-visual art and digital installation art, further expanding the boundaries of art.

## **6. Realistic Problems and Solutions of AIGC Painting**

As a typical representative of generative artificial intelligence, AI painting not only provides artists with a new way to create, but also exposes aesthetic convergence, technical deviation, copyright disputes, unemployment anxiety and other problems in actual production and creation.

### **6.1. Copyright and Intellectual Property**

Although AI tools have a strong ability to produce information, they are not compatible with the user's original judgment. There is ambiguity in the attribution of copyright to AIGC paintings. The existing legal system is mainly designed for works created by humans, and there are no clear rules on how to allocate copyright to works created by AI. This has led to disputes over who (the programmer, the user, or the AI system itself) should own the copyright to these works. In addition, the use of unlicensed art data when training AIGC models is highly likely to infringe the copyright of the original author and lead to legal disputes.

Solution: Put forward clear legal norms, and the government and relevant organizations should formulate and improve laws and regulations to clarify the copyright ownership of AI-generated works. One could consider giving copyright to individuals or businesses that create AI work, similar to how a photographer owns a copyright to a photograph taken by a camera. Establish an authorization mechanism, clarify the authorization mechanism for data use, and ensure that the copyright of the original author is respected and protected when using art data for AI training. Copyright grants can be tracked and managed by developing industry standards or using blockchain technology.

## **6.2. Artistic Ethics and Originality**

Whether AI-generated works of art are truly original is a hotly debated issue. The creative process of AI is mainly based on the analysis and reuse of existing data, and the creation of AI may lack depth and innovation compared to the works created by human artists through unique perspectives and emotions.

The solution: Create a hybrid creation model that encourages collaboration between AI and human artists to create more innovative and in-depth works by combining AI's technical strengths with human creativity. Establish an originality certification, develop an originality evaluation mechanism, and prove the originality of these works by identifying the unique creative components and technical means in AI works.

## **6.3. Technical Limitations**

While AIGC technology can produce high-quality art, its creativity and complexity are limited by reading data. In theory, AIGC aesthetic generation training can learn the style and content of paintings. AI mainly creates by imitating and combining existing data, and it is difficult to achieve breakthrough innovation. AI may also show limitations when dealing with complex emotional expressions or cultural connotations. In addition, training high-quality AIGC models requires a lot of data and computational resources, which can be a challenge for some small studios or independent artists.

The solution: Improve the diversity and quality of training datasets to enhance AI's creative capabilities by introducing art data from a variety of styles and cultural backgrounds. Minimize creation costs, develop more efficient training algorithms and models, reduce the need for computing resources, or spread the high training costs through cloud computing methods or shared computing resource platforms.

## **6.4. Market Acceptance**

Due to the unique nature of AIGC painting, the market's acceptance and trust in it is not high. Collectors and buyers may have doubts about the long-term value and authenticity of AI-generated works. In addition, the sales channels and pricing models of AIGC artworks are not yet mature, affecting its market performance.

Solution: Large-scale education and promotion, through exhibitions, lectures and media campaigns, to increase people's awareness and acceptance of AIGC painting, so that people understand the AI creative process and its potential value.

## **6.5. Social and Ethical Issues**

AIGC technology could pose a threat to the employment of traditional artists, especially in commercial art and advertising, where AI-generated images and designs could replace human work. In addition, AI-generated content may have moral or ethical implications, such as generating sensitive or inappropriate artwork.

The solution: vocational training and conversion, providing retraining opportunities for traditional artists, helping them master AI creative tools and adapt to new ways of creating art, while emphasizing the unique value of human artistic creation. Develop ethical standards and ethical guidelines for AI creation to ensure that the content generated by AI meets social ethical standards and prevents the generation of inappropriate or harmful content.

## **6.6. Laws and Regulations**

Current laws and regulations often lag behind the pace of technology development, and lack clear provisions on copyright, privacy protection and accountability for AI-generated content. There are also significant differences in legislation and regulatory standards in these areas in different countries and regions, which affects the global application and promotion of AIGC technology.

Solution: Combine legal update with international cooperation: the government and legislative bodies should update and improve relevant laws and regulations in a timely manner, and clarify the copyright, privacy protection and accountability mechanisms for AIGC paintings. At the same time, through international cooperation, we will promote countries to reach a consensus on AI technology supervision and formulate unified standards and norms.

## **7. AIGC's Influence on the Future of Painting**

AIGC technology will open new portals to art creation, providing innovative tools and methods to make art forms more diverse. An important trend in the development of AIGC is to have a certain degree of cognitive and interactive capabilities. Artists can use AIGC tools to explore unknown areas of art and create works that are not possible with traditional methods. At the same time, AIGC technology can also make art creation more civilian, not only professional artists can create beautiful paintings, ordinary people can also express their own artistic views and emotions with AI technology. This change will promote the popularization and innovation of art and stimulate the new vitality of artistic creation.

AIGC involves many professional technologies such as deep learning, large language model and algorithm, and the application of AIGC develops rapidly. As the number of AIGC artworks increases, how to deal with the copyright and intellectual property rights of these works will become an important issue. Existing copyright laws may be difficult to adapt to the new landscape of AI creation, and new laws are needed to clarify the attribution and protection model of AIGC works. This could trigger legal reform and international cooperation on a global scale to adapt to new modes of artistic creation and communication.

AIGC technology will change the way people learn and appreciate art. In the field of education, AIGC can serve as a powerful tool to help students learn art theory and techniques that stimulate their creativity and imagination. At the same time, AIGC can also provide a personalized art appreciation experience, generating unique art works according to the preferences of the audience, thus making art appreciation more interactive and personalized.

The AIGC will have a profound impact on the art market. On the one hand, the low cost and high efficiency of AIGC creation may lead to fundamental changes in the way artworks are produced and distributed, reducing the cost of artworks and expanding their audience. On the other hand, the market will need new mechanisms to evaluate and authenticate the value of AIGC works of art, which may facilitate the digitization and transparency of art transactions.

By providing a variety of creative means and expression platforms, AIGC technology will promote the exchange and integration of global cultures. The infinite possibilities of AIGC's work will inspire cross-cultural creative fusion, promote the collision and integration of artistic styles and ideas in different cultural contexts, and help to build a more diverse and inclusive cultural landscape.

## **8. Conclusion**

The development and influence of AIGC in the field of painting art is a multifaceted and complex phenomenon. This paper provides a comprehensive analysis of the history, current status, technological innovations, artistic expressions, and practical challenges of AIGC, exploring the profound transformations it has brought to the art of painting. Initially, AIGC technology not only expands the boundaries of artistic creation, allowing both artists and the general public to use artificial intelligence to produce artworks, but also heralds a new era of accessible, innovative, and diverse art creation. Technological advancements such as deep learning, generative adversarial networks, style transfer techniques, adaptive algorithms, and augmented reality have propelled the quality of artistic outputs to unprecedented levels.

However, despite the strong potential of AIGC technology, it also confronts significant challenges, including the ambiguities surrounding copyright and intellectual property, debates over artistic ethics

and originality, technological limitations, market resistance, societal and ethical concerns, and outdated regulations. To address these issues, I propose several solutions: clarifying legal standards, establishing authorization mechanisms, encouraging hybrid modes of creation, enhancing the diversity of training data, promoting public education, and developing professional training and ethical guidelines. These measures aim to foster the healthy development of AIGC technology.

In conclusion, the emergence of AIGC in the painting sector marks a pivotal moment at the intersection of technology and art, redefining artistic processes while introducing new legal, ethical, and market challenges. By proactively addressing these challenges, AIGC is poised to continue playing a distinctive role in the arts, unlocking limitless possibilities for future creative endeavors. Here are the references reformatted as requested.

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