

REFLECTIONS ON THE USE OF ARTIFICIAL INTELLIGENCE IN WORKS OF ART

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Abstract

Purpose: This paper aims to reflect on the use of Artificial Intelligence (AI) in works of art, examining its impact on the creative process, aesthetics, and audience reception, then provide a critical reflection on the use of AI in works of art, examining its potential benefits and drawbacks and exploring the ethical considerations involved. The paper examines the use of AI in works of art, with a focus on the methodologies and case studies that demonstrate the potential and challenges of this emerging field.

Research methods: The paper presents case studies of notable artworks that utilize AI, discusses the potential benefits and drawbacks of AI in art, and explores the ethical considerations involved. Through a review of the literature and analysis of six case studies, we explore the aesthetic, technical, and social dimensions of AI-generated art, as well as the ethical and critical debates surrounding its production and reception.

Findings: The paper concludes by emphasizing the importance of critical engagement and continued reflection on the use of AI in art. Our findings suggest that AI can offer new modes of creative expression and engagement, but also raise questions about the role of human agency and interpretation in the artistic process.

Implications: AI-generated art offers new opportunities and challenges for artists, scholars, and audiences, and that future research should focus on developing ethical guidelines, exploring collaborative practices, and examining the social and political implications of AI-based art. Case studies of AI-generated art can help us understand the potentials and limitations of this field by providing specific examples of how AI is being used to create art, and how artists and audiences are engaging with these works. These studies can provide insights into the creative processes, technical challenges, and social implications of AI-generated art.

Keywords: Artificial Intelligence (AI), AI-generated art methodology, Next Rembrandt, Sunspring, Rafael Lozano-Hemmer, Refik Anadol

INTRODUCTION

Artificial intelligence (AI) has rapidly evolved in recent years, becoming increasingly present in our daily lives. From voice assistants to self-driving cars, AI has transformed various industries, including the arts [1]. AI has become an increasingly prominent tool in the field of contemporary art [2], enabling artists to create works that blur the boundaries between human and machine



creativity. From generative algorithms to neural networks, AI-based art practices have opened up new possibilities for aesthetic experimentation, data visualization, and interactive experiences [3]–[5]. The use of AI in art has sparked both excitement and controversy, with some praising its potential to revolutionize the creative process while others expressing concerns about its impact on the nature of human creativity and authenticity [6], [7]. The use of AI in art also raises a range of critical and ethical questions, such as the relationship between art and technology, and the social and political implications of algorithmic decision-making. The paper presents case studies of notable artworks that utilize AI, discusses the potential benefits and drawbacks of AI in art, and explores the ethical considerations involved. The paper concludes by emphasizing the importance of critical engagement and continued reflection on the use of AI in art.

RESEARCH METHODS

The paper presents case studies of notable artworks that utilize AI, discusses the potential benefits and drawbacks of AI in art, and explores the ethical considerations involved. Through a review of the literature and analysis of six case studies, Authors explore the aesthetic, technical, and social dimensions of AI-generated art, as well as the ethical and critical debates surrounding its production and reception. Authors analyze these case studies using a combination of qualitative methods, such as content analysis and thematic coding.

FINDINGS

Methodologies for Using AI in Art

There are various methodologies for using AI in art, each with their own unique aesthetic, technical, and social dimensions. Here are some of the main methodologies [8]:

Style Transfer: Style transfer is a technique where the style of one image is transferred to another image using machine learning algorithms. This technique has been used to generate new artworks in the style of famous artists such as Van Gogh and Picasso [9], [10].

- (1) **Aesthetic dimension:** Style transfer allows for the creation of new artworks that blend the styles of different artists, resulting in unique and visually striking compositions.
- (2) **Technical dimension:** The technical process of style transfer involves training a neural network to recognize the style of a given artwork and applying that style to another image.
- (3) **Social dimension:** Style transfer has raised questions around authorship and originality, as the resulting artwork is created through the use of pre-existing images.

Generative Adversarial Networks (GANs): GANs are a type of machine learning algorithm that can generate new images based on a given set of parameters. In

the context of art, GANs can be used to create entirely new artworks or to modify existing ones [11]–[13].

- (1) Aesthetic dimension: GANs can create highly realistic and detailed images, resulting in new artworks that are difficult to distinguish from those created by humans.
- (2) Technical dimension: GANs require a large amount of data to train the neural network, and the output can be unpredictable.
- (3) Social dimension: The use of GANs in art has raised concerns around the potential for the technology to be used for unethical purposes, such as generating *deepfakes* or perpetuating stereotypes.

Interactive Systems: Interactive systems allow for real-time collaboration between humans and machines, enabling artists to create new artworks that respond to user input [8], [14].

- (1) Aesthetic dimension: Interactive systems can result in dynamic and responsive artworks that engage the viewer in new and unique ways.
- (2) Technical dimension: Interactive systems require sophisticated software and hardware to facilitate real-time collaboration between humans and machines.
- (3) Social dimension: The use of interactive systems raises questions around the role of the artist, as the resulting artwork is created through a collaborative process with the machine.

Overall, the different methodologies for using AI in art each offer unique aesthetic, technical, and social dimensions, and have contributed to a range of debates and discussions around the role of technology in the creative process. The aesthetic, technical, and social dimensions of AI-generated art are complex and multifaceted.

Aesthetic dimension

On the aesthetic front, AI-generated art can be evaluated based on its formal qualities such as color, composition, texture, and shape. AI-generated art can exhibit a range of styles, from mimicking the work of past artists to creating entirely new and unique styles. Evaluating the aesthetic quality of AI-generated art can be a subjective task, as what may be considered beautiful or aesthetically pleasing can vary greatly among individuals.

Technical dimension

From a technical perspective, AI-generated art involves the use of algorithms to create new artworks. The quality of the algorithms and the accuracy of the data used to train them can have a significant impact on the resulting artwork. The use of advanced technologies such as machine learning, computer vision, and natural language processing can also enhance the technical quality of the artworks generated by AI.

Social dimension

The social dimensions of AI-generated art are perhaps the most significant. The use of AI in art can raise questions about the role of technology in creative expression, as well as issues related to ownership, authenticity, and authorship. Additionally, the use of AI can perpetuate biases present in the data used to train the algorithms, leading to works that reinforce existing social and cultural norms. On the other hand, AI-generated art has the potential to democratize the art world by allowing more people to create and participate in artistic expression.

In summary, the aesthetic, technical, and social dimensions of AI-generated art are complex and intertwined. Evaluating AI-generated art requires considering these dimensions and recognizing the potential implications of this emerging technology on the art world and beyond.

Case Studies

Authors analyze six case studies of AI-generated art, selected based on their diversity in terms of artistic style, technical approach, and social impact. These case studies include:

- (1) "The Next Rembrandt" (2016) by J. Walter Thompson Amsterdam and ING Bank, which used machine learning algorithms to generate a new painting in the style of Rembrandt;
- (2) "Sunspring" (2016) by Oscar Sharp and Ross Goodwin, which used recurrent neural networks to generate a screenplay for a short film;
- (3) Rafael Lozano-Hemmer's "Pulse Room" (2006) which uses sensors and algorithms to create an interactive installation that responds to the heartbeat of the viewers;
- (4) Rafael Lozano-Hemmer's "Border Tuner" (2019), a large-scale interactive installation that uses machine learning algorithms to translate and connect people's voices across the US-Mexico border;
- (5) Refik Anadol's "Melting Memories" (2018), an art installation by Turkish-born media artist Refik Anadol that explores the intersection of technology and memory;
- (6) Refik Anadol's "Memoirs from Latent Space Study II" (2019), which used deep neural networks to visualize the memories of people who have passed through a specific location.

Authors analyze these case studies using a combination of qualitative methods, such as content analysis and thematic coding.

"The Next Rembrandt" (2016)

"The Next Rembrandt" (Figure 1) is a fascinating case study in the use of artificial intelligence in creating works of art [15]. In 2016, J. Walter Thompson Amsterdam and ING Bank collaborated to create a painting in the style of Rembrandt, using machine learning algorithms. The project began with the collection of data on Rembrandt's paintings, including his use of color, composition, and subject matter [16]. This data was then used to train a machine learning algorithm, which was designed to identify patterns in the data and generate new paintings that mimicked Rembrandt's style [17].



Figure 1. The Next Rembrandt Project

[Source: <https://news.microsoft.com/europe/features/next-rembrandt/> [15]]

The resulting painting was a portrait of a man, created using 3D printing technology to apply multiple layers of paint in a way that mimicked Rembrandt's technique (Figure 2). The final product was displayed in a public exhibition and received significant media attention (Figure 1). "The Next Rembrandt" is significant because it demonstrates the potential of AI to replicate the techniques and style of historical artists.

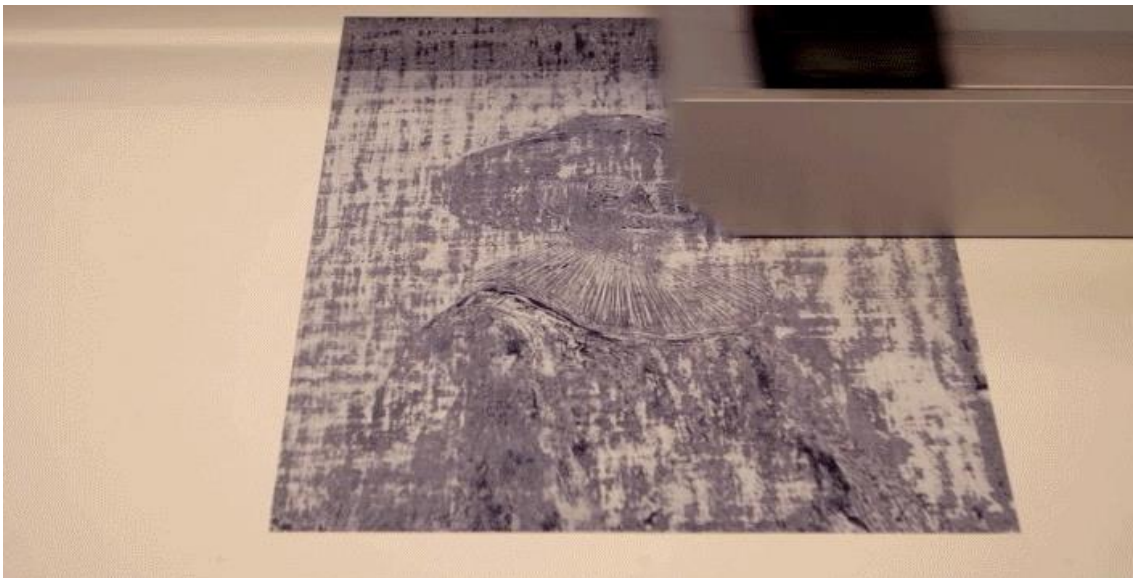


Figure 2. The Next Rembrandt Project

[Source: <https://news.microsoft.com/europe/features/next-rembrandt/> [15]]

However, it also raises questions about the role of AI in the creation of art and the relationship between human creativity and machine learning. Some argue that the project is a mere gimmick, while others see it as a promising avenue for exploring new forms of artistic expression. Overall, "The Next Rembrandt" is an important case study that highlights the potential of AI in the creation of art and

the need for ongoing critical reflection on the implications of this emerging technology.

“Sunspring” (2016)

“Sunspring” (Figure 3) is a short film that starring Thomas Middleditch, Humphrey Ker, and Elisabeth Gray was created by filmmaker Oscar Sharp and writer Ross Goodwin using artificial intelligence (AI) in the form of recurrent neural networks (RNNs). The film was produced as part of the 48-Hour Film Challenge at the Sci-Fi London film festival in 2016 [18], [19].

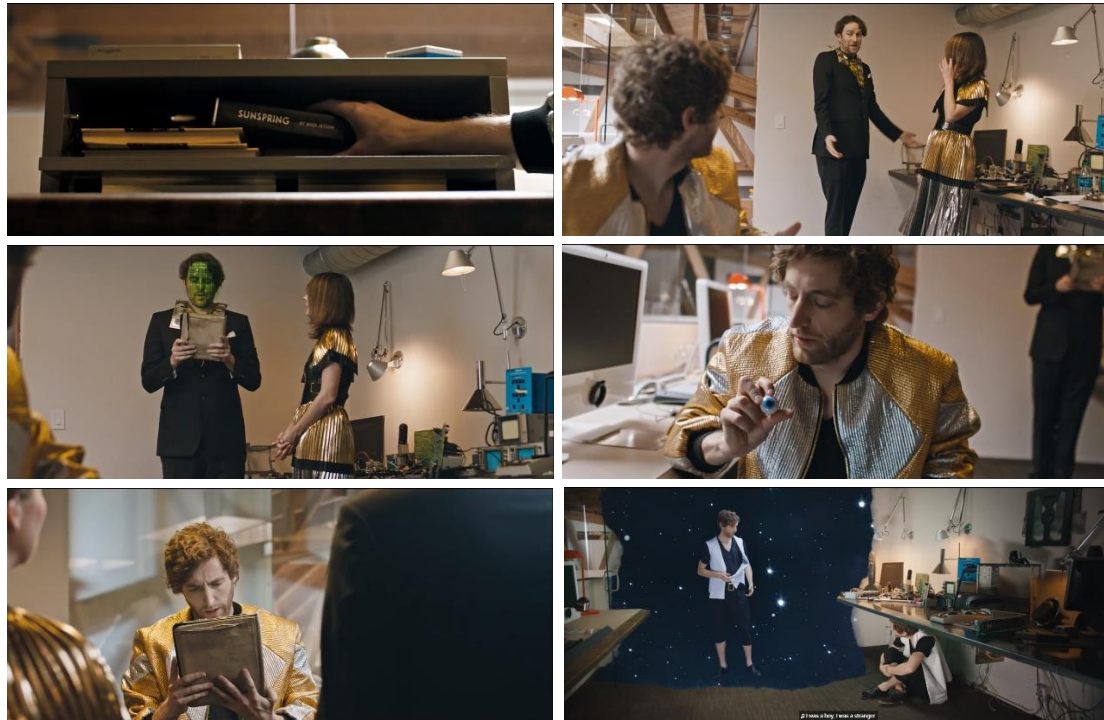


Figure 3. Sunspring screenshot

[Source: <https://arstechnica.com/video/watch/sunspring-sci-fi-short-film> [20]]

To create the screenplay, Goodwin fed the RNNs a dataset of science fiction film scripts, and the algorithm learned to generate text based on patterns and structures within the data [20]. The resulting screenplay was then given to Sharp to direct and produce, resulting in a surreal and nonsensical film that played with traditional narrative structures and challenged the role of human creativity in the filmmaking process.

One of the interesting aspects of “Sunspring” is the way in which it highlights the limitations and potential of AI-generated art. While the film is certainly strange and at times nonsensical, it also showcases the unique ways in which AI can inspire and inform the creative process.

Furthermore, “Sunspring” raises questions about authorship and creativity in art. While the script was generated by the AI algorithm, it was ultimately transformed into a film by human filmmakers, with their own interpretations and creative decisions shaping the final product. This raises questions about the

role of the artist in the creative process, and the potential for AI to challenge traditional notions of authorship and originality.

Overall, "Sunspring" represents an innovative and experimental use of AI in the creative process, and has sparked important conversations about the role of technology in art and the potential for AI to inspire new forms of creativity.

Rafael Lozano-Hemmer's "Pulse Room" (2006)

Rafael Lozano-Hemmer is a prolific artist who has created several works that use AI and related technologies. One of his notable works is "Pulse Room" (2006), which uses sensors and algorithms to create an interactive installation that responds to the heartbeat of the viewers [21].



Figure 4. Pulse Room (2006)

[Source: <https://www.arte-sur.org/home/pulse-room/>]

In "Pulse Room," the gallery is filled with hundreds of hanging incandescent light bulbs, each of which is controlled by a computer and a sensor that detects the viewer's pulse (Figure 4). As the viewer approaches the installation, their pulse is detected and translated into a flickering light that is amplified and reflected by the surrounding bulbs, creating a mesmerizing and immersive display of light and sound [22].

The inspiration for this artwork came from various sources, including the 1960 film *Macario* directed by Roberto Gavaldón, which features a scene where the protagonist experiences a hallucination in which each person is represented by a lit candle in a cave due to hunger. The artwork also draws upon musical styles such as minimalism, machinism, and serialism, as seen in compositions by Conlon Nancarrow, Steve Reich, and Glenn Branca. Additionally, the theory of Cybernetics, which explains the process of self-regulation of the heart, was also influential in the creation of this artwork [23].



Figure 5. Rafael Lozano-Hemmer's world of light and sound art
 [Source: <https://mikcexplore.com/home/2021/11/8/pulse-topology-a-conversation-with-artist-rafael-lozano-hemmer> [22]] Photo courtesy of Kemper Museum

The installation raises important questions about the relationship between technology, the body, and the environment (Figure 5). By using the viewer's heartbeat as a central component of the work, "Pulse Room" creates a powerful and intimate connection between the viewer and the installation, blurring the boundaries between the human and the machine.

Overall, "Pulse Room" represents a compelling example of how AI and related technologies can be used to create immersive and thought-provoking works of art. By using sensors and algorithms to respond to the viewer's heartbeat, Lozano-Hemmer has created an artwork that challenges our assumptions about the relationship between the body, technology, and the environment, and invites us to reconsider our place in the world around us.

Rafael Lozano-Hemmer's "Border Tuner" (2019)

"Border Tuner" (Figure 6) is a large-scale interactive installation that creates a live exchange between two cities that share a border: El Paso, Texas, in the United States, and Ciudad Juárez, in Mexico [24]. The installation consists of three robotic searchlights located on each side of the border that create bridges of light in the sky when they find each other. It can be controlled by the public using a custom-made interface. When the searchlights intersect in the sky, they create a bridge of light that spans the border [25].

When visitors speak into one of the interactive stations located on each side of the border, their voice is translated into the language of the other side using a machine learning algorithm. The translated voice is then played back through speakers on the other side, creating a dialogue between the two sides of the border [26]. The installation uses machine learning algorithms to analyze the voices of the public as they speak into the interface, transforming them into a visual representation of sound waves that are projected onto the searchlights. The searchlights also capture live video footage of the cities and their inhabitants, which is displayed on large screens in each location, creating a real-time dialogue between the two cities.



Figure 6. "Border Tuner" (2019)

[Source: https://www.lozano-hemmer.com/border_tuner_sintonizador_fronterizo.php [25]
Copyright : Rafael Lozano-Hemmer, "Border Tuner / Sintonizador Fronterizo, Relational Architecture 23", 2019.]

"Border Tuner" explores themes of communication, connection, and division in the context of the border between the United States and Mexico. The use of AI and machine learning adds an element of interactivity and responsiveness to the artwork, creating a dynamic and engaging experience for the public.

Through this installation, Lozano-Hemmer aims to create a platform for connection and conversation between people on opposite sides of the border, challenging the divisive rhetoric surrounding immigration and borders. The use of AI in this work allows for real-time translation and interaction, creating a seamless and dynamic experience for visitors.

In conclusion, Rafael Lozano-Hemmer's "Border Tuner" presents a unique and innovative approach to exploring the interplay between technology, art, and social interaction. The artwork provides a platform for meaningful engagement between communities separated by political boundaries, allowing individuals to communicate and connect across borders. From an aesthetic perspective, the piece presents a visually stunning spectacle that merges art, architecture, and technology in a captivating display of light and sound.

Technically, "Border Tuner" employs a sophisticated system of custom-built hardware, software, and networking protocols to enable real-time communication between participants. The use of AI and machine learning algorithms further enhances the piece's technical complexity, enabling the system to adapt and respond to changing environmental conditions and participant behaviors.

From a social perspective, "Border Tuner" raises important questions about the role of technology in shaping our relationships with one another and the world around us. The piece offers a powerful commentary on the social and political implications of border walls, and the potential for technology to transcend these boundaries and create meaningful connections between individuals and communities. Overall, "Border Tuner" represents a compelling example of how AI-based art can foster social engagement, spark critical reflection, and push the boundaries of what is possible in the realm of art and technology.

Refki Anadol's "Melting Memories" (2018)

"Melting Memories" (Figure 7) is an art installation by Turkish-born media artist Refik Anadol that explores the intersection of technology and memory. The installation uses deep neural networks to visualize the memories of people who have passed through a specific location, creating a dynamic and immersive artwork that reflects on the role of technology in shaping our understanding of memory and identity.

The installation is located in a historic building in Istanbul, and uses a combination of sensors, cameras, and other data sources to collect information about the people who have passed through the space over time. This data is then fed into a deep neural network, which processes the information and generates a series of abstract visualizations that represent the memories and experiences of those who have been in the space.



Figure 7. Melting Memories by Refik Anadol (2018)
[Source: <https://refikanadol.com/works/melting-memories/>]

One of the key features of "Melting Memories" is its use of deep neural networks to create abstract visualizations of memory and experience. By using machine learning algorithms to process the data collected from the space, the installation creates a unique and highly personalized experience for each

viewer, reflecting the diversity of experiences and memories that have been captured over time.

Another notable aspect of the installation is its focus on the relationship between technology and memory. By using machine learning algorithms to create visual representations of memory and experience, Anadol invites viewers to consider the ways in which technology is shaping our understanding of memory and identity, and the potential impact that these developments may have on our lives and society as a whole.

Overall, "Melting Memories" represents an innovative and thought-provoking use of AI in the creative process. By using deep neural networks to explore the relationship between technology and memory, Anadol has created an artwork that challenges our assumptions about the role of technology in shaping our understanding of the world around us.

Refik Anadol's "Memoirs from Latent Space Study II" (2019)

"Memoirs from Latent Space Study II" (Figure 8) is an art installation that uses deep neural networks to explore the relationship between memory and technology. The installation consists of a series of large-scale projections that depict abstract visualizations of memories and experiences, based on data collected from a variety of sources, including brain scans, social media activity, and other personal data [27].

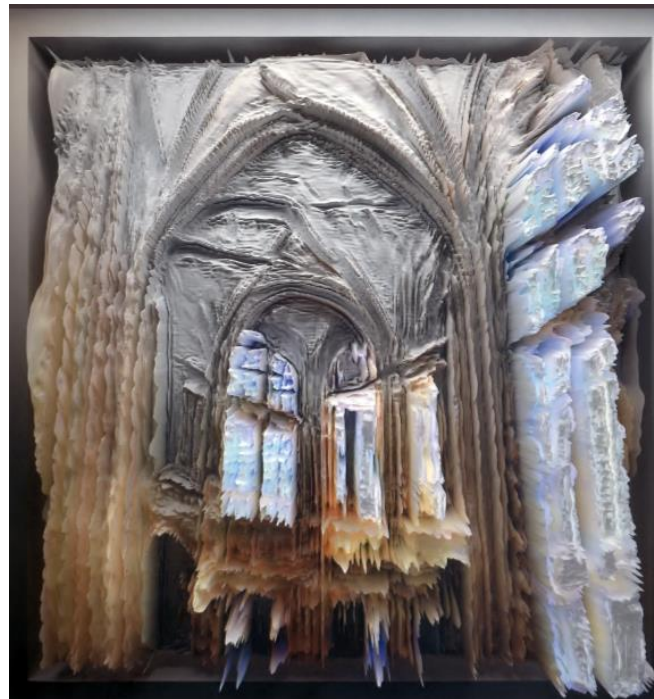


Figure 8. "Memoirs from Latent Space Study II" (2019)
[Source: Hermitage Magazine [27]]

Through its use of deep neural networks and other machine learning algorithms, "Memoirs from Latent Space Study II" creates a highly personalized and immersive experience for viewers, reflecting the unique memories and experiences of each individual. The installation also raises important questions

about the ethical implications of using technology to capture and visualize personal data, and the potential impact that these developments may have on our understanding of memory, identity, and privacy.

Overall, "Memoirs from Latent Space Study II" represents a powerful and thought-provoking example of how AI can be used in art to explore complex and challenging ideas. By using deep neural networks to create visual representations of memory and experience, Anadol has created an artwork that challenges our assumptions about the role of technology in shaping our understanding of ourselves and the world around us.

Benefits and Drawbacks

The use of AI in art has several potential benefits, including the ability to generate new forms of art, enhance creativity, and democratize the art-making process. AI can analyze vast amounts of data and generate new insights that humans may not have been able to uncover, leading to new forms of artistic expression. Additionally, AI can assist artists in the creative process, providing new tools and techniques to enhance their work.

However, the use of AI in art also raises several concerns, including the potential loss of human creativity and the impact on authenticity and originality. Some argue that the use of AI in art may lead to a "sameness" in artistic expression, with works being created based on algorithms and data analysis rather than human creativity. Additionally, there is a concern that AI-generated works may lack the emotional depth and complexity that comes from human experience and expression.

Authorship and Creativity

One of the main debates surrounding AI-generated art revolves around questions of authorship and creativity. Some argue that AI-generated art is not truly "authored" by the machine, as it is ultimately the product of human programming and training data. Others argue that AI-generated art is a new form of creativity, one that blurs the lines between human and machine authorship.

Proponents of AI-generated art often argue that the technology has the potential to democratize the art world, by allowing more people to create and participate in artistic expression. However, others argue that this technology may ultimately reinforce existing social and cultural norms, as the algorithms used to create AI-generated art are trained on existing data that may be biased or incomplete.

The Potential Implications of AI-Generated Art

The use of AI in art production and reception also raises a number of broader ethical questions, including questions about the potential impact of this technology on the art world and beyond. For example, some worry that the use of AI in art may lead to a devaluation of human creativity and the role of the artist in society. Others worry that AI-generated art may contribute to the automation of other creative industries, such as writing, music, and film.

Additionally, there are concerns about the use of AI-generated art in marketing and advertising, and the potential for this technology to be used to manipulate public opinion and behavior. As AI continues to advance, these concerns will become increasingly urgent, highlighting the need for ongoing critical reflection on the implications of this technology.

Ethical Considerations

The use of AI in art also raises several ethical considerations, including issues around intellectual property, privacy, and bias. The ownership of AI-generated works and the rights of the original creators and programmers are still a topic of debate, with some arguing that AI-generated works should be considered joint creations between humans and machines. Additionally, the use of AI in art can raise concerns about privacy, as data from individuals may be used to create works of art without their consent.

Furthermore, the use of AI can perpetuate biases present in the data used to train the algorithms, leading to works that reflect and reinforce social and cultural biases. For example, an AI-powered art project by a group of researchers at MIT, called "Norman," used algorithms trained on violent and graphic images to generate disturbing artworks. The project aimed to raise awareness of the potential dangers of biased AI, highlighting the need for ethical considerations in the use of AI in art.

CONCLUSION

The use of AI in art has sparked critical and ethical debates, as it raises questions about the role of technology in creative processes, the agency of the artist, and the interpretation of the artwork. One of the main debates concerns the idea of creativity in AI-generated art. Some argue that AI can only mimic existing styles and lacks the capacity for originality and creativity, while others argue that the algorithms used in AI art are capable of generating new and innovative forms.

Another critical issue relates to the agency of the artist. Some argue that AI-generated art is created by the algorithms and not the artist, raising questions about the authenticity and authorship of the artwork. This raises issues about intellectual property rights and the ownership of the creative output. Interpretation is also a critical issue in AI art. The use of algorithms to generate art challenges traditional methods of interpretation, as the meanings and intentions of the artist are not always clear. Some argue that the use of AI in art opens up new possibilities for interpretation, as viewers can bring their own experiences and understandings to the work.

Ethical concerns also arise around the use of AI in art, particularly around issues of bias and representation. The use of biased data to train algorithms can lead to perpetuating existing social biases and reinforce discriminatory practices. Additionally, the use of AI-generated images and videos in areas such as propaganda and disinformation can have negative societal impacts. In conclusion, while AI has opened up new avenues for artistic expression, it also raises critical and ethical issues that require careful consideration. The use of AI in art requires a balanced approach that considers both the aesthetic, technical,

and social dimensions of the artwork, while also addressing the broader societal implications of its use.

Case studies of AI-generated art can help us understand the potentials and limitations of this field by providing specific examples of how AI is being used to create art, and how artists and audiences are engaging with these works. These studies can provide insights into the creative processes, technical challenges, and social implications of AI-generated art.

One key finding from these studies is that AI can be used to generate novel and unexpected forms of art that would be difficult or impossible for human artists to create. For example, the "Next Rembrandt" project used machine learning algorithms to generate a new painting in the style of Rembrandt, which demonstrated the potential for AI to extend the boundaries of artistic creation beyond what individual human artists can achieve.

However, case studies have also revealed some limitations and challenges of AI-generated art. One issue is the question of authorship and creative agency. Some critics argue that AI-generated art lacks the intentionality and subjective experience of human artists, and therefore cannot be considered "true" art. Others contend that AI is simply a tool that artists can use to express their ideas and vision, and that the role of the artist is still central to the creative process.

Another challenge is the potential for AI-generated art to perpetuate biases and reinforce existing social and cultural norms. For example, if the data used to train an AI algorithm contains biased or stereotypical representations of certain groups of people, the resulting art may also reflect these biases. This raises important ethical questions about the responsibility of artists and technologists to ensure that AI-generated art is inclusive, diverse, and equitable. Overall, case studies of AI-generated art highlight the complex interplay between technology, creativity, and society, and underscore the need for ongoing critical reflection and ethical consideration in this rapidly evolving field.

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