TECNOLOGIAS
E ARQUITETURA

RESEARCH ON IMAGE GENERATING ARTISTIC CREATION ASSISTED BY AI TECHNOLOGY

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Master's in Digital Technologies for Business

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Resumo

O avanço contínuo das redes, big data e tecnologias de inteligência artificial (IA) tem impactado profundamente o campo da arte e design tradicionais, trazendo tanto oportunidades quanto desafios. A criação artística por meio de geração de imagens assistida por IA tornou-se uma área de grande interesse, promovendo um desenvolvimento sem precedentes na arte generativa. Este estudo busca explorar como utilizar a tecnologia de IA para auxiliar a criação artística por geração de imagens e promover novos modos de produção artística.

A pesquisa começa com uma análise da evolução e do panorama atual da arte de geração de imagens, destacando a sinergia entre as capacidades únicas da IA e as demandas de inteligência na criação artística. A IA está transformando tanto os métodos quanto os estilos de criação de imagens, enquanto é influenciada pelas tendências artísticas em evolução. A chegada de ferramentas de geração de texto para imagem introduz conceitos e técnicas inovadoras, redefinindo os processos criativos. Este estudo propõe estratégias e métodos relevantes para a arte assistida por IA, apoiados por experimentação prática, e apresenta um modelo inovador para a integração da IA nas práticas de arte generativa.

Em conclusão, a pesquisa examina as aplicações potenciais e as trajetórias futuras da criação artística visual auxiliada por IA. Ao integrar a IA na geração de imagens, os artistas podem acessar possibilidades criativas inéditas, embora enfrentem também alguns desafios. Para o futuro, será essencial fomentar a colaboração interdisciplinar e realizar pesquisas aprofundadas para liberar todo o potencial da IA na criação artística. Isso abrirá caminho para abordagens mais inteligentes, diversas e transformadoras na arte e no design.

Palavras-chave： Tecnologia de IA, Arte Generativa, Geração de Imagens, Pesquisa Criativa, Inovação em Arte e Design

Abstract

The continuous advancement of the network, big data, and AI technology has profoundly impacted the field of traditional art and design, creating both opportunities and challenges. Image generation art creation, assisted by AI (AI) technology, has seen unprecedented development and is a field of great interest for researchers. This study aims to explore how to use AI technology to assist image generation art creation and promote the development of new modes of art creation.

Firstly, the study analyses the development and current situation of image generation art, and explores the fit between the advantageous features of AI technology and the intelligent needs of image generation art creation. AI is significantly influencing the methods and styles of image generation art creation, while also being inspired by the direction in which image generation art is evolving. The advent of text-to-image intelligent generation technology offers novel concepts and approaches to artistic creation. This research suggests pertinent creative strategies and techniques, and delves into the realm of AI-assisted image generation art through practical experimentation, proposing an innovative mode of creation.

In conclusion, the study provides an overview of the potential applications and prospective evolution of AI-aided visual art creation, anticipating that AI will unlock further creative opportunities within the realms of art and design. The incorporation of AI into image generation adds a new layer to artistic creation, presenting both challenges and opportunities. Looking ahead, it will be essential to foster interdisciplinary collaboration and conduct in-depth research to fully harness the potential of AI in artistic creation. This will propel the field of art creation towards greater intelligence and diversity.

Keywords : *AI Technology, Image Generation, Generative Art, Creative Research*

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CHAPTER 1

Introduction

Throughout the course of human civilization, changes in production methods have played a significant role in shaping history. Based on the information from the website Souhu, the evolution of human civilization could be viewed as a continuous process of change in production methods, as illustrated in Figure 1. This figure indicates that the annals of human history and the trajectory of scientific and technological advancement, the exponential growth of intelligent technologies heralds the dawn of the fourth industrial revolution. Konina believed that the Fourth Industrial Revolution is characterized by the speed, scale, and changing role of machines and technology in all aspects of business, posing a threat to incumbent companies and forcing them to modernize their business models and strategies and structures[1].

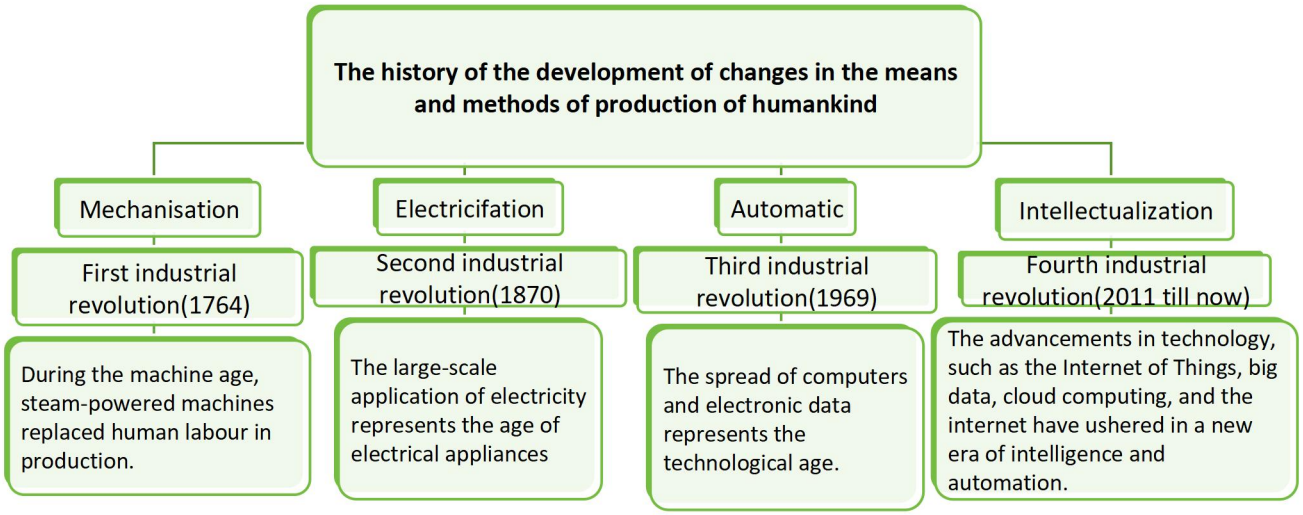


Figure 1: The history of the development of changes in the means and methods of production of humankind. (Image credit: Created by the author (self), source: Souhu Website,2018)

This informativeness era is poised to catalyze a new wave of innovation in industrial practices., particularly in the realm of artistic creation in which the advent of sophisticated AI technologies is not only revolutionizing the methods and aesthetics of image generation but also propelling the evolution of AI itself. Salvaggio E considered that contemporary AI image generation tools rely on datasets for creating images, with these datasets typically sourced from the World Wide Web. Alternatively, artists have the option to curate their own datasets using photographs. As a result, when standing on the cusp of this industrial revolution, the integration of AI into the creative process promises to redefine the landscape of art and design, offering unprecedented opportunities for innovation and expression. The fourth industrial revolution is imminent and will cause another

large-scale wave of intelligence and breakthrough innovative research in various fields. Intelligent technology is becoming a brand-new creation tool, particularly in the field of art and design. This development brings infinite possibilities for artistic creation and promotes the integration of art and technology[2].

The interaction between technological innovation and human creativity has always been a driving force for societal progress. In recent years, Chiodo proposed an opinion in his paper that the use of the words AI art (art produced by AI) has exponentially increased, and the word has started entering the philosophical debate which is from the philosophy of technology to the philosophy of art. Throughout human history, artistic expression and scientific progress have been closely intertwined. When considering AI technology's impact on the field of art and design, two main aspects should be taken into account [3].

Firstly, the development of AI is advancing rapidly, with a wide radiation range and deep impact. According to McKinsey's global research data, the adoption of AI automation technology can increase global productivity by an annual rate of 0.8%-1.4% . AI is an emerging strategic technology that plays a pivotal role in promoting a new round of technological revolution and industrial transformation. It has become the focus and hot spot of current scientific and technological development worldwide[4].

Secondly, the continuous evolution of AI technology has introduced a new tool for creative art design. The development of intelligent image generation is accelerating, driven by advancements in algorithms, especially deep learning, which has spurred a wave of AI innovation. As technology, philosophy, art, and design converge, AI is increasingly playing a significant role in creative fields. In the current era of promoting a people-centred approach, the provision of humane care has become a crucial issue in social development. In this context, the integration of intelligent technology into the field of art and design is a significant force in advancing the development of human nature care. Intelligent algorithms can generate images with remarkable realism and artistic value by analyzing a large amount of visual data, particularly in the field of image generation art. This not only shortens the creation cycle but also expands the audience's aesthetic experience and cultural horizons, providing new opportunities for the creation of image-generating art[5][6].

The relationship between image generation art and AI can be traced back to the early 1950s when the concept of 'AI' was first introduced. Both generation art and AI technology are based on computer technology, and their close connection is inherent in both fields. This connection has established the inevitability of their development and integration since their inception. The integration of AI technology and image generation art has led to an increasing number of artists using AI to create art. This trend provides new creative inspiration and means of expression, but also presents challenges to traditional art forms and aesthetic concepts. AI technology and image-generating art are expected to continue playing a significant role in the art world, fostering artistic innovation and development[7].

To enhance the application of AI technology in art creation, it is crucial to investigate the theoretical aspects of image generation art creation, review existing research findings, and identify shortcomings and challenges. This will enable us to fully leverage the potential of AI technology in art

creation and develop effective application strategies. Additionally, it will provide theoretical guidance and insights for the future of art creation in the digital era.

This paper will explore the trans formative potential of AI in the realm of art and design, focusing on how it can transcend traditional human limitations and foster a new era of human-AI symbiosis in artistic creation. We will analyze case studies, such as the groundbreaking "Portrait of Edmond de Belamy" by Obvious, which leveraged AI to push the boundaries of creativity, and examine data from surveys that gauge public reception and the impact of AI-generated art on the art world. Additionally, we will investigate the role of differentiated design strategies, exemplified by AI tools like DALL-E and Midjourney, which have empowered designers to create innovative and personalized designs, reshaping the design process. Through in-depth exploration, we encourage students to consider how AI can be integrated into art design, drawing on projects like Google's DeepDream, which has been instrumental in generating surreal and hallucinatory images, and discussing the implications for the development of a new paradigm in art design. By examining these real-world applications and the associated data, we aim to provide a comprehensive understanding of AI's current influence and future potential in shaping the landscape of art and design.

This study will delve into the application strategy of intelligent image generation art, focusing on how AI technology can be harnessed to enhance and innovate in the field of artistic creation. We will explore the ways in which AI can be integrated into the creative process, enriching aesthetic practices and offering new perspectives for aesthetic research. Students will be encouraged to understand and develop the application of AI in art creation, examining case studies that showcase the successful implementation of AI in generating unique and compelling visual art. More importantly, this study will also investigate the various ways AI technology is employed in the creation of images for artistic purposes. We will summarize and condense the methods and techniques currently being used in the field of intelligent art, providing a comprehensive overview of the tools and algorithms that are shaping the future of artistic expression. Students will be provided with creative ideas and practical experience, equipping them with the knowledge to actively participate in the creation of AI-assisted art. This will include discussions on the ethical considerations and creative challenges that arise when AI is used as a co-creator in the artistic process.

CHAPTER 2

Literature Review

2.1 Concepts and Characteristics of Generative Art

In the arts, the term 'generative' was first used by literary scholars such as Tristan Tzara, Brion Gysin, and William S. Burroughs to create literary works, such as poetry, in a randomized manner[8] (Appendix I, II, III).

According to Greenberg and Kumar, generative art was born in the 1960s in the context of automated computer graphics, as new media art began to enter the public eye. The term was coined by Margaret Boden and Ernest Edmonds. However, the exact origin of the term remains uncertain.Georg Nees and Frieder Nake presented artwork in 1965 that marked the beginning of generative art[9].

During this period, the terms 'Generative Art' and 'Computer Art' were used interchangeably. Many early computer artists, such as Manfred Mohr and Kenneth Charles Knowlton, as well as Vera Molnár, a French media artist of Hungarian descent, widely considered one of the pioneers of Generative Art and one of the first women to use computers in her art practice, used the term 'Generative Art' and related terms. Vera Molnár is a Hungarian-French media artist widely recognised as a pioneer of generative art. She was one of the first women to use computers in her art practice.

In 1972, Paul Neagu established the Generative Arts Alliance. In later developments, self-organising systems became a key element of Generative Art. This was proposed by Clauser in 1988. In 1989, Celestino Soddu introduced the concept of Generative Design into architecture and urban design with his work titled 'Città-Aleatorie', as shown in Figure 2. Towards the end of the 20th century, artists, musicians, philosophers, designers, and theoreticians began communicating with each other, forming a cross-disciplinary trend that promoted the development of generative art. In 1998, the First International Congress of Generative Art was held at the Politecnico di Milano, marking a new stage in the development of generative art[10].

The most influential conceptual definition of generative art was proposed by Philip Galanter, a professor at New York University. In his study 'What is 'Generative Art'? Generative Art in the Context of Complexity Theory,' Galanter cites complexity theory as the background for the theory of generative art. In his thesis, Gallant defines the concept of 'generative art' as the production of a complete work of art by a creator through the use of a computer programme, rules of natural language, a machine, or other invention, with a certain degree of self-regulation.In other words, generative art is art created using autonomous systems, such as computers or other non-human stand-alone systems. These systems determine the characteristics of a work of art and can partially or fully assist humans in generating works of art[11].

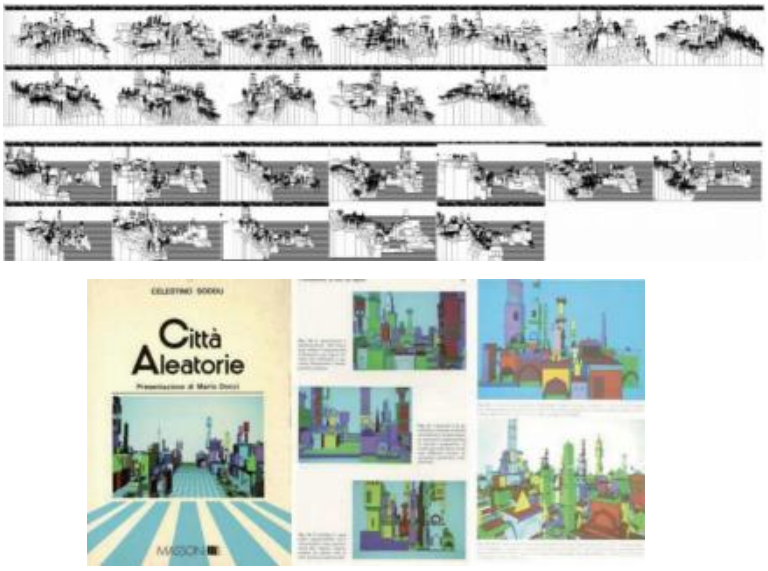


Figure 2 :Vera Molnar (left) and her work " (Des) Ordres " (1974) (right)[10].

Based on the former literature of generative art above, it could be characterized by four basic points, as shown in Figure 3: (1) Randomness, which is used to create new combinations or forms. (2) Evolutionary, which is based on certain rules and algorithms and uses genetic algorithms or other evolutionary algorithms to gradually evolve new forms. (3) Dynamic: Generative art is a form of art that evolves over time according to specific rules. (4) Technical: Generative art involves the use of technical tools, such as computer programs, natural language rules, machines, or other inventions, to create art[12].

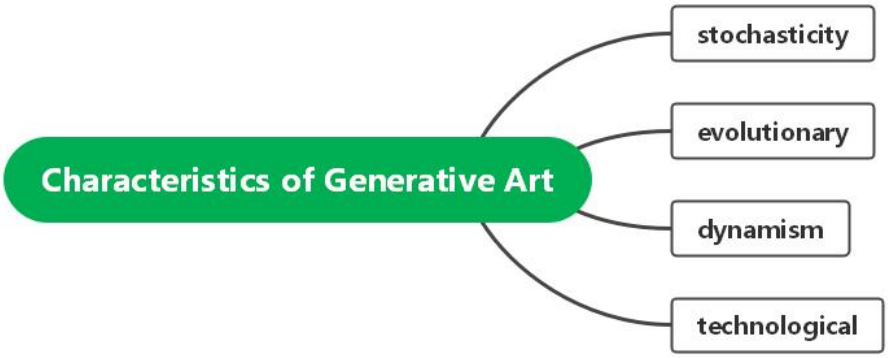


Figure 3: Inductive analysis of the characteristics of generative art based on the definition of generative art. (Image credit: Created by the author)

Summarizing the characteristics of different perspectives of generative art can help us understand and appreciate the diversity and complexity of generative art in a deeper way. It can also provide guidance and direction for the creation and theoretical research of generative art, helping to explore its application in different fields and future development trends.

Generative art is an art form that creates works of art through computer programmes and natural rules. Its emergence and development stem from the advancement of computer technology and the

growing aesthetic demand for art. With the continuous progress of computer vision and AI technology, generative image art has gradually become a new art form. Theobald O has proposed how to navigate image cues, masking techniques, framing, and lighting to enhance the visual appeal of his creations. In the book, he emphasizes the importance of mastering these elements, highlighting their role in achieving consistency and originality in AI-generated art. Visual images bring new forms of expression to generative art, promoting its continuous development and evolution. In the following section, we will analyze the concept and visual characteristics of image generative art in depth[13].

2.2 The concept of image-generating art

In the 20th century, artists John Cage, William Burroughs, and Marcel Duchamp prioritized randomness as the most important generative principle,however, works based on randomness may not necessarily be considered generative art[14].

Jackson Pollock was an American painter and a key figure in the Abstract Expressionist movement. He is renowned for his unique creation of Drip-Painting. Unlike traditional painting techniques, Pollock would move around or across the canvas while painting, resulting in compositions that lacked a clear centre and made the structure difficult to identify, as shown in Figure 4. This technique was groundbreaking and influential in the art world. The repeated unconscious movements created complex and intricate images, as shown in Figure 5. According to physicist Richard Taylor, Jackson Pollock's artworks exhibit fractal characteristics found in nature, as shown in Figure 6. Although Pollock's work exhibits the characteristics of natural fractals, it should not be equated with image-generating art. This is because Pollock's drawing process relies entirely on his drawing skills, without the use of any external systems or computer programmes. Moreover, his drawing process is not completely random; it also involves subjective decision-making by the artist. It is therefore inaccurate to take the characteristics of "randomness" and "natural fractal" as the defining criteria of image-generating art. While such artworks may show the characteristics of natural fractals, they cannot be classified as image-generating art[15].



Figure 4 : Abstract Expressionist painter Pollock at work[15].



Figure 5: Jackson Pollock's drip art paintings[15].

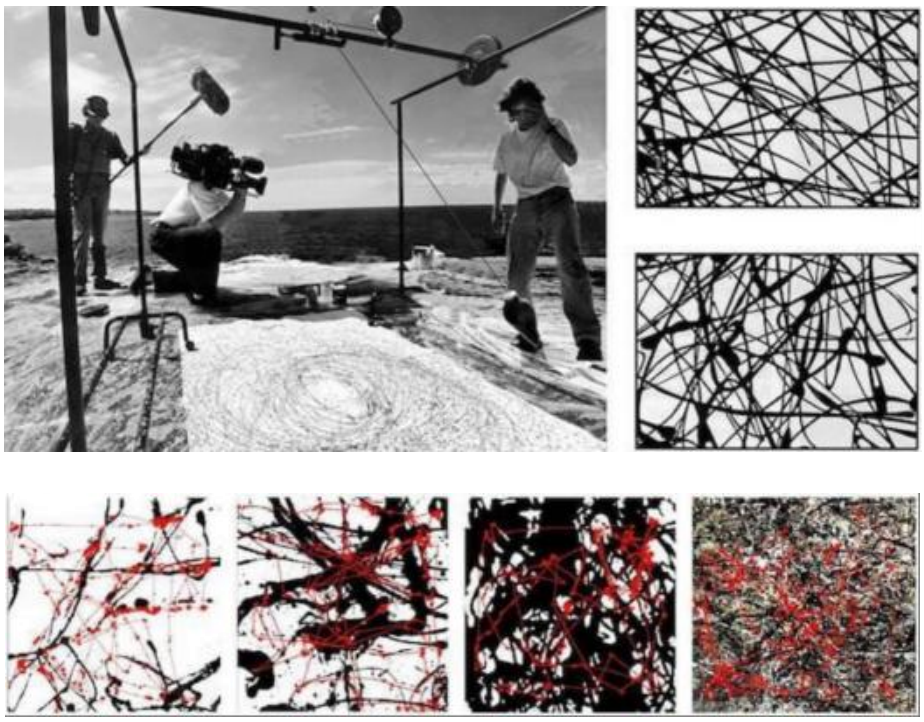


Figure 6 : Physicist Richard Taylor's fractal image analysis of Pollock's painting[15].

Drawing on Philip Gallant's definition of generative art, this text explores definition questions about the theory of image-generative art. Specifically, it examines how image-generative art is created, why artists choose this method, and the thematic content of this art. Additionally, it considers whether image-generating art can be classified as an art form that uses technical means for its generation. Furthermore, it also considered that could the system of artistic practice used in image-generating art clearly defined and functioning autonomously.

Reflecting on the above, the defining premises of image-generating art include the following:

(1) Use of computer programmes or algorithms to generate works of art: image-generating art usually uses computer programmes or algorithms to generate works of art, which can be pre-written, trained neural network models or adaptive generative algorithms.

(2) Autonomy and originality of the artwork: the generated artwork should have a degree of autonomy and originality, i.e. the artist does not directly formulate the position, colour or shape of each pixel or element, but instead generates and controls the process of generating the artwork through the use of a program or algorithm.

(3) Image-generating art, despite using computer programmes and algorithms to create artworks, can still be considered an art form that can be compared to traditional forms such as painting, sculpture, and photography. As such, it is subject to the corresponding artistic and aesthetic standards.

(4) Exploratory and pioneering in artistic creation and aesthetics: Since image generation art uses computer programmes and algorithms, it is likely to be exploratory and pioneering in artistic creation and aesthetics, capable of digging out new artistic forms and aesthetic styles, and having a far-reaching impact on artistic development. In short, image generation art is a form of art with self-control generated through computer programmes or algorithms, which breaks through the formal limitations of traditional art and relies on technologies such as machine learning and AI.

In 'The Art in the Age of Mechanical Reproduction', Walter Benjamin argues that the reproduction of works of art is not a mere duplication, but rather involves some degree of innovation compared to the original work. These innovations are not immediate, but rather develop over time, reflecting a growing tendency throughout history. This is analogous to the current state of image-generating art, which is rapidly advancing with the development of technology and the increased productivity of images. Under the influence of the information society, 'mechanical reproduction' is progressing towards the innovative path of 'machine-generated. In the current era of image interpretation, the act of viewing has become ingrained in society, providing a strong social and cultural foundation for the advancement of image-based art[16].

Image generation art can be understood as the use of computer programmes to generate visual images. It is an art form that aims to explore and demonstrate the imagination and creativity of human artists through the power of computer programmes and algorithms. Image Generation Art is a new form of visual art that combines visual art and computer graphics. It involves the use of a system with a certain degree of autonomy, based on modern digital technology, to integrate the rational

thinking of the machine and the emotional thinking of the artist. The result is a presentation of random visual effects through digital media.

2.3 Classification of Image Generating Art

According to the complexity of computer-generated images and the method of technical implementation, the art of image generation could be classified into four categories: software-generated, fractal-generated, algorithm-generated, and intelligent-generated.This method usually requires a large amount of data and computational resources to train the model and generate the images, and currently the methods represented by deep learning and neural networks have become one of the mainstream techniques in the modern art of image generation[17][18].

2.3.1 Software Generation

Software generation means using tools such as drawing software, image processing software or 3D modelling software to generate images.

David Hockney, a distinguished British artist, has been a pioneer in integrating digital tools into his artistic practice. His use of the iPad and other digital painting tools has allowed him to create a distinctive series of artworks that highlight the versatility and creative potential of digital technologies in contemporary art. His works, as depicted in Figure 7, demonstrate how software-generated images can be used to innovate and push the boundaries of traditional painting methods. Hockney's embrace of digital media has not only expanded the possibilities of image generation in art but also enriched the discourse on the role of technology in the arts, contributing significantly to the evolution of digital art[19].

Similarly, in the realm of digital oil painting, researchers such as Dutta, Tanima and Gupta have proposed a novel reversible technique that uses digital paintbrushes to simulate traditional bristle brushstrokes, allowing artists to recreate the textures and effects of oil paint digitally. Their method emphasizes realism and employs a mathematical model to control pixel distribution, making it possible to reproduce the subtle details and atmospheric qualities of traditional oil paintings with high accuracy. This technique is implemented in prototypes across multiple platforms, including Android, Windows, and Ubuntu, showcasing the flexibility and accessibility of digital painting technology[20].

At the same time, Zhang Yiping's research on digital image processing algorithms offers a method to visualize oil painting techniques in a flattened digital format, aiming to bridge computer technology and traditional art. Zhang's study delves into color models like RGB and XYZ, examining how certain wavelengths can affect color representation, thereby highlighting the unique challenges in accurately translating traditional color nuances into a digital format. Together, these advances underscore the trans-formative impact of digital technology on contemporary art, demonstrating how software-generated tools are enabling new forms of artistic expression and redefining the creative process[21].



Figure 7 : David Hockney, Spring to Wadgate Woods, drawing on iPad, 2011.

2.3.2 Fractal Generation

Fractal generation involves using mathematical fractal geometry principles and algorithms to create images with self-similarity and complexity. The Mandelbrot set is a complex, infinitely detailed shape that's created by repeatedly applying a simple mathematical formula. This set is famous for its beauty and endless complexity, making it a popular tool for both math and art, especially in computer-generated graphics. An example of this is the Mandelbrot set, which is generated by a simple mathematical formula but presents a complex and exotic form, as shown in Figure 8. The Mandelbrot set is renowned for its intricate image complexity and mathematical elegance. It is widely used in scientific research, artistic creation, and computer graphics. Fractal generation enables artists to produce a diverse range of image forms and texture effects, thereby expanding the possibilities of artistic expression[22].

Building on this concept, Yisrael Radai ' s work in Computers & Graphics provides a unique exploration of computer art through a variation on the traditional method of coloring the region outside the Mandelbrot set. By modifying the coloring algorithm, Radai demonstrates how artists can use fractal-based techniques not only to define shapes but to create vibrant, dynamic visual compositions that reflect the interplay between order and chaos inherent in fractal structures. His approach exemplifies how fractal algorithms, though rooted in mathematics, can serve as a creative tool for producing visually captivating works that push the boundaries of digital art. This method highlights the versatility of fractal generation in the field of computer graphics, illustrating how even slight modifications in algorithmic design can yield strikingly different visual effects and enhance the aesthetic depth of fractal images[23].

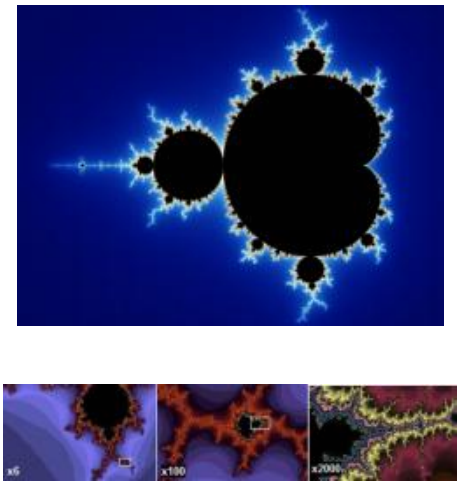


Figure 8 : The Mandelbrot Collection.

2.3.3 Algorithm Generation

Algorithmic generation is a sophisticated method within the realm of AI that involves the use of computer programs or algorithms to autonomously create images. These algorithms are designed with a set of rules that dictate the creation of abstract images, often emulating specific artistic styles. Unlike software-assisted generation, which may involve human input during the drawing process, algorithmic generation is fully automated, with the AI controlling every aspect of the image creation.

This AI-driven approach to image generation is capable of producing a wide array of abstract styles, mimicking the distinctive aesthetics of renowned artists such as Piet Mondrian, Wassily Kandinsky, and Oscar Villalba. As illustrated in Figure 9, these AI-generated images not only replicate the visual language of these artists but also extend the possibilities of artistic expression by introducing novel patterns and compositions that are beyond human imagination[24].

The integration of AI in algorithmic generation represents a significant advancement in the field of art and design, offering a new avenue for creative exploration and innovation. It challenges traditional notions of artistic creation and opens up new frontiers for artists and designers to experiment with, ultimately contributing to the rich tapestry of digital art.

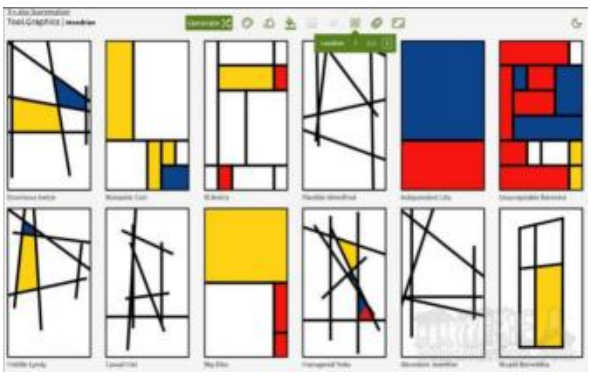


Figure 9:"Mondrian Art Generator" Mondrian Style Art Generator[24].

2.3.4 Intelligent Generation

Intelligent generation creates images using AI techniques and machine learning algorithms. This approach typically requires a large amount of data and computational resources to train the model and generate the image. Currently, deep learning and neural networks have become mainstream techniques in modern image generation[25].

Artistic practices that use AI techniques for creating or representing images are increasingly being recognized across various fields. In September 2022, artist Jason M. Allen, known as -M-, used the AI program Midjourney to create Théâtre D'opéra Spatial, an image that won the Blue Ribbon Award in the Emerging Artist Competition at the Colorado State Fair—making it the first AI-generated artwork to win this award (see Figure 10). Additionally, on October 25, 2018, the French art collective Obvious made headlines when their AI-generated portrait Edmond de Belamy was auctioned at Christie’s for $432,000, marking the first time in history that an AI artwork was sold at such a prestigious venue (see Figure 11). These milestones have sparked widespread attention and discussions about AI’s role in the art world[26][27].

Intelligent generation technology is increasingly used in modern art. It provides artists with new tools for creation and offers a space to reflect on the capabilities of AI and the limitations of humans. The current accelerated integration of science and technology with art has led to the creation of AI Generated Content (AIGC).AIGC has significantly transformed and disrupted the production and consumption of image-generated artworks. This will provide people with richer experiences and choices for their digital lives, and become an essential driving force for the new era of digital civilization[28].



Figure 10 :Intelligent Image Generation Work Theatre D'opera Spatial.



Figure 11 :Portrait of Edmund Bellamy, Obvious, 2018.

2.4 Encoding, decoding and dynamic characteristics of image generation art

Image-generating art is a new form of digital art that combines encoding and decoding techniques with the inspiration of artists. It incorporates the will of the public and engages in a dialogue with computers, continuing to explore the relationship between humans and machines with its visual characteristics. The following aspects are presented: encoding and decoding, dynamic and static, interaction and dialogue, data and image, and random and imaginary.

2.4.1 Encoding and Decoding

The process of encoding and decoding image-generating art is a crucial element in determining the effectiveness of the information delivery of a work of art. In the process of encoding and decoding, factors such as the background and culture of the artist's audience are employed to ensure that the artistic message is conveyed accurately. Conversely, the audience must possess a certain level of general knowledge of art and aesthetic ability in order to be able to correctly understand the message expressed by the artist. Through the process of encoding and decoding, the interaction between the artist and the audience is of paramount importance. The artist must consider how to convey the artistic message accurately, while also acknowledging that viewers collectively construct the overall structure of image-generating art. This process involves the complete creation and appreciation of art, as well as the formation of a shared visual language between the artist and the audience.

2.4.2 Dynamic and Static

Kim believed that image generation art is an art form based on computer technology and algorithms, which generates images that can present dynamic or static characteristics. In the early era of map-reading, images were mostly presented in a static way, i.e., through a fixed picture to convey information and express art. However, with the advent of the digital era, the art of image generation has gradually shifted from static to dynamic. Dynamic image generation art is more effective at attracting attention through movement, change and interaction, thereby facilitating the expression of information and artistic effects in a more intuitive manner[28].

In essence, the dynamic and static characteristics of image generation art represent two of the most fundamental forms of expression. As computer technology continues to evolve and artists

continue to explore new avenues, the forms and characteristics of image generation art will continue to diversify and evolve.

2.4.3 Interaction and dialogue

The interactive and dialogue features of image-generating art refer to the interactive relationship established between the artist and the viewer in the process of image-generating art creation and viewing. This interaction is achieved through the intrinsic combination of software and hardware devices and the extrinsic connection between the artwork and the audience. The intrinsic combination of software and hardware devices provides more possibilities for the creation of image-generating art.

The external hardware device can compensate for the limitations of the generating software, while simultaneously enhancing the artist's creative freedom and control. This interaction not only expands the range of tools and techniques available for image-generating art, but also enables the creation of more dynamic, detailed, and imaginative works through the integration of hardware devices. The interactive and dialogue features of image-generating art offer distinctive advantages in terms of artistic expression, dissemination, audience engagement, and other aspects. The interaction and dialogue between the artwork and the audience facilitate a more immersive and colourful experience for the latter.

2.4.4 Randomness and Imagination

The field of image generation art, as a computer and programming-based art form, exhibits distinctive stochastic and imaginative characteristics. Randomness is defined as the absence of predictable patterns or laws in events. In image generation art, it is often the randomness produced by code algorithms that is of interest. This is due to the algorithms used by the artist to generate algorithms with algorithmic properties, which result in images that possess unpredictable random characteristics. The introduction of this randomness not only increases the artistry and uniqueness of the image-generating artwork, but also stimulates the viewer's imagination, enabling him or her to interpret and appreciate the artwork from different perspectives. Although randomness is often seen as unstable and difficult to control, it is widely used in art. Leonardo da Vinci, in his Trattato della pittura (Treatise on Painting), states that artists should stare at dirty walls in order to unleash their imagination. This concept emphasises the significance of randomness in stimulating an artist's imagination and creativity. By constructing and modifying code algorithms, image-generating artists can express their imagination and creativity in a virtual space. This release of imagination not only enlightens the audience's imagination so that they can appreciate the artist's creativity and inspiration from the artwork, and then deepen their understanding and appreciation of the artwork, but also promotes the innovation and development of image generation art.

CHAPTER 3

3.1 A Hierarchical Classification of AI Technologies

AI can be divided into three levels according to its different levels of simulation and learning capabilities: weak AI (Artificial Narrow Intelligence, ANI), strong AI (Artificial General Intelligence, AGI) and super AI (Artificial Super Intelligence, ASI), as shown in Figure 12.[30]

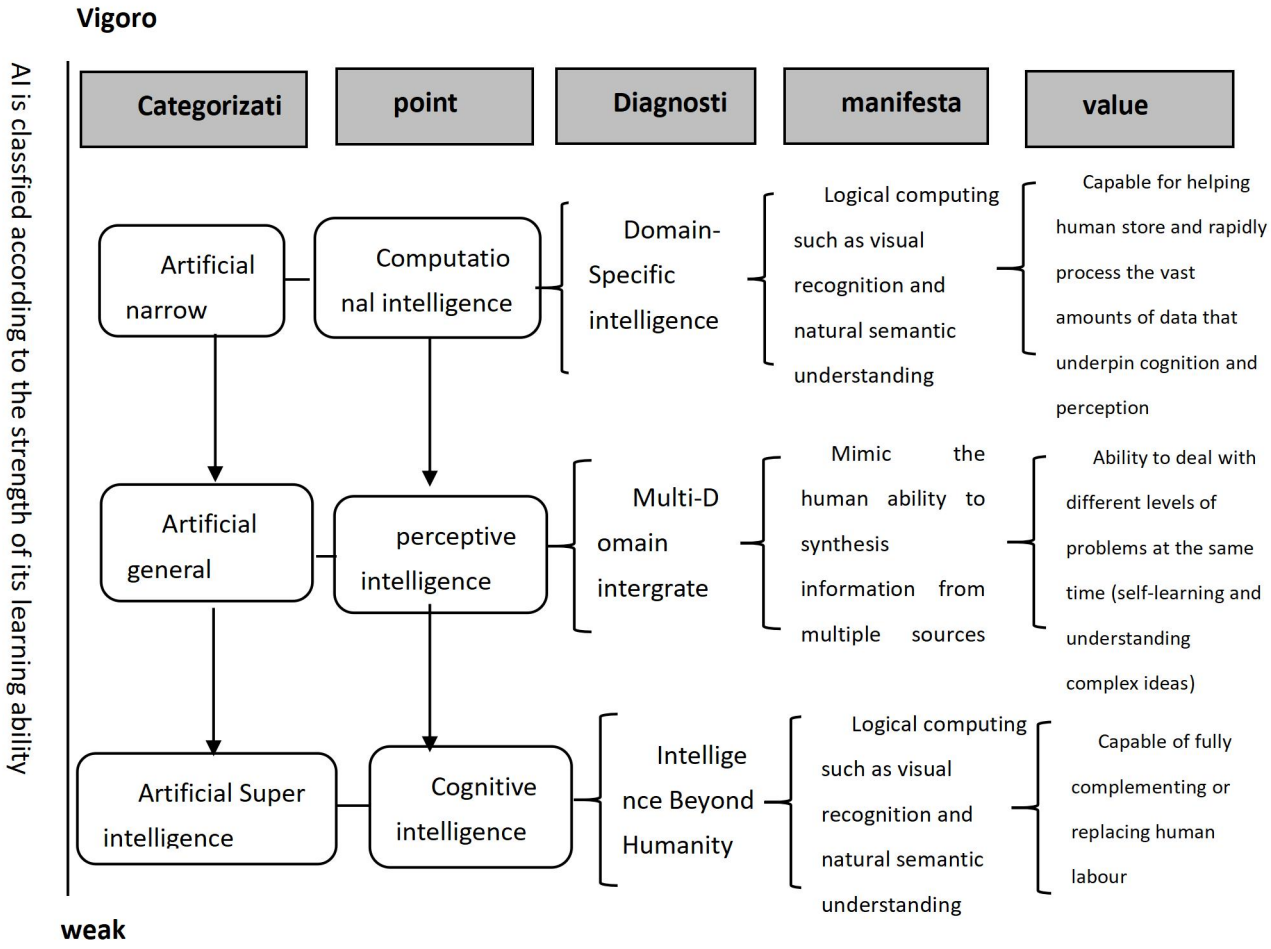


Figure 12 :Classification of AI Technologies.(Image credit: Created by the author)

3.1.1 Artificial Narrow Intelligence

Artificial narrow intelligence (ANI) is currently a more mature and widely used AI technology in practice. It is designed to solve problems in a specific field, and is capable of analysing, learning and recognising data, as well as making decisions and taking actions based on predefined rules or models. ANI lacks autonomous consciousness and creativity, and is unable to think or create new knowledge on its own. Nevertheless, it is capable of demonstrating remarkable capabilities in specific application scenarios, such as in speech recognition, image recognition, natural language processing, intelligent recommendation, and so on.

At present, ANI is employed in a multitude of contexts, encompassing the entirety of human production and life. Its applications are particularly prevalent in the domains of smart homes, intelligent customer service, intelligent manufacturing, medical and healthcare, and finance. Furthermore, ANI plays a pivotal role in numerous artistic creation fields, including the generation of images, music, text, and other works through machine learning.

3.1.2 Artificial General Intelligence

Artificial general intelligence (AGI) is an AI that possesses intelligence equal to or surpassing that of humans. Its goal is to create an intelligence capable of thinking, learning, planning, reasoning, and problem solving like a human. In contrast to ANI, AGI is not just a single-task machine; it is more like a human intelligence with full cognitive and perceptual-cognitive capabilities. This implies that AGI can be utilized in a much broader range of application areas, encompassing the capacity to comprehend, reason and make decisions in complex environments, while also being able to learn from experience and enhance their performance[31].

Although current AI technology has made significant progress, there are still numerous challenges and problems to overcome in order to achieve strong AI. This is because to realize AGI requires a multitude of features of human intelligence, including natural language processing, reasoning, thinking and emotion, etc. Consequently, a combination of research and technology in multiple fields is required, such as deep learning, natural language processing, knowledge representation and reasoning.

As AGI technology continues to develop, it is likely to have a profound impact on human art and culture. This will result in a transformation of human artists' creative thinking, methods and aesthetic concepts. Furthermore, it will lead to the emergence of image-generating art forms that are difficult for humans to understand.

3.1.3 Artificial Super Intelligence

Artificial Super Intelligence (ASI) refers to an AI system that is far beyond the level of human intelligence. It has the ability to cope with changing situations and abstract thinking, and demonstrates a cognitive and expressive ability far beyond human beings in science, technology, humanities and even interpersonal social interaction. Unlike human intelligence, ASI's intelligence level is not subject to physiological and psychological limitations, and it can continuously improve itself through self-learning and self-optimisation[32].

The advent of ASI may have profound implications for the human conception of humanity. The integration of biological and machine intelligence will have a profound impact on the boundaries between humans and machines, potentially leading to a blurring of these distinctions. The primacy of humans in the field of natural biology may be challenged by the emergence of ASI as a new intelligent leader. This implies that the non-living intelligent art creation methods that ASI can form will supplant the original cognitive system of humans and facilitate further evolution of human culture.

3.2 The technological core for realizing AI

Machine learning (ML) and deep learning (DL) are both significant technologies within the field of AI. ML is a foundational AI technology designed to enable machines to autonomously process and analyse data through algorithms, learn the distinctive patterns in the data, and make decisions and predictions based on the distinctive patterns in the data. DL is a neural network-based machine learning algorithm that automatically learns and extracts multi-level feature representations from large-scale data to better solve various complex tasks. Unlike traditional machine learning methods, deep learning algorithms are able to extract features layer by layer through multi-layer nonlinear transformations, achieving a gradual evolution from low-level simple features to high-level complex abstract features[33].

3.3 Fitting AI Technology to Image Generating Artistic Creation

The capacity for intelligence is an inherent trait of the human species, which has evolved gradually over an extended period of existence. Human intelligence is not solely determined by biological evolution; rather, it is gradually formed in the process of continuous interaction, communication, and learning with the external environment. As an integral aspect of human spiritual civilisation, art embodies the essence of human intelligence. By analysing the development lineage and attribute characteristics of image generation art, it can be found that the most significant feature of image generation art is to create with the help of algorithmic procedures. With the continuous progress of science and technology, AI technology has become an important means to assist the creation of visual art. On the other hand, the creation of image-generating art needs to break through the previous forms of expression and open up more possibilities for the creation of contemporary visual art. This section builds on the theoretical analysis of the innovation and development of AI technology presented in the previous section. It focuses on the analysis of the fit between AI technology and the creation of image generation art from two perspectives: the advantageous characteristics of AI technology and the intelligent needs of visual creation.

3.3.1 Advantageous features of AI technology

At present, the research of AI is still limited to the scope of weak AI. In this context, this study presents a summary of four advantageous features of current AI technology compared to humans: high computing power, unlimited working time, stable output efficiency, and expanded human perception (see in figure 13).

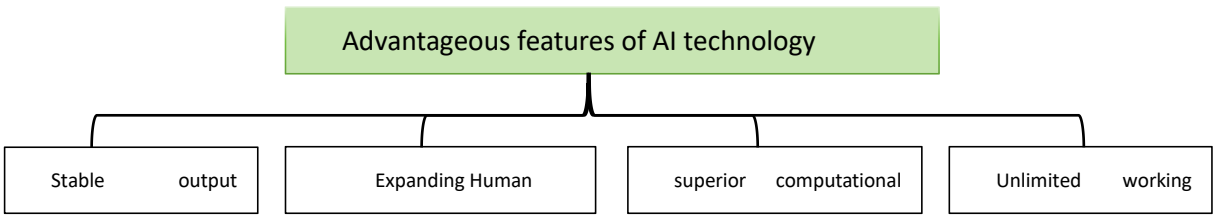


Figure 13 :Characterization of the advantages of AI technology.(Image credit: Created by the author)

(1) High computing power. The high computing power of AI enables it to process large amounts of data and complex algorithms in a very short period of time, thus facilitating the efficient deployment and use of huge databases.

(2) Unlimited working hours. Unlike human workers, AI is not constrained by time slots, rest needs or other human burdens. Its realization relies on computer arithmetic, which also ensures a state of continuous work over long periods of time.

(3) Stable output efficiency. The application of AI in this context ensures stability and efficiency, enabling the solution of problems in an objective manner, free from the influence of personal emotions.

(4) Expanding human perception. The output results of AI's are influenced by the data and algorithms used, while its internal parameters and weight adjustment process is done automatically by machine learning algorithms without human intervention.

In 2020, the Alibaba DAMO Academy published a technology trends report which predicted that the future of AI would enable cognitive intelligence and machine collaboration. These key technologies would drive the evolution of AI from a perceptual level to a cognitive level with logical reasoning and decision-making capabilities. Although AI is currently in the initial stages of exploration in the cognitive realm, if it can continue to learn deeply and effectively understand and apply knowledge, it will expand into more application areas and may even create disruptive value and bring a new way of creating art and design.[34][35]

3.3.2 The necessity of intelligence in the creation of images for artistic purposes

The advent of visual images in the development of AI technology for the field of art and design has brought about a hitherto unprecedented form of expression, whereby science and technology are employed to assist the creation of visual art. This has also led to the necessity for intelligence in the creation of image-generating art.

From table 1 it can be concluded that intelligent technology can provide a variety of ways to support artists in the creative phase of their work, enabling them to cope better with challenges and produce more creative work.

Table 1:The need for intelligence in image-generating artistic creation.(Image credit: Created by the author)

creative process	Possible problems	Intelligent Requirements
creative conception stage	Creative Bottleneck	Creative support tools
	Constraints on reference	Intelligent Collaboration Tools
	Technical constraints	Creative Aids
material collection stage	Quality and availability of material	Material Search Tool
	copyright issue	Copyright protection tools
	search repeatedly	Material Management Tools
Stage of realization of the work	Technical constraints	Creative Aids
	Resource constraints	Resource management tools
	Creative constraints	Overcoming Creative Difficulties
Refinement and modification phase	subjectivity	Decision support tools
	time limit	Progress management tools
	edit sth repeatedly	Creation support tools

3.3.3 The Impact of AI Technology on Image Generating Artistic Creation

In constant technological iterations, the mode of production, appreciation and dissemination in the field of image making is constantly being redefined and reshaped, driving change in the field. And in the modern era of AI, the development of image-making technology has driven further change in image-making, and each era of technological change brings new challenges and opportunities. In this section, we will analyse the impact of AI technology on image creation from three perspectives: market demand, creation efficiency and creative subject, as shown in Figure 14.In this section, we analyze the impact of AI technology on image generation from three perspectives: market demand, creation efficiency, and creative subject. To support this analysis, a combination of case study analysis and empirical data collection was employed. This includes recent studies on the role of AI in art and design, while case studies of AI-driven design systems, such as the Lubaan system used by the Ali Group, provide concrete examples of AI applications in the field. Additionally, insights were gathered

through interviews with professionals in the art and design industry, as well as surveys that assessed the attitudes of artists toward AI-assisted creative processes. This comprehensive approach enables us to assess the broader implications of AI's impact on artistic creation.

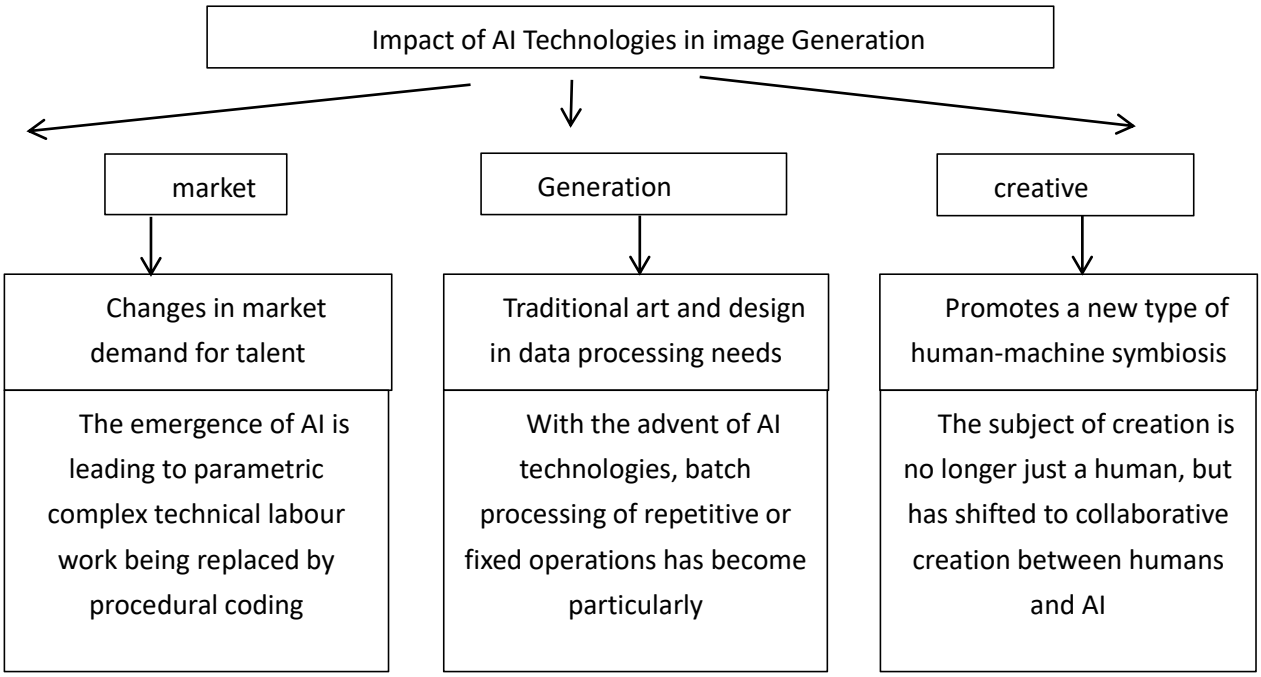


Figure 14:Analysis of the Impact of AI Technologies in the Field of Image Generation.(Image credit: Created by the author)

The continued development and application of AI technologies is leading to the replacement of traditional labour by automation, and even complex skilled labour jobs are being replaced by parametric programming codes. This change will ultimately lead to a shift in the demand and structure of the labour market, from manual talent to creative talent. In the field of art and design, the emergence of AI is also bringing about a significant change, as traditional, low-end, repetitive design is replaced by an AI approach.

It is now possible for some AI systems to complete numerous creative advertising designs with minimal input from designers, through the use of data analysis and integration. Following a blind test of human-machine design competition, the design level of the "Moonwalk" AI system has been demonstrated to be comparable to that of junior designers. Such AI design systems have the potential to replace some repetitive and low-end design work, resulting in the elimination of 2.2 million to 2.6 million junior designer positions[36].

The advent of new technologies and shifts in the market landscape indicate that the future demand for talent in the job market will increasingly depend on a highly skilled creative workforce capable of generating economic value through their creative work.For the entire art and design field, the emergence of AI will boost the development of art and design, providing more opportunities and space for creators to better utilize their creativity and imagination.

The advent of the big data era has led to the generation of vast quantities of data, necessitating enhanced data processing capabilities for research and application in a multitude of fields. In this context, quantitative thinking has emerged as a dominant mode of thought, encompassing the act of quantifying and digitising phenomena for more effective data analysis and utilisation[37].

In the field of art and culture, image generation art as a cross-discipline, in the face of a huge number and variety of data, the traditional art design methods can no longer meet the processing needs. At this time, the emergence of AI technology provides important help for batch processing of repetitive or fixed operations in image generation art. AI technology can automatically process a large amount of data according to certain algorithms and rules, extract useful information from it, and help designers complete design tasks more quickly and efficiently[38].

The Ali Group's Lubaan system adopted a novel design approach during Tmall's "Double 11" in 2017. Initially, the Ali Group invited designers to create fixed templates that were suitable for the specific style of "Double 11". Subsequently, the Lubaan system learned from these template images through structured design, semantic analysis and data classification and integration, and eventually generated 400 million e-commerce scenario posters for each product brand in just seven days. This is equivalent to the workload that thousands of designers could hardly complete in decades, greatly improving the design efficiency and reaching a speed that traditional designers could not reach.

The application of AI technology, through the use of deep learning, neural networks and other technologies, enables the rapid processing and analysis of large amounts of data. This technology also facilitates the automatic extraction of the characteristics and laws of the data, thus enabling the automated creation of image generation art. The application of this technology can not only accelerate the generation efficiency of image generation artworks, but also provide designers with more diversified and creative inspirations. This, in turn, further promotes the integration of art and technology, and creates more rich works.

The primary agent in the creation of image-generating art is the individual engaged in art design. AI technology was originally developed as a means of promoting the rapid increase in industrial productivity. However, the self-learning ability and self-correction consciousness of AI have led to the formation of machine-specific modes of creation, whereby the algorithm is used to continuously improve the system. The primary focus of design is no longer solely on the individual, but rather on the collaboration between humans and AI. In essence, the advancement of AI technology has led to the emergence of a novel form of human-machine symbiosis.

AI can be employed as a creative tool for artists, as well as a quasi-creative subject that works with people through autonomous learning and self-creation. This form of creation can not only bring new creativity and expression to the art world, but also provide new ideas and methods for human beings to explore and discover a broader field of art.

3.4 Human-computer collaborative creation

The convergence of AI and image generation art creation is a trend that is gaining momentum. Those engaged in creative pursuits must recognize the potential of AI as an emerging technology and integrate it into their creative process. This integration should facilitate a deeper fusion of art, science,

and technology. Furthermore, it is essential to promote art creation as a means of ushering in greater progress and development.

3.4.1 Diversification of Artistic Creation Methods

The advent of AI technology has opened up new avenues for image generation and art creation. Currently, the field of art creation is witnessing a surge in diversification, encompassing a plethora of creative themes and styles of expression. In this diverse landscape, AI technology offers artists a valuable tool to process a vast array of material with greater efficiency, automating repetitive tasks. This frees up time for artists to concentrate on conceptualism ideas and realizing creative thoughts, thereby enhancing both the creative efficiency and the creative quality of their work.

The high efficiency, objectivity and stability of AI technology align with the diverse needs of artistic creation. For instance, image recognition and classification technology can assist artists in swiftly and accurately identifying the requisite materials, while image style conversion technology can facilitate the integration of disparate style elements into their creations, thereby enabling the generation of images representative of the desired style. Furthermore, AI technology can also assist artists in undertaking automatic painting style conversion, automatic filling and repair operations, thereby facilitating the realization of creative ideas[39].

The integration of AI technology and the diversification of art creation methods is not only intended to enhance the efficiency of creation and reduce time and cost, but also to facilitate the expression of artistic creativity and imagination by artists, and to assist artists in developing a more diverse range of art designs. AI technology has become an invaluable tool for artists to navigate the challenges of diversification in the creation of image-generating art.

3.4.2 Intelligent tools for art creation

The advent of intelligent art creation tools has the potential to facilitate more expansive artistic exploration, while simultaneously enhancing an artist's adaptability to new creative avenues. In the context of the current era, where technological advancement is a pervasive force, it is imperative that art creation methodologies evolve to incorporate technological thinking, thereby expanding the domain of aesthetics and fostering the creation of more vibrant artistic works.

The integration and development of AI technology and image generation art creation is contingent upon the availability of intelligent art creation tools. These tools facilitate the creation of art in a more efficient manner, while simultaneously expanding the possibilities of creation. For instance, AI technology enables artists to rapidly generate intricate images, models, and scenes, as well as automatically generate colour schemes and composition schemes for artworks. The further development of intelligent art creation tools will play a pivotal role in the evolution of art creation.

The continuous development and application of AI technology will result in a corresponding increase in the innovation and breakthroughs observed in image generation and art creation. In order to continue exploring and innovating in new art forms and achieve even better artworks, it is essential to remain abreast of the latest technological developments and to pay attention to cutting-edge trends.

3.5 The Impact of Text Intelligence Generating Image Technology on Artistic Creation

After decades of development, AI has shown remarkable potential in text-to-image generation, transforming human language into images. This research explores how AI enhances image quality and diversifies art creation. An increasing number of researchers are beginning to explore this technique, which has attracted considerable attention from the art world.In this section, the textual intelligent image generation technology will be employed as a research object to analyse its impact on the field of artistic creation[40].

The creation of traditional artworks requires significant expertise, but text-based intelligent image generation technology has lowered this barrier. Users can now produce high-quality images simply by inputting text descriptions, democratizing artistic creation and expanding creative possibilities.

Text-to-image generation technology faces challenges such as distortion, lack of authenticity, repetition, and limited creativity due to its inherent limitations. Furthermore, an excessive reliance on technology may result in artists losing a certain amount of creativity and creative inspiration, which in turn diminishes their unique artistic value. Consequently, it is imperative to utilize this technology while concurrently fostering creativity and imagination, as well as the sensual experience and creative inspiration inherent to the creative process[41].

The development of text-intelligent image generation technology not only lowers the threshold of artistic creation, but also expands the space of aesthetic cognition for people. In this regard, text-intelligent image generation technology can have a positive impact in the following aspects: Firstly, intelligent generation image technology can provide a novel aesthetic experience. Traditional artworks typically rely on the artists' observation and perception of the external world, as well as their subjective understanding and ability to express themselves. Secondly, the technology of intelligently generating images from text provides a wider range of artistic materials. Thirdly, the application of textually intelligent image-generating technologies can facilitate artistic innovation. Fourthly, text-intelligent image-generating technologies afford the audience a greater number of opportunities to engage with the content.

The advent of textually intelligent image generation has had a profound impact on the creation and consumption of art. It has facilitated the creation of art at a more accessible level, while simultaneously offering viewers a more expansive, nuanced and diverse aesthetic experience.

CHAPTER 4

An analysis of intelligent image generating artistic creation strategies

4.1 The application of AI technology in the generation of images for the creation of art.

In order to achieve the goal of exploring whether AI technology can improve the quality and diversity of artistic creation and the application strategies in its image generative art creation. This paper adopts a qualitative analysis approach, focusing on understanding the essence and intrinsic relationship of phenomena through non-quantitative data. In this chapter, we use typical case analysis methods to analyze their creative methods and artistic influences based on Deep Dream and GAN-supported artworks cases. Then, experiments are conducted to verify the specific application and innovation potential of deep learning-driven text-to-image technology in artistic creation. Finally, by comparing traditional and AI-assisted creation, a comprehensive evaluation is carried out from the dimensions of efficiency, artistic diversity and technical limitations, and improvement strategies are proposed. The above methodology is closely related to the research objectives, with both theoretical depth and practical operation, providing a comprehensive guiding framework and innovative ideas for the deep integration of AI and art.

The extensive utilisation of AI technology in the domain of art has led to the emergence of deep learning image generation as a significant trend in contemporary technological advancement. Furthermore, deep learning technology offers an infinite number of possibilities for artistic creation, which is currently one of the most attention-grabbing innovation directions. This section will analyse the results of image generation art creation based on deep learning technology in the current industry. The aim is to draw more diversified innovative ideas and creative paths from them, in order to provide a theoretical basis and value reference for the research on the strategy of intelligent technology participating in image generation art creation in the following study.

Google's open source Deep Dream is a deep neural network-based image generation technique that artistically manipulates existing images to create unique image styles. In 2016, Google hosted an exhibition called Deep Dream: The Art of Neural Networks, which encouraged collaboration with AI. One of the artists, Memo Akten, employed the Deep Dream generator to create a piece entitled 'GCHQ', which was based on a map of the British intelligence agency GCHQ. Various distortions and styles were added to create a striking visual effect, as illustrated in Figure 15.[42]



Figure 15:"Deep Dreaming: The Art of Neural Networks" Auction - GCHQ by Memo Akten.

The emergence of Deep Dream has pioneered a new way of generating images, marking a rapid development in the field of computer-generated art, allowing us to see creative, artistic and unique images created by computers.

The French art collective "Obvious" employed the use of AI to generate a painting, entitled "Edmond de Belamy," which forms part of a series of eleven portraits of members of the Belamy family created by the Obvious team in Paris. This is illustrated in Figure 16.[43]

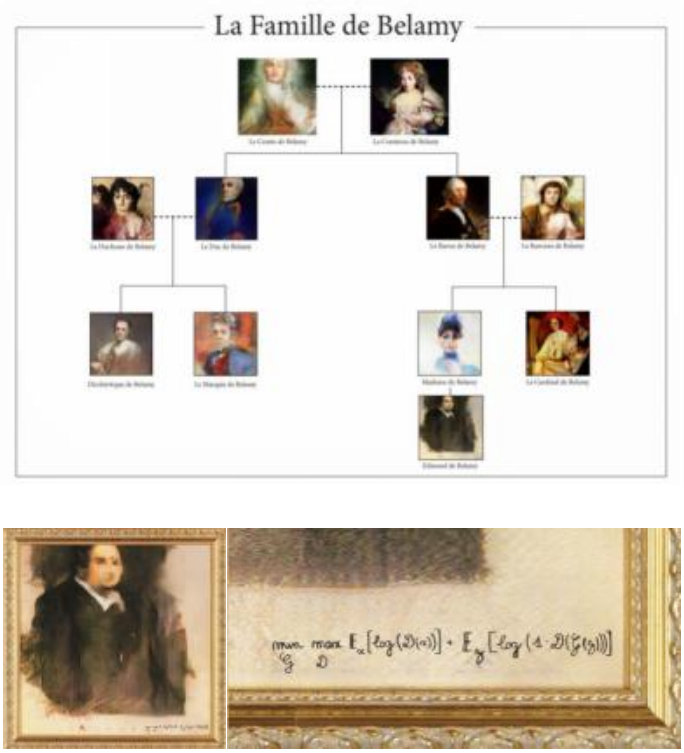


Figure 16:The Edmund Bellamy Family Series Portraits, 2018, is an example of the Obvious genre.

The Obvious team employed Generative Adversarial Networks (GANs) based on deep learning techniques to create the portraits. This represents an innovative approach that combines art and AI

technology, with the objective of exploring the potential of AI technology in art creation. The combination of AI technology with image-generating art creation by the Obvious team has opened up new possibilities for the future of art creation. Their research has a significant impact on the art field and provides new ideas and directions for the development of computer science and AI technology.

Refik Anadol is a pioneering new media artist and director whose work is forward-thinking and innovative in its practice of data and machine intelligence aesthetics. He is dedicated to the pursuit of maximizing the potential of human creativity in the realm where it intersects with machines, and to the exploration and exploitation of the infinite possibilities of the digital age through his artwork.

The principal creative instrument employed by Refik Anadol is the utilisation of a computer's neural network as a collaborative partner, through which the artist transforms the vast quantities of data that are generated in the course of everyday life into image-generating artworks that are both impactful and aesthetically pleasing.

At the 2nd AAI International Forum on Art and AI, Anatole shared his thoughts on the theme of "Space in the Mind of a Machine" as a guest speaker. Based on his own research, he provided an in-depth explanation and definition of "Artificial Imagination", and discussed the potential and prospects of AI art. As one of the curators of this international forum, the author will analyse in depth Refik Anadol's use of AI technology in the creation of image-generating art in the following section.

(1) Machine Hallucination

Anadol Batch removed the characters from over 100 million images of New York City and entered them into a database. By deploying machine learning algorithms, it was possible to identify 1,025 potential dimensions of New York City, including images of old and new buildings that revealed hitherto hidden connections in the history of architecture. These findings are presented in Figures 17, 18 and 19.[44]

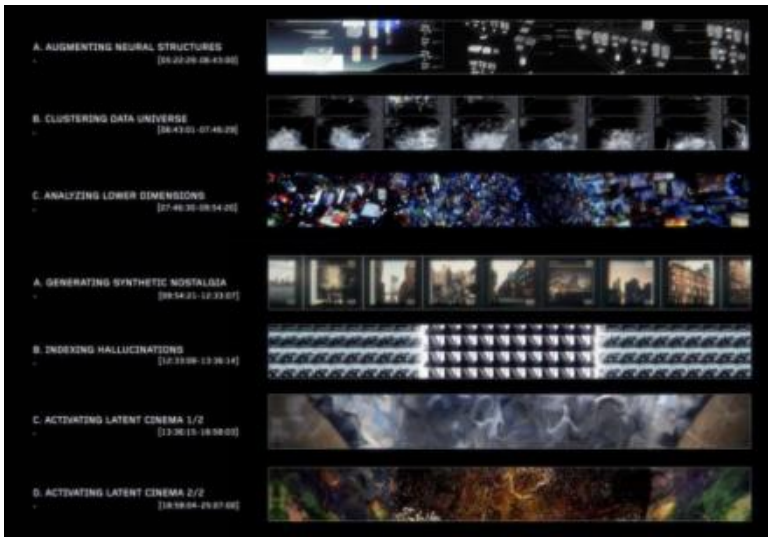


Figure 17:A sample of the creation storyboards for Machine Hallucination.

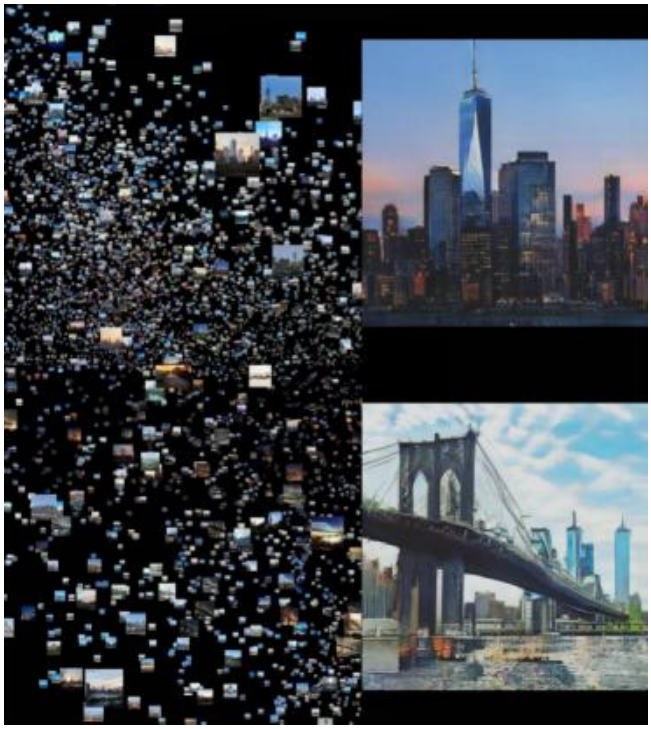




Figure 18:Some of the New York City photographs entered into the Machine Hallucination competition are included below.

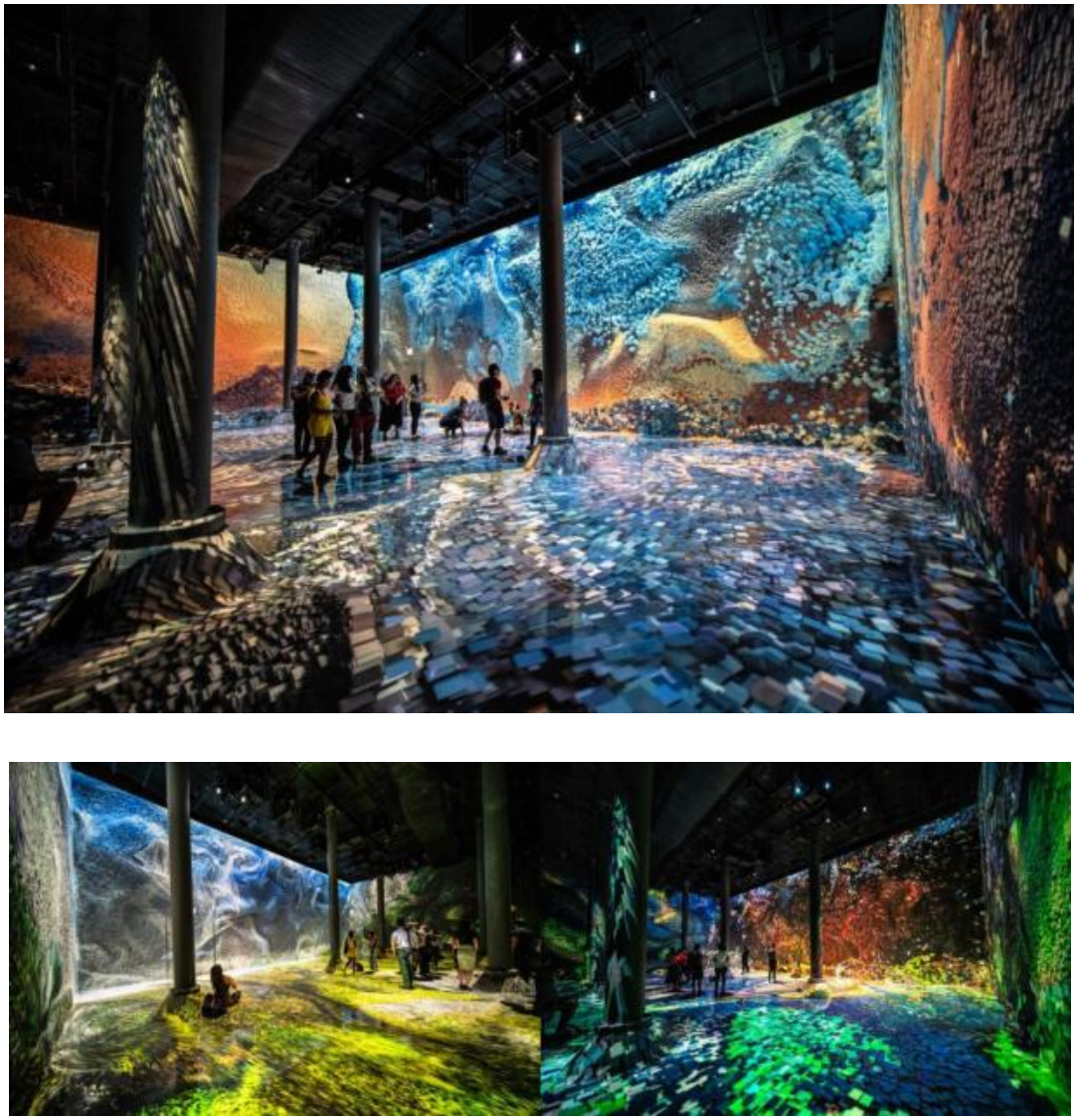


Figure 19:The Machine Hallucination live exhibition was held in New York in 2020.

(2) Quantum Memories

The artwork, entitled "Quantum Memories," was created by the Refik Anadol Studio and displayed on the largest LED screen ever deployed at the NGV (National Gallery of Victoria), as shown in Figure 20. The artwork explores the possibility of parallel worlds based on the intersection between Google's AI quantum hegemony experiments, machine learning, and probabilistic aesthetics. Approximately 200 million images of nature and landscapes were processed through AI, utilising Google's publicly available quantum computing research data and algorithms to create a new quantum noise-generating dataset that serves as a building block for the artwork. This process is illustrated in Figures 21 and 22.The project entitled "Quantum Memory" represents a distinctive form of immersive art. It comprises a three-dimensional visual work and an audio experience based on the generation of quantum noise, which collectively create a distinctive aesthetic experience.



Figure 20:Quantum Memories, Refik Anadol, 2020.

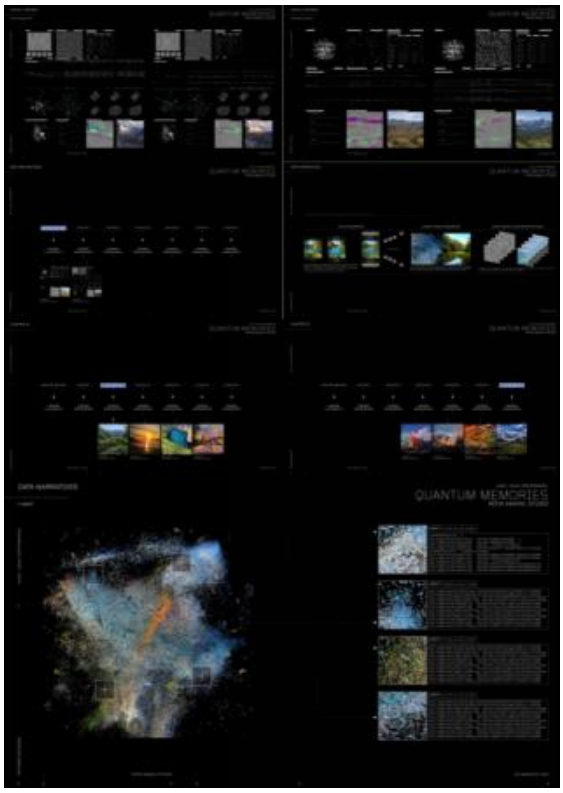


Figure 21:One of the stages of the Quantum Memories image generation process.

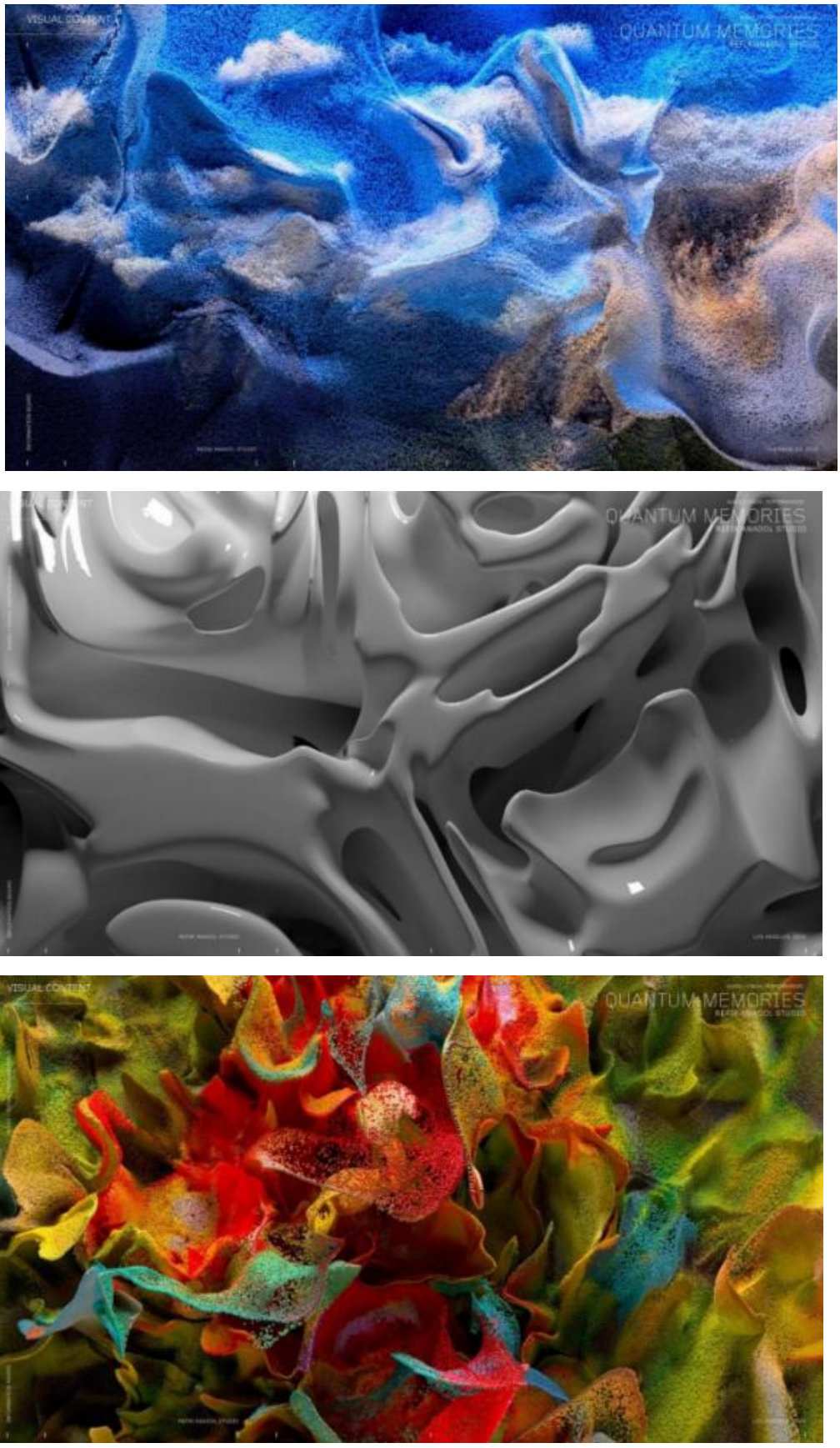


Figure 22:The Quantum Memories software generates image detail maps.

The continuous development of deep learning technology has led to the emergence of image generation in the field of art as a prominent trend in the current generation of AI. The industry has witnessed the emergence of numerous deep learning technology-based image generation art creation results. These works not only demonstrate the power and innovation of deep learning technology in technology, but also showcase a unique style and imagination in art creation. The integration of deep learning technology with artistic creation enables artists to utilise computer algorithms and data to generate distinctive images and artworks. This approach offers novel avenues for artistic creation and provides individuals with a broader spectrum of artistic experiences.

The combination and analysis of these results from image generation art creation based on deep learning technology facilitates a deeper comprehension and grasp of the application and development trend of deep learning technology in art creation. This will provide a more diverse reference of innovative ideas and creation modes for subsequent research on the strategies of intelligent technologies involved in image generation art creation.

4.2 A study of the attributes of text intelligent generation image technology in artistic creation.

The increasing evolution of AI technology has led to the emergence of text intelligent image generation technology, which has attracted considerable attention in the field of art creation. This technology enables the conversion of text descriptions into visually outstanding images, thereby facilitating the automatic generation of art works. With the continuous improvement and enhancement of text intelligent image generation technology, its application in art creation has become increasingly diverse, offering artists greater creativity and potential.In light of the preceding discourse on the status quo of text-based intelligent image generation technology in the context of art creation and the analysis of the outcomes of intelligent image generation art creation, it can be posited that the attributes of text-based intelligent image generation technology can be divided into two categories: those pertaining to learning creation and those pertaining to innovative creation[42]. This is illustrated in table 2.[45]

Table 2:Attribute Analysis of AI Technology in Image Generating Artistic Creation.(Image credit: Created by the author)

Application Properties	**Learning Creative Properties**	**Innovative Creative Properties**
Attribute Classification	Data-driven learning	Automated Innovation Creation
	learning by clustering and classification	Data-driven innovation creation
	adaptive learning	Intelligent Innovation Tools
	collaborative learning	Diversified Innovation Portfolio
	Personalised Learning	Abstracting innovative forms

4.2.1 Learning Creative Properties

Humans and AI share a number of similarities in terms of their capacity to perceive the world and to understand it. The most significant of these is the ability to learn. Just as humans continue to expand their knowledge and enhance their abilities through education, experience and exploration, AI must learn to gradually improve its capabilities. This is the first common trait between humans and AI on the path of creation.

The "Google Brain" project employs deep learning to achieve semantic understanding at varying levels of depth, thereby enhancing its cognitive and deconstructive capabilities and facilitating more accurate and intelligent task completion. This represents a significant driving force behind the ongoing advancement of AI.As illustrated in Figure 23.[46]

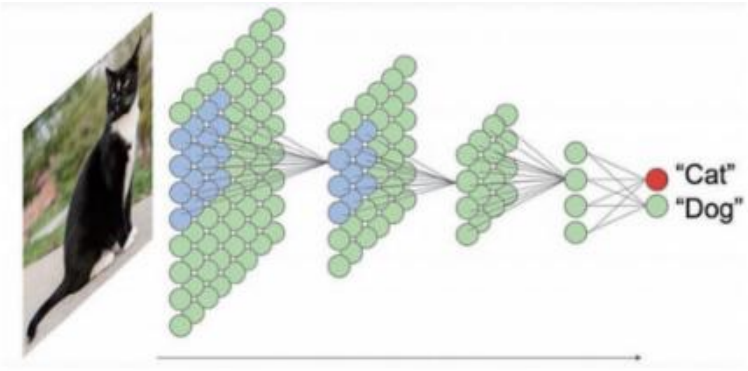


Figure 23: A study of cat recognition in Google's Google Brain.

The learning characteristics of AI provide a completely new perspective and means for the creation of artistic images. Its development will also promote human innovation and progress in various fields, bringing more benefits and development to human society. Based on the

comprehensive analysis above, the application of AI technology in the creation of image-generating art has the following learning attributes, as shown in table 3.

Table 3:Analysis of the learning characteristics of AI techniques applied to artistic image generation.(Image credit: Created by the author)

Learning Attributes	**concrete expression**
Data-driven learning	AI technology requires a large amount of data as input, which it learns to generate new works of art. This type of learning allows AI technology to better understand and mimic an artist's style and technique.
Clustering and classification learning	AI technology can analyse and categorise data by identifying and extracting features in the data through clustering and classification learning. In art creation, this ability can help AI models analyse the characteristics and similarities of different art styles, providing better reference and guidance for artists.
adaptive learning	AI can extract knowledge and laws from large amounts of data through machine learning algorithms, and constantly adjust and optimise its own algorithms and models to improve the accuracy and impact of artistic creation. AI technology is becoming more intelligent and adaptive.
collaborative learning	AI can learn in concert with human artists, continuously learning and adapting to different creative environments and requirements through interaction with artists and audiences, thus enhancing the quality and innovation of artistic creation. By integrating and applying knowledge and technology from different fields, machines can create new art forms and styles, while helping artists explore and discover new artistic fields and possibilities.
Personalised Learning	AI can continuously improve and optimise the artworks generated according to the needs and feedback of different artists and audiences, and can perform personalised learning and adaptation to better meet the artistic needs and aesthetic preferences of different groups of people.

4.2.2 Innovative Creative Properties

AI is gradually expanding its capabilities from classification and prediction to generation and innovation. Through unsupervised learning, Generative Adversarial Networks (GANs) are capable of discovering internal structures from raw data and automatically classifying them, thereby enabling the generation of innovative creations. In contrast to supervised learning, unsupervised learning does not necessitate labelled data; rather, it learns autonomously through algorithms, akin to the manner

in which humans discern the world through observation and action. The innovative capabilities of AI technology in the domain of image-generating art are manifold and diverse, as evidenced by table 4.[47]

Table 4:A critical examination of the innovative attributes of AI technology in image-generating artistic creation.(Image credit: Created by the author)

Innovative Attributes	**concrete expression**
Automated Innovation Creation	AI technology has the potential to automate the creation of new image works by automatically learning and generating them through techniques such as deep learning algorithms and neural networks. This approach enables artists and designers to save time and effort while creating work with distinctive styles and characteristics.
Data-driven innovation creation	The application of AI technology to the creative process can provide artists with more accurate and meaningful creative material and inspiration by analysing and processing large amounts of data. For example, machine learning algorithms can be used to analyse and classify large amounts of image data, thereby providing artists with more accurate and targeted creative material.
Intelligent Innovation Tools	The utilisation of AI technology may be employed as a novel instrument to facilitate the creative process of artists. By integrating AI technology into their practice, artists may more effectively explore diverse painting styles and themes, as well as enhance their capacity to express creativity.
Diversified Innovation Portfolio	AI technology has the capacity to synthesise disparate artistic styles, cultural influences and historical elements into entirely novel artistic creations. This kind of cross-cultural and cross-generational fusion creativity allows creators to liberate themselves from the traditional way of creating artworks and no longer be limited by existing elements and styles. This, in turn, opens up more creative possibilities and stimulates more creative inspirations and creative ideas.
Abstracting innovative forms	The application of AI techniques can result in the generation of unconventional and even surreal works of art. One such technique is the use of GAN technology, which enables the generation of abstract, fantastical or bizarre image works with a unique visual impact and artistic influence.

The rapid development of AI technology has led to the emergence of text intelligence generated image technology, which is now regarded as a highly promising field. In this fusion environment of art and science, artists from various fields are able to create art using text intelligence generated image technology. As an emerging tool for image generative art creation, this technology has successfully transcended the boundaries of learning and innovation, opening up new avenues for artistic expression. However, it also presents certain challenges for creators in terms of how to apply it in image generative art creation. Consequently, in the following section, we will analyse the application strategies of textual intelligent image-generating technology based on the aforementioned attributes of AI technology in image-generating art creation.

4.3 A Critical Examination of Text Intelligent Generation Image Technology

The continuous evolution of the media has expanded the scope of people's aesthetic cognition, and at the same time has led to a change in the criteria for judging works of art. The advent of AI has enabled the development of text intelligence, which in turn has facilitated the generation of image technology. This has led to the emergence of a novel form of aesthetic practice, characterised by the integration of AI into the creative process. This integration has also yielded innovative forms of artistic expression, while simultaneously providing a new source of material and inspiration for aesthetic research[48][49].

The correct understanding, application and development of text intelligent generation image technology has become an important topic for future art creation. This section will analyse the application strategy of text intelligent image generation technology in detail from the aspects of practical application and problem response, as shown in Figure 24.

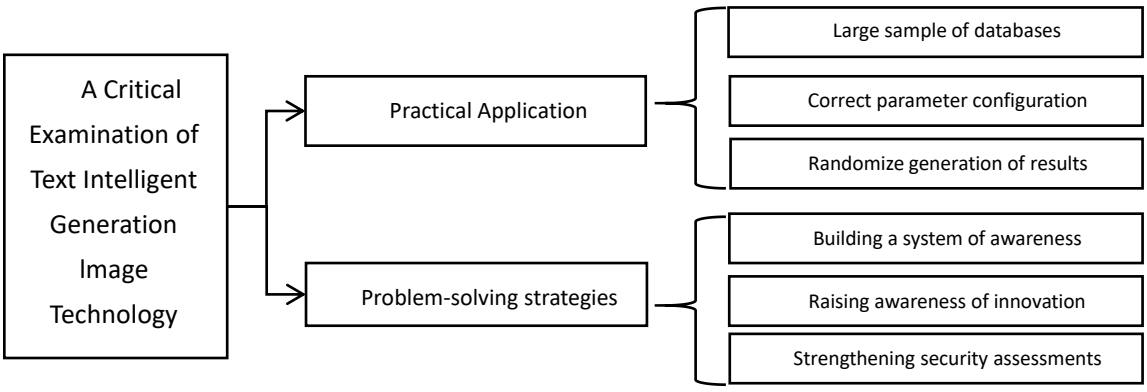


Figure 24: A Critical Examination of Text Intelligent Generation Image Technology.(Image credit: Created by the author)

4.3.1 Strategies for Applying Creative Practices

4.3.1.1 Rich data samples

The success of text-based intelligent image generation techniques depends heavily on the quality and quantity of the training data. In machine learning, algorithms can only find relevance from existing data, so the accuracy and richness of the data is very important for training a reliable image

generation model. For example, the success of Autodrawl, a graffiti generation tool, is largely due to the collection of over 800 million graffiti entries from the Quick,Draw! drawing tool, as shown in Figure 25. This data can provide the algorithm with rich drawing examples to help it learn different drawing styles and forms[50].

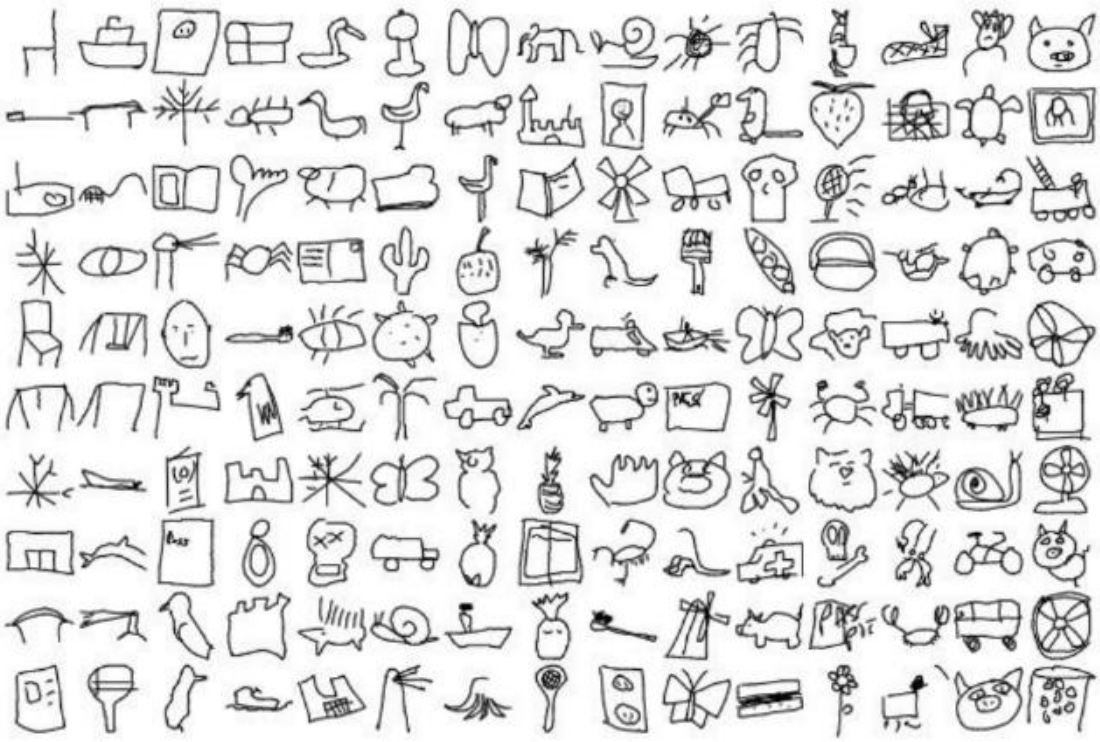


Figure 25: Example sketch from QuickDraw dataset

4.3.1.2 Correct parameter configuration

The field of Text Intelligent Generated Image Technology (TIGIT) is concerned with the transformation of natural language descriptions into images. The configuration of the relevant parameters can have a significant impact on the quality and accuracy of the generated images. Aleksandr Mordvintsev, the engineer behind Deep Dream, has highlighted that while the code itself is relatively straightforward to write, identifying the optimal parameters is a challenging task. Despite the simplicity of the code, which is only 30 to 40 lines long, the process of fine-tuning the parameters and identifying the most effective settings can require a significant number of experiments and trials.

In order to optimise parameter settings, creators must understand the role and impact of each parameter. There are two main methods for adjusting parameters: an adjustment method based on experience and intuition, and an automatic adjustment method based on data. The former is typically more effective when used by seasoned experts, while the latter can be facilitated by various automated tools and algorithms. Regardless of the method employed, the optimal parameter configuration necessitates the execution of multiple experiments and tests. This entails the training of the dataset on several occasions and the evaluation of the generated images. By providing feedback

and adjusting the results, the parameter settings can be gradually optimised for enhanced image generation.

4.3.1.3 Randomised generation of results

The advent of intelligent image generation technology has ushered in a new era of possibilities and challenges for artistic creation. This technology enables the generation of stunning artworks through the application of machine learning algorithms and extensive data training. However, the lack of determinism in the output of intelligently generated image technology also means that the ability of the creator to control the output is limited.

Consequently, when creators utilize intelligent image generation technology to create, they must acknowledge that the output of this technology is not entirely controllable. It is essential that creators relinquish their complete control over the results and learn to co-create with machines in order to create excellent image-generating artworks. In this context, creators must adapt to this new creative environment and adopt new creative ideas and modes. They must also understand the characteristics and limitations of intelligent image generation art. Furthermore, they must explore and learn how to cooperate with AI technology. Finally, they must explore this new art field together and continue to promote the development and application of intelligent image generation technology.

4.3.2 Strategies for Coping with Creative Problems

The integration of AI technology and art has prompted widespread concern and reflection in the field of art. The application of textual intelligence generated image technology in the field of art creation has broadened the creative ideas to a certain extent, but at the same time it has also caused some problems. The application of scientific and technological achievements, exemplified by AI-generated image technology in the field of art, is in its nascent stages. There is considerable scope for further development and innovation in this area, and thus a pressing need for in-depth consideration of the relevant issues.

The application of AI-generated image technology in art creation has brought about numerous innovations and breakthroughs. However, it has also revealed cognitive limitations. This is because theoretical cognition is the foundation and premise of intelligent visual art creation. Nevertheless, some creators lack a comprehensive understanding of this technology when utilising AI technology in their creations, which results in instability in the quality of their creations and a lack of innovation in their artworks. Consequently, it is of paramount importance to reinforce the education and research of intelligent visual art.

It is recommended that the government, universities and research institutions collaborate to establish an intelligent visual arts education and research system. This would facilitate the advancement and innovation of intelligent visual arts. Strengthening the education and research of intelligent visual arts would assist in resolving the cognitive challenges associated with the application of AI-generated image technology to artistic creation. This would provide a robust foundation for the

development of intelligent visual arts, promote the integration of art and technology, and inject new vitality and creativity into artistic creation.

Text-to-image generation technology enables easy replication, making originality hard to verify. The replication of databases and algorithms further hampers innovation, reducing the creative potential and uniqueness of generated artworks.

In order to address this issue, it is essential to combine the algorithmic model with the creator's own innovative thinking and aesthetic awareness in the application of text intelligent image generation technology. This will facilitate the deep integration of AI and human intelligence, thereby enabling creativity to become the core force that dominates the creation of content. Firstly, art creators must pay attention to and learn from various art forms in order to broaden their artistic horizons and stimulate creative inspiration. Secondly, art creators must direct their attention towards the investigation of their own artistic styles and concepts, the discovery of their own personalities and brands, and the utilisation of this information as the foundation for their creations. Concurrently, art creators must engage in the continuous accumulation of materials, the enhancement of their creative abilities and aesthetic sensibilities, and the maintenance of an analytical and critical consciousness[51].

AI-generated image technology boosts creative efficiency and diversity but raises security concerns. Key issues include the copyright status of AI-generated works and ethical challenges posed by this technological advancement.

In order to address these issues, it is essential to clarify the copyright and liability attribution of text-based intelligent image generation technology and provide legal protection for the legitimate rights and interests of creators. Concurrently, it is imperative to establish ethical norms and management mechanisms to guide the application of AI technology. These should be employed to audit and supervise individuals and organisations that utilise text-based intelligent image generation technology for creative work, ensuring that it is legal, standardised and meets ethical requirements. Conversely, it is imperative to enhance the moral responsibility and ethical awareness of creators, thereby fostering a constructive and conducive atmosphere for artistic creation.[52][53]

In conclusion, the advancement of AI technology is an unstoppable phenomenon. Artists must therefore be aware of the latest technological developments, monitor market trends and incorporate innovative ideas into their creations in order to remain competitive in the current market.

CHAPTER 5

Conclusion on Human-Machine Collaboration in Intelligent Image-Generating Art

As humans engage in the process of intelligent image generation, they have historically explored creative modes that enable human artists to combine and maximize their creativity and computational generation capabilities. As AI technology continues to evolve, intelligent ways to collaborate are becoming more accessible, and human-machine collaboration is becoming more efficient. Epstein thus proposed the concept of Collaborative Intelligence, which posits that human goals can be achieved through collaboration between humans and intelligent machines.In the field of image-generating art, the establishment of human-computer collaboration can facilitate intelligent reciprocity and reinforcement between humans and AI, allowing for the full exploitation of the advantages of both parties' capabilities and thus the creation of a new value of image art. Therefore, in this creative context, creators must adapt their creative thinking in order to respond more rapidly to the new creative environment and to realise the potential of this new art form[54].

This study will analyse the transformation of the creation mode of intelligent image generation art under human-computer synergy from the three levels of creation idea, creation thinking and creation mode. This will be done in order to clarify the creation mode of image generation art that tends to be intelligent under the background of human-computer synergy.

5.1 New Ideas for Creating Human-Machine Collaboration

5.1.1 Moving the creative centre of gravity forward

The field of intelligent image generation is a comprehensive one, encompassing art, technology and data. The creation of high-quality intelligent image generation works requires creators to possess a certain degree of artistic literacy and technical knowledge, as well as a substantial number of accurate data samples to train AI models. Therefore, creators must shift their focus of creation forward, focusing on data collation and industry research in the early stages.

It is of the utmost importance to be cognizant of the most recent technological advancements within the industry and to direct one's attention to the findings of pioneering AI research before embarking on the creative process. Those engaged in the creative endeavor can gain insight into the evolution of AI technology and its potential applications through exposure to the latest research findings of leading figures in the field of scientific research, thereby providing themselves with a more robust foundation for ideation and inspiration.

In addition to an understanding of the latest advances in AI technology, creators must also be able to accurately collect and process data. The accuracy and categorisation of data for identification is crucial in artistic creation. The use of different features and elements will result in the production of

different effects and expressions, which will affect the direction of subsequent artistic creation. Therefore, creators should establish their own data sources to ensure the accuracy and reliability of the data. In the actual practice of intelligent technology-assisted image generation art creation, creators should adjust their own creative logic, shift their creative focus forward, and devote more energy and time to data collection and processing.

5.1.2 Adjustment of the creation model

Intelligent image generation art uses machine learning algorithms to create complex images. Unlike traditional art, where creators can easily use open-source programming languages like Processing, intelligent image generation requires a deeper understanding of the technology. Creators must grasp its capabilities to choose the best model that aligns with their creative goals.

5.1.3 Expanding the creative medium

The term 'art medium' refers to a material tool used by humans to convey aesthetic information. Different media have different characteristics, which affect the way in which artistic expression is conveyed and the presentation of artistic value. Over time, the characteristics of media evolve. The development of AI technology is born from this media evolution. With the continuous progress of AI technology, artists can use computer algorithms to generate artworks, thus creating richer, more diverse and expressive art forms.

The core of image-generating art is conveying thoughts and emotions, requiring both the artist's expertise and AI's flexibility. While traditional media-based art offers multi-sensory impact, it lacks a contemporary, intelligent experience. AI fills this gap, adding interactivity and digital expression, making it a key tool for the future of image generation art.

5.1.4 Switching creative goals

Intelligent Image Generation Art represents a novel form of artistic expression that differs from traditional art creation. Rather than merely producing artworks, the objective of Intelligent Image Generation Art is to train AI with the capacity to create art and to realise the act of creation itself, or what might be termed 'meta creation'.

The development of intelligent image generation art is still in its infancy, and the adjustment and transformation of creative ideas still require continuous practice and exploration. Nevertheless, it is foreseeable that the future of intelligent art will bring more diversified and innovative artworks, and at the same time will have a certain impact and influence on the traditional art world. It is imperative that individuals maintain an open mind and embrace this nascent art form, actively engaging with it in order to facilitate the integration of art and technology and to contribute to the cultural development of humanity.

5.2 A New Path to Creative Collaboration between Man and Machine

The continuous development of machine learning and deep learning technology has enabled the gradual extension of intelligent creation methods to the field of art and design. In traditional image-generating art creation, creators are typically required to utilise a range of tools and creation

techniques based on their own life experiences and feelings in order to generate image-generating artworks that align with their own concepts and views.

However, the application of AI technology is transforming this traditional creative logic. In particular, intelligent image generation and art creation transforms visual elements into data at the early stage of creation. This is achieved through the processing and invocation of computer programs and specific algorithms, which filter suitable creative materials from the massive visual elements. Finally, the machine performs calculations and outputs the results. This kind of creation logic not only saves the creator's time and energy, but also has the potential to facilitate the exploration of new creative avenues and the advancement of traditional visual arts.

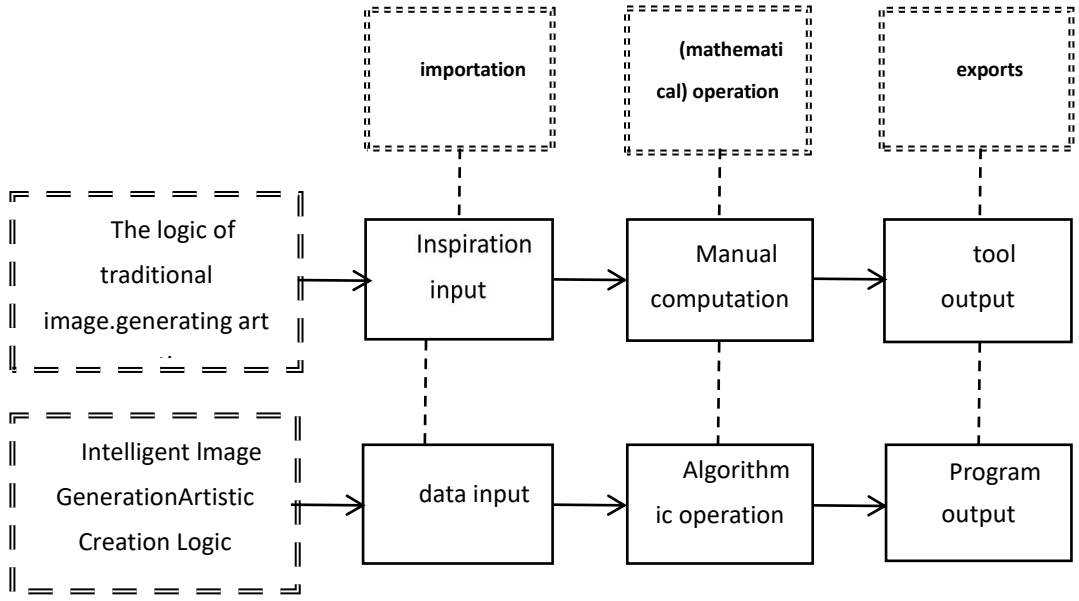


Figure 26: Logical Comparison of Traditional Image Generating Artistic Creation and Intelligent Image Generating Artistic Creation.(Image credit: Created by the author)

The integration of AI technology into the creative process of image generation art is a complex and gradual process that necessitates close collaboration and interaction between the creator and the intelligent system. This collaborative creation mode enables creators to more efficiently create artworks with unique styles and high values, while the intelligent system can also continuously improve its algorithms and models through interaction with creators, thus better serving creators and the development of art creation.

The creative process in which AI technology is involved in the generation of images for artistic purposes comprises the following principal stages (see in table 5):

Throughout the creative process, the collaboration between AI technology and creators is characterised by a high degree of proximity and complementarity, resulting in the formation of an organic combination of intelligence and creativity.

Table 5:AI Technology Involved in the Creative Process of Image Generating Artistic Creation.(Image credit: Created by the author)

Step	creative process	Creative Concrete Performance
1	Ideas for creative inspiration	At the initial stage of image generation, creators must clarify their inspiration and ideas, which serve as the foundation for the creative process. AI technology can play a supportive role in this stage, offering assistance with inspiration and ideas.
2	Selection of the scope of the study	After the creator conceives the inspiration, the next step is to define the creation's theme and goal. AI guides this process by providing relevant knowledge and resources based on the theme and goals.
3	Acquisition of target data	Once the parameters of the study have been delineated, the creator must gather data pertinent to the subject matter, which encompasses a multitude of forms, including images, text, and sound. AI technologies assume the role of supervisors and scholars, offering assistance in the collection and processing of data.
4	Analysing target data	Once the requisite data has been gathered, it must be subjected to analysis and processing in order to extract the most useful information and features. The deployment of AI technology can serve as a valuable assistant in this regard, assisting in the analysis and extraction of data.
5	Extracting creative themes	After analyzing the data, the creator extracts the core theme of the creation. AI aids by semantically analyzing the data, suggesting relevant information, and assisting in determining the creative theme.
6	refinement of stylistic features	Image generation relies on refining stylistic features. After extracting the theme, creators refine the style using personal aesthetics and AI algorithms. By analyzing sample images, AI learns various style features like lines, colors, and textures, then generates stylistic elements that match the theme, setting the foundation for image creation.
7	Modelling the network	The construction of network models represents the fundamental aspect of image generation. Creators are afforded the opportunity to select the model that aligns with their creative style and theme for training, thereby facilitating the generation of images.
8	algorithmic program	Once the network model is built, AI automates the process, generating images with thematic and stylistic features to inspire creators.
9	Export of creative solutions	After computations and optimizations, AI provides several creative solutions, from which the creator selects the final outcome through human intervention.
10	Enrichment of creative details	Creators can enrich their works by adding details and adjusting elements to enhance expressiveness. AI technology can also be used to optimize the work, ensuring its quality and aesthetic appeal.
11	Presentation of the final work	The human-computer collaboration results in an image that the creator can evaluate, refining the process for future creations. Meanwhile, the intelligent system learns and improves through interaction, enhancing its contribution to subsequent collaborations.

5.3 A new model of human-computer collaboration in creation

In the forthcoming intelligent age, human creativity will assume a pivotal role. Creativity, imagination and innovation represent the most valuable resources for human beings. Creativity aids have been developed to assist creators in extending their creativity, imagination and innovation from the stage of creative conception to the stage of final realisation, and across any potential field of application, such as science, design, engineering or art[55][56].

The integration of AI technology and art creators represents a significant advancement in the field of intelligent visual art creation. Currently, AI is regarded as a novel creative tool that can be combined with the creativity of creators to generate distinctive works of art. This creation method has the objective of liberating computers from the purely technical application field, integrating the language of artistic expression, and giving full play to the advantages of AI in processing large-scale data, computing, etc. It also aims to take advantage of the creator's ability to control the creative expression, comprehensive analysis, etc., in order to maximise the potential and realisation of the artistic creation and efficiency of the human-computer collaboration. Consequently, the optimal approach to human-machine collaboration in the creation of intelligent image generation art is to achieve an equilibrium between the autonomy of humans and machines.

5.3.1 AI Guided Learning Creation Model

The AI-guided Learning Creation Mode is a collaborative mode based on AI technology that assists artists in creating images by providing pre-specified knowledge sequences and event logic through an intelligent system. In this mode, the intelligent system has a high degree of autonomy, and is able to provide a series of artistic creation support to help the artist with image generation. In contrast, the artist has a relatively low degree of flexibility and is constrained to create images based on the image database provided by the intelligent system. In this mode, the intelligent system is able to utilise existing image data to enhance the efficiency and accuracy of image generation, while the artist is afforded the opportunity to continuously explore innovative artistic expressions through collaboration with the intelligent system.

The book 1111101000 Robots contains 1,000 drawings created by an AI. These images were generated by the OpenAI image generation system, DALL-E 2, using prompts written by the visual artist Ben Barry. Figure 27 shows an example of one of the images.In terms of the creative approach, Ben Barry assists the artist with image generation through a trained AI model. This involves combining the artist's creativity with the model's generative capabilities in order to achieve creative image generation.

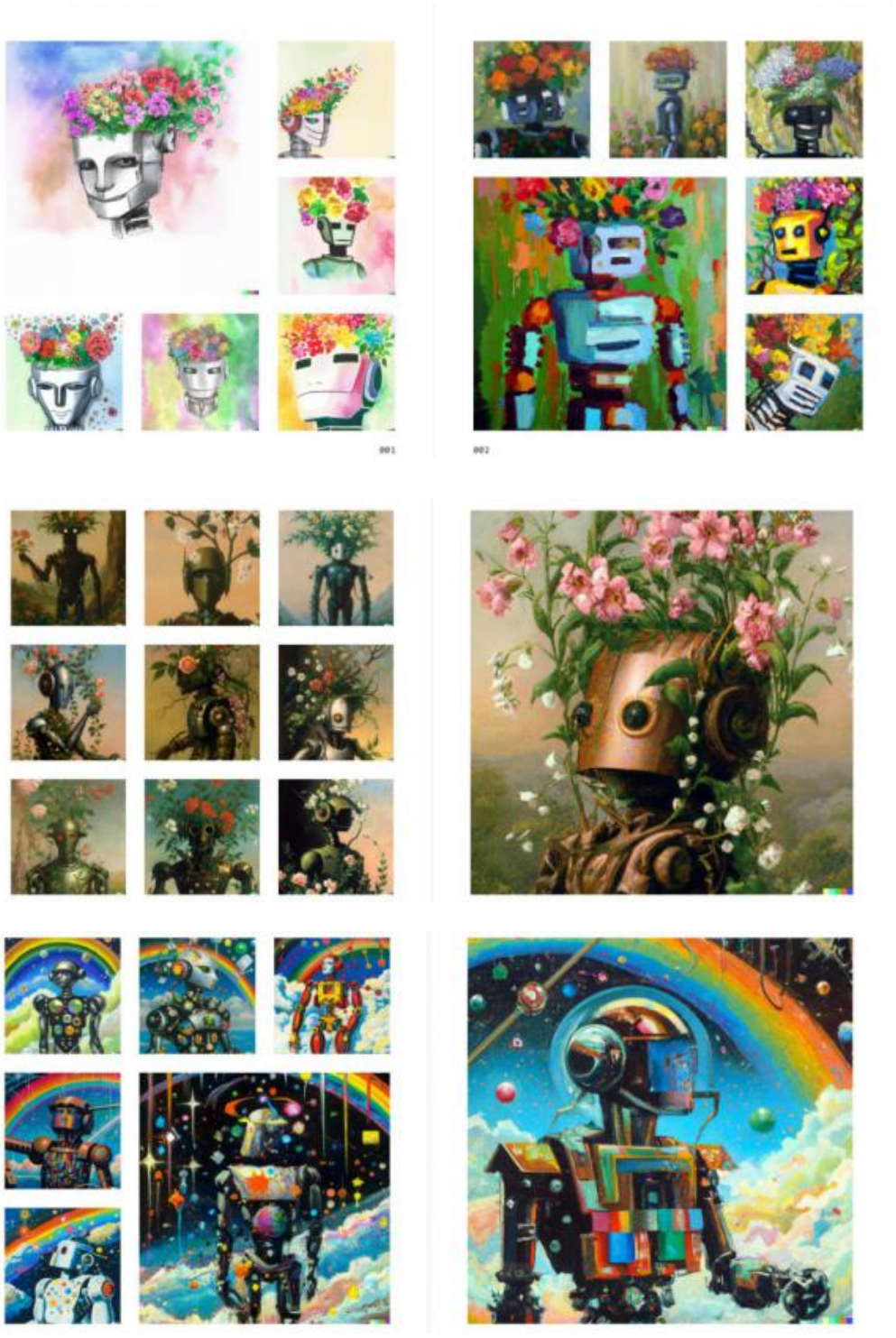


Figure 27: The DALL-E 2 AI system generates images from the catalogue "1111101000 Robots"

5.3.2 An AI-assisted collaborative authoring model

The AI-assisted collaborative creation model places greater emphasis on the interrelationship between the creator and the AI technology than the AI-guided learning creation model. In this mode, the creator and the AI system jointly control the generated image, thereby facilitating a higher degree of human-machine interaction and cooperation.

For instance, the Spanish illustrator Nekro continues his previous style of painting by utilising the AI image generation tool Midjourney to combine AI-generated images with his own creations. This establishes a "self-replicating" workflow, whereby images are generated from AI, a library of generated images is created by the artist, and the desired parts of each image are selected to reconstruct them according to the artist's design concept. This process is illustrated in Figure 6-5. The process begins with the generation of images from AI, followed by the construction of a library of generated images. The required parts of each image are then selected, and the image is reconstructed according to the artist's design concepts. This is illustrated in Figure 28.

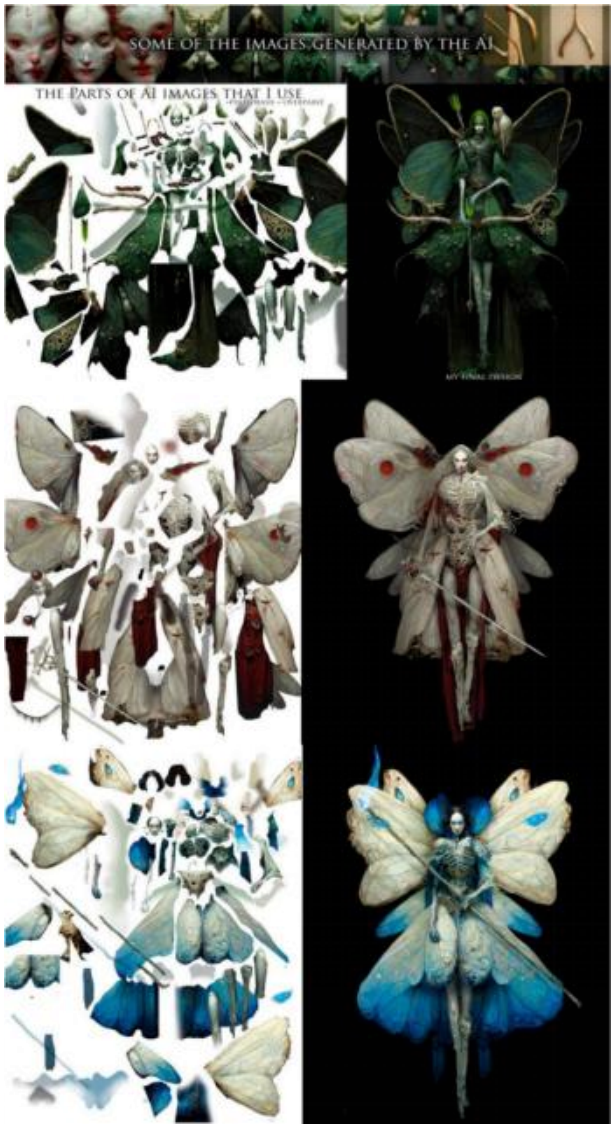


Figure 28: Image-generating work by artist Nekro with Midjourney

The AI-assisted cooperative creation mode represents a more flexible and efficient approach to artistic creation, emphasising the collaboration and interaction between the creator and AI technology. This mode is designed to align more closely with the human creation mode, and its application is expected to promote innovation and development in the field of art, create more colourful artworks, bring richer and more diverse visual experiences, improve the aesthetic level and visual effect of artworks, and open up new artistic expressions and creation modes.

5.3.3 Models of creative creation enhanced by AI

The concept of Human-centred AI (HAl) represents an innovative approach to artistic creation. It entails the utilisation of AI technology to generate images, with the intention of empowering human creativity. The underlying principle is that human intelligence should remain the dominant force in the creative process.

The objective of the AI-enhanced creative model is to realise HAl. This is achieved by emphasising the autonomy and control of the creators, while also ensuring that the AI system is under the control and guidance of humans. This approach enables intelligent technology to be used as a tool to assist humans in achieving their goal of artistic creation. In this model, the core of artistic creation is the human mind, with intelligent technology serving as a tool to assist humans in achieving their artistic goals.In the context of creative art creation, the human-led human-computer collaborative creation model is more advantageous than other models. This is because only humans can truly understand and express feelings and emotions[57][58].

CUSP is the outcome of artist Jake Elwes placing randomly generated images from neural networks (GANs) in a tidal landscape with the intention of reconstructing a familiar childhood scene that took place on the Essex marshes, as illustrated in Figure 29.[59]



Figure 29: Jack Elwes Places Randomly Generated Images from GANs in Tidal Landscapes

Jack initially trains the machine using the existing information in the image dataset, after which it is instructed to continue learning the traits of different marsh bird species. During this process, the machine-generated images exhibited a shift in morphology between the different bird species, resulting in unexpected variations. This was due to the fact that the images did not adhere to the human classification system, as illustrated in Figure 30. This work demonstrates how CUSP, the artist Jack Elwes, is combining AI technology with art creation. This integration is empowering art creation, exploration and discovery of new art forms and languages.



Figure 30: Jack Elwes Places Randomly Generated Images from GANs in Tidal Landscapes

The human-centred intelligent image creation model facilitates the implementation of AI technology in the domain of artistic creation, thereby enabling more precise and artistic expression of human emotions, cognitive processes, and worldviews. This model also fosters collaboration between humans and machines, expands human imagination and creativity, and contributes to human social development and cultural progress.

CHAPTER 6

Future Prospects of Visual Art Creation in the Age of AI

The advent of AI technology offers artists a plethora of creative avenues and possibilities. It enables artists to express their ideas with greater accuracy and introduces a new level of creativity and imagination. However, intelligent visual art also presents certain challenges and problems. These include the challenge of balancing AI and artists' creativity and ensuring that AI works are compatible with human emotions and values.

6.1 AI Brings New Opportunities for Visual Arts Creation

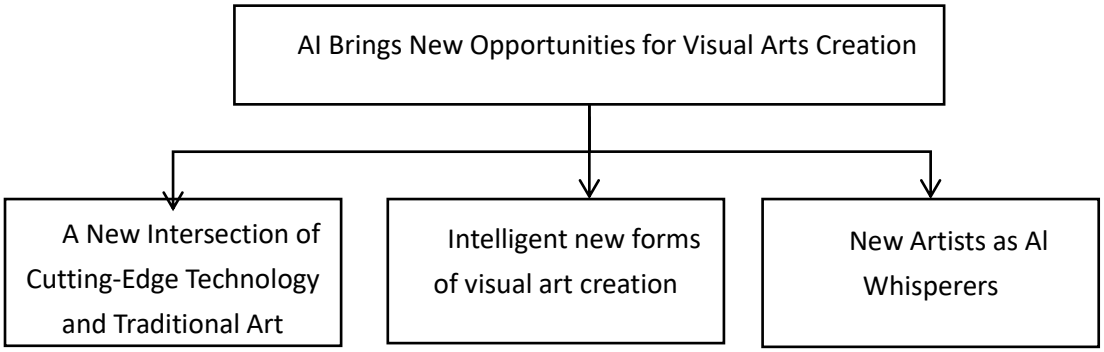


Figure 31: AI Brings New Opportunities for Visual Arts Creation.(Image credit: Created by the author)

6.1.1 A New Intersection of Cutting-Edge Technology and Traditional Art

The field of intelligent image generation art is experiencing a period of rapid growth, emerging as a new and innovative art form. It offers artists a novel avenue for expression, combining cutting-edge technology with traditional artistic techniques, challenging the boundaries of traditional art forms and fostering a more innovative and infectious approach to art.

ING has initiated The Next Rembrandt, an initiative designed to commemorate the celebrated painter Rembrandt's distinctive "Rembrandt Light" style of art. This is achieved through the utilization of AI technology, which is employed to examine traditional artworks, as exemplified in Figure 32.



Figure 32:The Next Rembrandt Project

The project was a collaborative research endeavour conducted by a multidisciplinary team of experts over an eighteen-month period. The objective was to utilise AI algorithms in order to emulate the painting style of Rembrandt, with the intention of perpetuating his artistic talent and gifts. As shown in Figure 43 and Figure 44.



Figure 33:Rembrandt's major paintings (left) and a schematic representation of the subject of "The Next Rembrandt" (right)



Figure 34:3D layered rendering of the paintings generated by the "Next Lombard" project (left) and the resulting painting (right)

This painting, created through an intelligent generation process, successfully captures the essence of Rembrandt's artistic style and characteristics. The integration of technology and art is evident in the clever manner in which the image has been generated. The emergence of intelligent image generation art provides us with a new cultural and artistic experience, while simultaneously promoting the communication and interaction between traditional culture and modern technology. Furthermore, it facilitates the development and application of AI technology.[60]

6.1.2 Intelligent new forms of visual art creation

The role of AI technology in the creation of visual art is becoming increasingly significant. It is not only expanding the boundaries of the art field in terms of theme, form and technology, but also promoting the cooperation and interaction between artists and AI technology. The art world's tolerance of collaborative creation between artists and AI technology, the market's recognition of the value of the results of collaborative creation, and the artists' pursuit of new paths for AI technology-assisted creation are trends that collectively advance the enhancement of the level of traditional visual art creation. AI technology plays an important role in artistic creation. It not only greatly enhances the imagination and creativity of artists, but also enriches the form of art works and creative tools. Furthermore, it opens up a new field of human-computer co-creation. Currently, AI algorithms have made significant breakthroughs in imitating and exploring the path of creation. This makes traditional visual art creation constantly innovative and creates new forms of intelligent visual art that meet the characteristics of the times.

6.1.3 New Artists as AI Whisperers

In the current field of intelligent image-generating art, AI is not yet able to produce creative visual artworks completely independently because it lacks the free will and subjective willingness that human artists possess.

Although AI technology can gradually replace some of the manual labour involved in intelligent visual art creation, the core value of art creation itself still needs to be performed by artists. In comparison to the relationship between the camera and the photographer, the role of AI in the art creation process is more akin to a tool, unable to independently select the creative material, creative theme and presentation form, among other key factors. These factors affect the formation of artistic value and must be controlled by the artist. During the creative process, the artist must also make constant decisions and adjustments. Consequently, AI technology cannot entirely replace the artist, but rather serves as an auxiliary tool for their creation.

In the journal Wired, the renowned technology thinker Kevin Kelly has introduced the concept of "AI Whisperers," which refers to the co-creation (co-creation) with the help of AI technology. This new type of artist guides AI collaborators towards a unified vision, similar to the role of a director. The advent of AI as a new art form has also given rise to a new breed of artists. The subjects of art creation, namely AI and artists, are both concerned with the expression of the combination of human and machine thinking, as well as the fusion of human and machine inspiration.

6.2 Future Trends in Intelligent Visual Art Creation

The field of intelligent visual art creation is an art form that integrates a number of different technologies, including AI, machine learning, computer vision and others. As the field develops, it will be influenced and driven by a number of different factors, including technology, art creation and social culture.[61]

In terms of technology trends, intelligent visual art creation will be influenced and driven by the following:(1) The implementation of more sophisticated algorithms and software. (2) The advent of a greater variety of hardware devices. (3) The development of more efficient data processing and storage technologies. (4) The advent of more popular intelligent visual creation tools.

In terms of the evolution of artistic creation, the future development of intelligent visual art creation will be influenced and driven by the following aspects:(1) A more diverse approach to creativity.(2) A greater focus on innovation and experimentation.(3) A greater emphasis on artful education.

The popularization and development of AI has led to a gradual shift in the perception of intelligent visual art creation. Previously the domain of a select few artists and technology companies, this form of art is now entering the public eye. The popularity of intelligent art creation has not only changed the creators' way of creation and artistic expression, but also had a far-reaching impact on social culture. The social and cultural trends of intelligent visual art creation include the following:

(1) The creation of intelligent visual art will facilitate social development. In the future, intelligent visual art will be used to advance social development, with applications in various areas of human society, including urban planning, environmental protection, cultural heritage, and so forth. (2) The creation of intelligent visual art will influence the evolution of the art market. The future intelligent visual art will influence the evolution of the art market, including pricing, sales, and the display of artworks. (3) Intelligent visual art creation will place greater emphasis on social significance and value. AI's deep learning and data analysis capabilities will enable it to access more detailed expressions of human emotions and thoughts, thereby providing artists with more accurate and efficient creation tools. At the same time, intelligent visual art creation will also place greater emphasis on cross-cultural communication and art integration, thereby promoting the diversified and international development of art through intelligent technology and cross-border cooperation.

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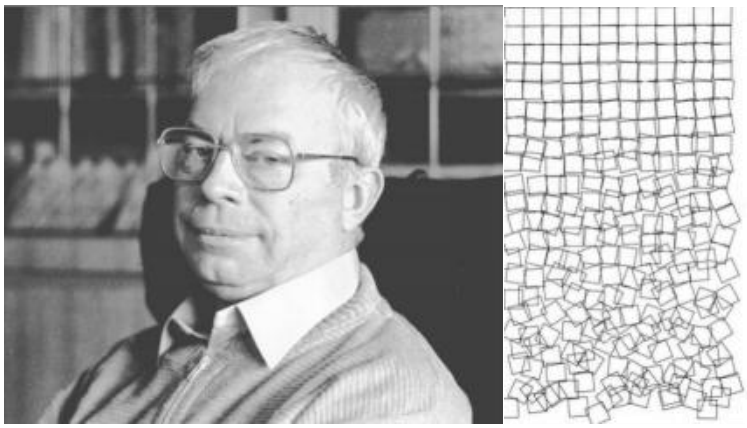
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Appendix

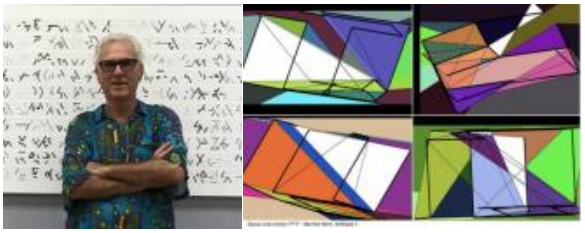
Appendix I: Frieder Nake (left) and his working models from 1960s (right)[62] .



Appendix II: Georg Nees (left) and his work "Schotter" from 1968 (right)[63].



Appendix III: Manfred Mohr(left) and his work "Space.color.motionP777" (right) [64].



Appendix IV: Ken Knowlton (left) and his Bell Labs colleague Leon Harmon. behind them is a computer-generated artwork they created in 1967 called Computer Nude (Studies in Perception I).Behind them is a computer-generated artwork they created in 1967, titled Computer Nude (Studies in Perception I)[65].



Appendix V:Vera Molnar (left) and her work " (Des) Ordres " (1974) (right) [66].

