A Study of AI Painting in the Era of the 4th Industrial Revolution

Zhen Sun

Fine Arts, Hongik University, Seoul, Korea

sunzhen19961119@163.com

Keywords: 4th Industrial Revolution, Artificial Intelligence, AI Art, Deep Learning

Abstract: Artificial intelligence (AI), which is the driving force behind the 4th industrial revolution, has shown remarkable performance in the creative field of art by using deep learning and has been continuously expanding the field of machines. In the field of image generation, this outstanding AI has brought a new era to 21st-century painting like a painter. Just as the innovation of photographic technology opened up a new era, painting today has entered a new realm through transformation. As a new generation of expressive tools, AI that inspires artistic inspiration is reshaping traditional art and creating new art forms with various image generation techniques. Therefore, this paper aims to conduct in-depth research on AI Art to examine the artistic significance and value of these AI that aim to inspire artistic creativity. At the same time, this paper will examine the system and structure of artificial intelligence and discuss the possibilities of AI painting based on deep learning.

1. Introduction

The scientific and technological advancements of the 4th industrial revolution have endowed machines with intuitive judgment and artificial creativity. The 21st-century art, which reflects the spirit of the times, has utilized the technology of artificial intelligence. Google's Go-playing artificial intelligence "AlphaGo," based on deep learning, won a game that required intuitive judgment. Google's art artificial intelligence project, Magenta, began creating art. Art is expressed through the artist's aesthetic consciousness, and the imagination that inspires artistic creation is created by the artist's intuition. However, as the forms generated by machines with artificial creativity are given meaning, artificial intelligence technology has become art.

Artificial intelligence (AI) is a computer machine, and AI art is the use of computer machines with artificial intelligence as tools for creative activities. AI painting that utilizes artificial intelligence is an art that imitates the works and creativity of existing painters. Art can be divided into meaning and form. From the perspective of art form, there is no difference between existing art and artificial creativity art. However, there will be significant differences in meaning. Naturalistic art is created based on the artist's intention, so the meaning is implicit in the form. However, the form of computer machines with artificial intelligence has no intention. With the advent of the era of strong artificial intelligence that completely imitates the human mind, machines can also have intentions. However, the current weak artificial intelligence that imitates and creates based on given data only produces forms without the machine's creative intention. In the field of AI painting with artificial creativity, artificial intelligence extracts patterns from the injected data according to the artist's intention, recombines them, and exports images. That is, the machine with artificial creativity designed by useful tools creates forms according to the artist's intention, and the created forms are given meaning by the viewer's aesthetic consciousness.

To accept and utilize 21st-century art AI painting, it is necessary to understand AI painting with artificial creativity. Therefore, this paper analyzes AI painting with artificial creativity that has artistic and other technical aspects and carefully considers the direction that AI painting should pursue.

2. AI Art Technological Milestones

Recent years have seen a surge in AI Art interest, bolstered by numerous significant technological developments. Within the realm of computer graphics and vision studies, numerous algorithms for

  DOI: 10.25236/icssem.2024.028

rendering and texture synthesis have emerged in recent decades. The design of these algorithms aimed to alter images through multiple methods, incorporating an "artistic style" like painterly or sketched styles into the input image. Nonetheless, the employment of deep neural networks in photo stylization and image creation started quite recently and has intensified over the past five years. Deep Dreams, pioneered by Mordvintsev and colleagues, was among the initial techniques to attract considerable interest during 2015. Initially, this technique aimed to enhance the clarity of deep convolutional neural networks through the visualization of patterns that optimize neuron activation. The technique gained popularity as a novel digital art form due to its psychedelic and hallucinatory stylistic impact[1].

Neural Style Transfer (NST) stands out as a pivotal AI innovation that catalyzed the swift adoption and advancement of AI technologies in the realm of art. Gatys and colleagues pioneered this technique in their impactful research. This showcased the effective application of Convolutional Neural Networks (CNNs) in crafting stylized visuals by isolating and merging the “content” and “style” of the image. Subsequent to this innovation, a multitude of fresh research inputs and applications emerged. An extensive summary of the current NST methods and their diverse uses is provided in. The lexicon used in computer graphics and vision indicates a clear and uncomplicated comprehension of "content" and "style". The term "Content" refers to identifiable objects and figures in an image, whereas "style" denotes a visually appealing or captivating divergence from the content's photorealistic representation. Yet, within the realm of art history, style transcends just the visual aspects of lines and brushstrokes; it is frequently viewed as a nuanced and context-specific notion. Additionally, the stylized visuals created through NST techniques typically showcase a clear amalgamation of pre-existing image inputs rather than a distinct and original artistic work. Undoubtedly, NST techniques offer a fascinating technological advancement in the realm of automated image alteration. Consequently, it makes sense that numerous applications based on these techniques have developed, providing end-users with a straightforward and engaging structure for manipulating photos. While NST holds promise for inventive applications in digital art creation, maintaining a critical perspective on the tendency to label everything with an artistic overlay is essential. The vast array of combinations makes it technically demanding and lengthy to find and match two identical content and style images, aiming to create a unique, impactful, and unforgettable final artwork.

Generative Adversarial Networks (GANs) stand out as a pivotal technological advancement that greatly influenced the contemporary AI art scene. The concept of GANs was introduced by Goodfellow and his team.in an effort to employ machines for creating new visual material. GANs primarily function by training two rival models, typically executed as neural networks: the generator and the discriminator. The generator aims to identify the range of authentic samples in the input and create lifelike images, whereas the discriminator's training goal is to differentiate between artificial and authentic images in the initial sample. This optimization method is structured as a minimax optimization challenge, ending at a saddle point that represents the generator's lowest and the discriminator's highest values. The deployment of this system has yielded remarkable outcomes, producing believable and lifelike variations in images across diverse content types. GANs rapidly rose to prominence as a key research field in artificial intelligence, giving rise to numerous sophisticated and specialized forms of the initial architecture, including Cycle GAN, Style GAN, and Big GAN[2][3].

Concurrently, within the realm of artificial intelligence studies, transformer-based structures have garnered significant attention for their effective use in diverse areas, notably in text and multimodal contexts. Open AI unveiled DALL-E, a sophisticated neural network, in January 2021, capable of generating images from text prompts and articulating diverse ideas in everyday language. Despite numerous attempts to develop text-to-image synthesis systems, the recent unveiling of DALL-E outcomes appears highly encouraging and has garnered considerable focus lately. Despite the unavailability of this specific model to the public, we are confident that sophisticated text-to-image synthesis models of this nature will signify a significant progression in the realm of future AI art.

3. The Contemporary AI Art Scene

The contentious issue garnering interest has been validated anew in the realm of AI Art. Post the October 2018 auction of Christie's "Portrait of Edmond de Belamy" by the Obvious collective for $432,500, there's been a surge in AI art interest, necessitating an in-depth discussion of this emerging trend in modern art. Debates on authorship and moral dilemmas have been ignited by the "Portrait of Edmond de Belamy" case. Nonetheless, art historians, artists, and AI experts and creators are increasingly focusing on other significant matters, including the aspects of innovation, originality, and independence in AI art.

Despite the widespread appeal of the "Portrait of Edmond de Belamy" case, numerous AI art enthusiasts argue that other artists' creations exemplify AI art more effectively: "Numerous artists in this domain highlight that the AI creators of this costly piece, Obvious, were awarded a substantial prize, and their concepts lacked originality and intrigue." Nonetheless, the Christie's auction sparked a global surge in AI art creation, leading to a rise in the quantity of artists participating in AI art production worldwide. The swift evolution of AI art over the last two years is reflected in the growing array of digital platforms for AI art (like AI Artists.org), along with various exhibitions, conferences, contests, and AI art-focused discussion groups.

Despite numerous pieces being categorized as "AI art, the specific AI methods employed in their creation remain ambiguous, as several artists withhold complete details of their artistic methodology. Nonetheless, given the swift growth and focus on AI art, comprehending and deliberating every factor influencing the assessment of individual works' quality is essential. Presently, engaging in this activity demands a certain level of technical expertise and abilities. Nonetheless, AI technology is swiftly evolving into frameworks that are more accessible and simple to use. Consequently, determining if an AI artwork's worth is influenced by its production's technical intricacy and innovation, or merely by the freshness of its visual presentation and contextual innovation, presents a challenge.

4. The Innovation in AI Artistry

There's a growing tendency to incorporate artificial intelligence in the creation of art, sparking debates over the artistic essence of these creations and their historical role in visual arts. Grasping the intricacies of AI art requires delving into the uniqueness of this art form in the context of art history. Does the 21st century merely offer technically viable answers to the concepts of the 20th century? In the past, there was a growing anticipation among individuals to employ cutting-edge technology in crafting art forms that mimic life. Grasping the uniqueness of contemporary AI art requires recognizing that computers' integration into the art world originated with their introduction. Yet, prior to the advent of computers, concepts of unpredictability and artificial unpredictability had been transformed into artistic forms, exemplified by Jackson Pollock's "action painting" and Jean Arp's "chance collage". For a deeper insight into the historical context of AI art, we encourage readers to consult a summary of randomness as a tool for fostering creativity and unpredictable art processes. Furthermore, the term "generative art" refers to the application of somewhat autonomous systems in the creation of art, a concept extensively examined both theoretically and practically in recent decades. Initiatives like the 2006-initiated "Painting Fool" project laid the groundwork for today's AI art movement, tackling both technical and sociological aspects, aiming to develop software that would eventually be recognized as a legitimate creative artist.

The growing focus on AI art in recent times, coupled with the widespread excitement about the acronym "AI," has led numerous AI art experts to emphasize its historical significance. Elgammal points out Harold Cohen's creation of one of the initial computer-generated art software in 1973.Named "AARON," this software was employed to create images adhering to set guidelines. Todoro is of the opinion that software akin to those presently employed in AI art creation has been developed independently of computers. He references Raymond Queneau's 1961 work "Cent Mille Milliards de Poèmes" as a case in point, enabling the creation of 1014 varied poem combinations via its format and printing technique.In his piece "Can Computers Create Art?", Aaron Hertzmann draws parallels between AI art and photography's creation, delving into the interplay of art and technology

in the realms of film production, 3D computer animation, and programmatic art[4].

Considering the historical context, it's reasonable to doubt the uniqueness and originality of the fundamental tenets of AI art. Nonetheless, recent advancements in technology have indeed opened up opportunities to examine these concepts from various perspectives. The majority of present-day AI art pieces are interpreted as creations from the exploration of "latent space". Arguably, the most innovative feature of AI art lies in its ability to explore abstract, multidimensional realms that encapsulate visual representations. Seen through the lens of an artist, latent space transcends the realms of real and imaginary spaces, embodying a realm of limitless ideas born from both recognized and mysterious multidimensional interplays. The primary challenge and distinct "signature" of an artist lies in meticulously designing this space and uncovering its features. Here, comprehending how humans contribute to the cooperative interaction with machines gains significant importance[5].

5. Conclusion

AI painting gradually intervenes in the artist's intention in the image generation process to ensure the limited and original artistic value. Programming that reflects artificial intelligence technology as art is an important behavior that allows artists to manage and control machines (computers, robots, and other machines). The conditions for programming and designing devices and interfaces are also included in the artist's creation. With the development of digital technology, big data, deep learning, and artificial intelligence in the 4th industrial revolution, the art produced using artificial intelligence technology will further increase. To express the originality of AI painting, not only the data and algorithms proposed by engineers but also these data should be used to seek methods for creators to express their personalities.

The technological artificial intelligence of the 4th industrial revolution has opened up a cross-border and super-fused world, and art fused with artificial intelligence is transforming life into art. If contemporary artists can understand, comprehend, and utilize artificial intelligence that brings artistic inspiration, the painting art of the 21st century will be more colorful. I hope this research can become an opportunity to create AI painting that reflects the spirit of the 21st century. If data that expresses personality is collected, painting algorithms that give artistic inspiration as expressive tools will be given, and more actively devoted to AI painting creation, unprecedented new art can be born. It is expected that AI painting that can express both objective and subjective, external and internal sensibilities will emerge according to the digital environment, making the painting art of the 21st century more abundant.

Acknowledgements

This paper is funded by the 2023 Mudanjiang Normal University Youth Academic Backbone Project: Research on Art Creation Paradigm in the Context of Artificial Intelligence Era (MNUQN202309).

References

[1] Condliffe, Jamie, Some Genius Finally Turned Google's Deep Dream Code into a Web App, Gizmodo 2015.

[2] Dolhansky, Brian, Cristian Canton Ferrer, "Eye In-Painting with Exemplar Generative Adversarial Networks", Proceedings Article, 2018 IEEE/CVF Conference on Computer Vision and Pattern Recognition, 2018 (DOI: 10.1109/cvpr.2018.00824)

[3] Ahmed Elgammal et al. (2017), "CAN: Creative Adversarial Networks, Generating "Art" byLeaming About Styles and Deviating from Style Norms", https:/arxiv.org/abs/1706,07068.

[4] Marian Mazzone & Ahmed Elgammal (2019), "Art, Creativity, and the Potential of Artificial Intelligence", www.mdpi.com/journal/arts. Arts 2019, 8, 26; doi: 10.3390/arts8010026.

[5] Li, Y., & Chen, Y. (2021). A Review of Neural Style Transfer. Journal of Visual Communication and Image Representation, 77, 103058. https://doi.org/10.1016/j.jvcir.2021.103058