

Algorithmic Aesthetics: A Critical Analysis of AI-Generated Art in the Digital Age

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Abstract

This article examines the burgeoning role of Artificial Intelligence (AI) in the realm of art and creativity, exploring its impact across visual arts, music, and literature. Through an analysis of key AI technologies such as Generative Adversarial Networks (GANs) and advanced language models, we investigate how machine learning algorithms are reshaping creative processes and challenging traditional notions of authorship and originality. The article presents case studies of AI-generated artworks, compositions, and writings, evaluating their reception and implications for the creative industries. Furthermore, we delve into the ethical considerations surrounding AI in art, including issues of copyright, authenticity, and the potential displacement of human artists. By synthesizing current research and industry developments, this article provides a comprehensive overview of the state of AI in creative fields, offering insights into the future of human-AI collaboration in artistic expression and the potential for new forms of creativity enabled by technological advancements.

Keywords: Artificial Intelligence (AI), Creativity, Generative Art, Machine Learning, Neural Networks, Digital Art, AI Music Composition

ALGORITHMIC AESTHETICS

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I. Introduction

The rapid advancement of Artificial Intelligence (AI) has ushered in a new era of creativity, challenging traditional notions of artistry and pushing the boundaries of human imagination. As AI technologies continue to evolve, their application in creative fields has sparked both excitement and controversy within the artistic community and beyond. From generating visual art through Generative Adversarial Networks (GANs) to composing music and writing poetry, AI systems are demonstrating capabilities that were once thought to be uniquely human [1]. This paradigm shift has not only opened up new avenues for artistic expression but also raised profound questions about the nature of creativity, authorship, and the role of human artists in an increasingly automated world [2]. This article explores the multifaceted impact of AI on art and creativity, examining its applications across visual arts, music, and literature, while also delving into the ethical, legal, and philosophical implications of this technological revolution in creative industries.

II. Background: AI and Creativity

A. Definition of AI in the context of creative processes

Artificial Intelligence (AI) in the context of creative processes refers to computational systems capable of performing tasks that typically require human creativity. This field, often termed "computational creativity," encompasses the study and development of AI systems that can generate, evaluate, and even appreciate creative works [3]. These systems employ various machine learning algorithms, particularly deep learning models, to analyze patterns in existing artworks, music, or literature, and produce new content that exhibits characteristics of creativity. In the realm of art and creativity, AI is not merely a tool wielded by human artists but can be seen as a collaborative partner or even an autonomous creator, challenging traditional notions of authorship and the creative process.

B. Historical perspective on AI in art and creativity

The intersection of AI and creativity has a rich history dating back to the mid-20th century. Early experiments in this field included the generation of simple melodies and basic visual patterns. A significant milestone was reached in the 1970s with Harold Cohen's AARON, one of the first AI systems designed to create original artworks. As computational power increased and algorithms became more sophisticated, AI's creative capabilities expanded dramatically. The 21st century has seen a surge in AI-generated art, music, and literature, with systems like DeepArt, MuseNet, and GPT-3 pushing the boundaries of what's possible in machine creativity [4].

C. Key AI technologies used in creative fields

Several key AI technologies have emerged as powerful tools in creative fields:

1. Generative Adversarial Networks (GANs): These are used extensively in visual art creation. GANs consist of two neural networks—a generator and a discriminator—that work in opposition to create new, original images that mimic the characteristics of a training dataset.
2. Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) networks: These are particularly useful in sequence generation tasks, such as composing music or writing text. They can learn patterns in sequential data and generate new sequences that follow similar patterns.
3. Transformer models: These have revolutionized natural language processing and are the basis for systems like GPT (Generative Pre-trained Transformer). They excel at generating coherent and contextually relevant text, making them valuable in literature and poetry generation.
4. Evolutionary Algorithms: Used in various creative domains, including music composition. These algorithms mimic the process of natural selection to evolve and refine creative outputs over multiple

generations.

These technologies, among others, have dramatically expanded the possibilities for AI in creative fields, enabling the generation of increasingly sophisticated and diverse artistic outputs. However, as Jordanous points out, the evaluation of creativity in these systems remains a complex challenge. The goal of many of these systems is not just to produce creative works, but to do so with some level of autonomy and to be perceived as creative by human observers [3]. This raises important questions about the nature of creativity itself and how we can meaningfully assess it in non-human entities.

Technology	Primary Use	Example Application
Generative Adversarial Networks (GANs)	Visual Art Generation	DeepArt
Neural Style Transfer	Applying Artistic Styles	Google's DeepDream
Recurrent Neural Networks (RNNs)	Music and Text Generation	MuseNet
Transformer Models	Text Generation	GPT-3

Table 1: Key AI Technologies in Creative Fields [5, 6, 7]

III. AI-Generated Visual Art

A. Overview of AI art generation techniques

The field of AI-generated visual art has seen remarkable advancements in recent years, primarily driven by two key techniques: Generative Adversarial Networks (GANs) and style transfer algorithms.

1. Generative inimical Networks(GANs) GANs, introduced by Goodfellow et al. in 2014, have revolutionized AI-generated art [5]. A GAN consists of two neural networks: a generator that creates images, and a discriminator that evaluates them. The generator aims to produce images that are indistinguishable from real ones, while the discriminator tries to identify which images are AI-generated. This adversarial process results in the creation of increasingly realistic and creative artworks.
2. Style transfer algorithms: Style transfer techniques allow the application of one image's artistic style to the content of another image. The seminal work by Gatys et al. in 2015 demonstrated how Convolutional Neural Networks (CNNs) could be used to separate and recombine the content and style of different images, opening up new possibilities for AI-generated art [6].

B. Case studies of AI art platforms

1. DeepArt: DeepArt.io, launched in 2015, is one of the pioneering platforms for AI-generated art. It uses neural style transfer algorithms to allow users to apply the style of one image to the content of another. The platform has gained popularity among both amateur and professional artists for its ability to create unique artistic renditions of photographs.
2. Google's DeepDream: DeepDream, introduced by Google in 2015, uses a different approach. It employs a trained convolutional neural network and modifies the input image to maximize the activation of specific layers or neurons. This process results in dream-like, often psychedelic images that reveal the patterns and features the AI has learned to recognize.

C. Analysis of AI-generated artworks and their reception

The reception of AI-generated art has been mixed, sparking debates about creativity, authorship, and the nature of art itself. Some critics argue that AI-generated art lacks the emotional depth and intentionality of mortal-created art. Others see it as a new frontier in artistic expression, where the AI becomes a collaborator or a new type of artistic tool.

Notable examples of AI art gaining recognition include the portrait "Edmond de Belamy" created by the collective Obvious using GANs, which sold for \$432,500 at Christie's in 2018. This sale marked a significant moment in the acceptance of AI-generated art in the traditional art world.

However, challenges remain. Questions of copyright and authorship are particularly complex when it comes to AI-generated art. There's ongoing debate about whether the credit should go to the AI, the programmer, the person who trained the AI, or some combination thereof.

Despite these challenges, AI-generated visual art continues to evolve and gain acceptance. As the technology improves and artists become more adept at using these AI tools, we can expect to see even more innovative and thought-provoking works that blur the lines between human and machine creativity.

IV. AI in Music Composition

A. AI music generation techniques

AI has made significant strides in the field of music composition, employing various techniques to generate original musical pieces. These techniques often draw from the rich history of algorithmic composition while leveraging modern machine learning approaches:

1. Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) networks: These are particularly effective for music generation due to their ability to learn and reproduce sequential patterns. They can capture the temporal dependencies in music, making them suitable for generating melodies and harmonies [7].
2. Generative Adversarial Networks (GANs): While more commonly associated with image generation, GANs have also been adapted for music composition. They can generate novel musical sequences by learning the distribution of existing music.
3. Transformer models: Originally developed for natural language processing, transformer models have been successfully applied to music generation. They excel at capturing long-range dependencies in music, allowing for the creation of more coherent and structured compositions.
4. Reinforcement Learning: This approach allows AI systems to learn composition by receiving feedback on their generated music, potentially based on predefined rules of music theory or listener preferences.

B. Examples of AI music composition platforms

Several platforms have emerged that showcase the capabilities of AI in music composition:

1. OpenAI's MuseNet: This deep neural network can induce 4- nanosecond musical compositions with 10 different instruments. It was trained on a diverse range of musical styles and can combine them in novel ways [8].
2. Google's Magenta: An open-source research project exploring the role of machine learning in the process of creating art and music. It offers various models and tools for AI-assisted music composition.
3. AIVA (Artificial Intelligence Virtual Artist): A platform that uses deep learning algorithms to compose original music for various applications, from film scores to video game soundtracks.
4. Amper Music: An AI music composition platform designed for content creators, allowing them to generate custom music tracks for their projects.

C. Comparison of AI-composed music with human-composed music

The comparison between AI-composed and human-composed music is a subject of ongoing debate and research:

1. **Structural coherence:** While AI can generate music that follows learned patterns, human composers often bring a level of intentionality and long-term structure to their compositions that AI still struggles to replicate consistently.
2. **Emotional depth:** Human-composed music often carries emotional nuances and personal expressions that AI-generated music may lack. However, the emotional impact of music is subjective, and some listeners report emotional responses to AI-composed pieces.
3. **Creativity and novelty:** AI systems can create novel combinations of musical elements, sometimes producing unexpected and innovative results. However, the creativity of AI is bound by its training data, while human composers can draw from a broader range of influences and experiences.
4. **Adaptability:** Human composers can easily adapt to specific requirements or contexts, while AI systems may need retraining or fine-tuning for different styles or requirements.
5. **Collaboration potential:** AI music generation tools are increasingly being used in collaboration with human composers, augmenting their capabilities rather than replacing them entirely.

While AI has made impressive progress in music composition, it is generally seen as a powerful tool rather than a replacement for human composers. The unique strengths of AI, such as its ability to quickly generate and explore musical ideas, are being integrated into the creative process of many musicians and composers.

V. AI in Literature and Writing

A. Natural Language Processing (NLP) in creative writing

Natural Language Processing (NLP) has revolutionized the field of AI-assisted creative writing. NLP techniques enable AI systems to understand, interpret, and generate human language, opening up new possibilities for automated and augmented literary creation. Key NLP technologies in creative writing include:

1. **Language Models:** These predict the probability of a sequence of words, allowing AI to generate coherent text.
2. **Sentiment Analysis:** This helps AI understand and replicate emotional tones in writing.
3. **Named Entity Recognition:** This allows AI to identify and use proper nouns appropriately in generated text.
4. **Text Summarization:** This enables AI to distill key information from longer texts, useful in both analysis and generation of content.

B. AI text generation models (e.g., GPT-3)

Recent advancements in AI text generation have been largely driven by transformer-based models, with GPT-3 (Generative Pre-trained Transformer 3) being a notable example. Developed by OpenAI, GPT-3 represents a significant leap in natural language generation capabilities [9].

Key features of GPT-3 and similar models include:

1. **Massive scale:** Trained on vast amounts of text data, these models can generate highly coherent and contextually relevant text.
2. **Few-shot learning:** They can perform tasks with minimal specific instructions, adapting to various writing styles and formats.

- Versatility: Capable of generating diverse types of content, from poetry and stories to articles and code.

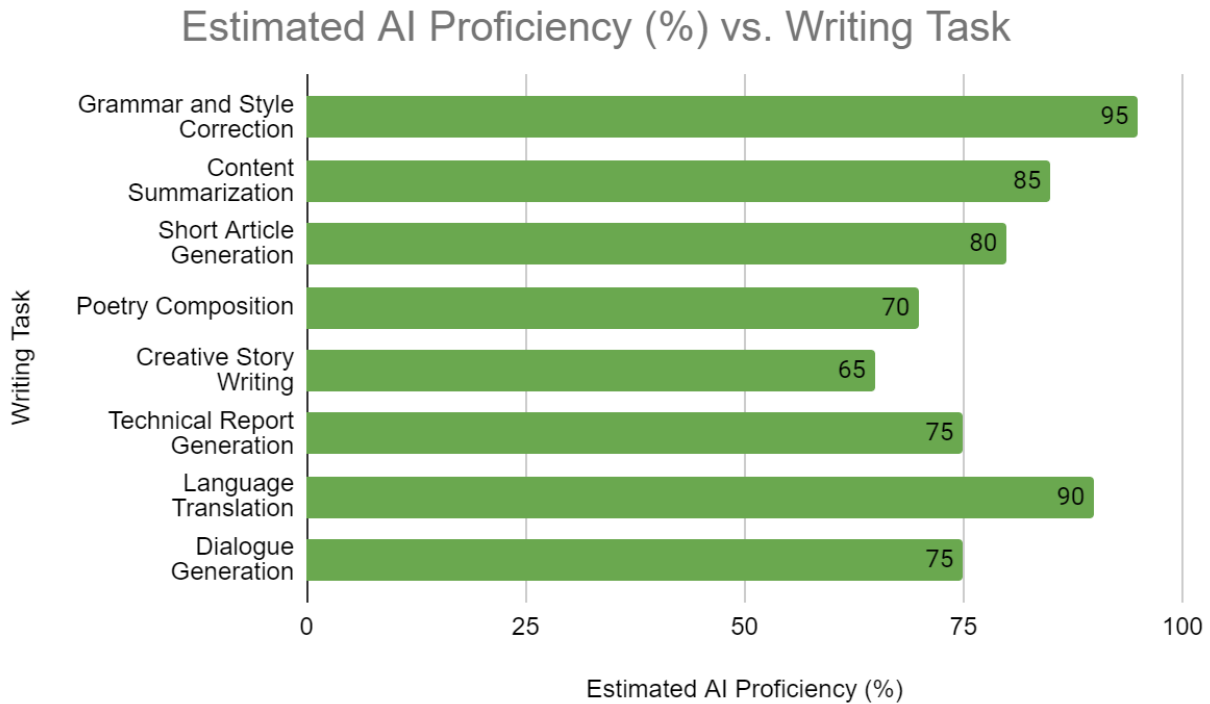


Fig. 1: Estimated AI Capability in Writing Tasks (2023) [9, 10]

C. Examples of AI-generated poetry, stories, and articles

AI has demonstrated capabilities in various forms of creative writing:

- Poetry: AI models have generated poems that mimic different styles and forms. For instance, the bot "Poem.exe" creates haiku-like poems based on Twitter content.
- Stories: AI story generators like "AI Dungeon" create interactive narratives that adapt based on user input.
- Articles: News organizations have experimented with AI-generated articles, particularly for data-driven stories like financial reports or sports recaps.

While these AI-generated works can be impressive, they often lack the depth of human-created content and may produce inconsistencies or factual errors.

D. Implications for journalism and content creation

The integration of AI in literature and writing has significant implications for journalism and content creation [10]:

- Automated content generation: AI can produce large volumes of content quickly, potentially transforming industries like content marketing and journalism.
- Augmented writing: AI writing assistants can help human writers by suggesting improvements, checking facts, or generating outlines.
- Personalized content: AI can tailor content to individual readers' preferences and reading levels.
- Ethical concerns: The use of AI in journalism raises questions about transparency, accountability, and the potential spread of misinformation.
- Job displacement: There are concerns about AI potentially replacing human writers in certain areas,

though many experts believe AI will augment rather than replace human creativity.

6. Copyright and authorship: AI-generated content raises complex legal and ethical questions about intellectual property rights.

While AI has made significant strides in literature and writing, it currently serves primarily as a tool to augment human creativity rather than a replacement for human authors. The technology continues to evolve, prompting ongoing discussions about its role in the future of creative writing and journalism.

VI. Implications for the Art World

The integration of AI into artistic practices has profound implications for the art world, challenging traditional notions of creativity, authorship, and the role of the artist. These developments are reshaping the landscape of creative industries and prompting critical discussions about the nature of art itself.

A. Redefining creativity and authorship

The emergence of AI-generated art has sparked debates about the nature of creativity and authorship:

1. Creativity: AI's ability to generate novel and aesthetically pleasing works raises questions about whether creativity is an exclusively human trait. Some argue that AI's outputs are merely sophisticated combinations of existing data, while others contend that this process mirrors human creativity.
2. Authorship: When an AI system creates a work of art, determining the "author" becomes complex. Is it the AI itself, the programmer who created the AI, the person who trained the model, or the user who initiated the generation process?
3. Intentionality: Traditional concepts of art often involve the artist's intent. AI-generated art challenges this notion, as the "intent" may be distributed among the AI system, its creators, and its users.

B. Copyright and ownership issues in AI-generated art

The rise of AI-generated art has created new challenges in intellectual property law:

1. Copyright eligibility: In many jurisdictions, copyright law requires human authorship. This raises questions about the legal status of AI-generated works.
2. Ownership: If AI-generated works can be copyrighted, who owns the rights? The AI developer, the user, or perhaps the AI itself?
3. Infringement concerns: AI models trained on existing artworks may produce outputs that closely resemble copyrighted works, potentially leading to unintentional infringement.

C. The role of AI as a tool for human artists

AI is increasingly being viewed as a collaborative tool for artists:

1. Augmentation: Many artists are using AI to augment their creative process, generating ideas or assisting with technical aspects of creation.
2. New mediums: AI opens up new possibilities for interactive and evolving artworks that can respond to inputs or change over time.
3. Democratization: AI tools can make certain aspects of art creation more accessible to those without traditional artistic training.

D. Economic impact on the art market and creative industries

The integration of AI into the art world is having significant economic implications:

1. New markets: AI-generated art is creating new markets and collectibles, as evidenced by the high-profile sales of AI artworks.
2. Disruption of traditional roles: AI could potentially disrupt roles in creative industries, from graphic design to music composition.

3. Valuation challenges: The art market must grapple with how to value AI-generated works, considering factors like scarcity and provenance in a digital context.
4. Increased productivity: In commercial creative fields, AI could dramatically increase the speed and scale of content production.

These implications are not just theoretical but are already being felt across the art world. For instance, the sale of the AI-generated portrait "Edmond de Belamy" for \$432,500 at Christie's in 2018 marked a pivotal moment, forcing the art world to seriously consider the place of AI in art [11].

As AI continues to evolve and integrate into artistic practices, these implications will likely deepen and expand. The art world faces the challenge of adapting its legal, economic, and philosophical frameworks to accommodate these new forms of creativity while preserving the value and integrity of human artistic expression.

VII. Ethical Considerations

The integration of AI into the creative process raises a number of ethical considerations that challenge our understanding of art, creativity, and the role of the artist in society. These considerations span issues of authenticity, the potential displacement of human artists, and the perpetuation of biases in AI-generated art.

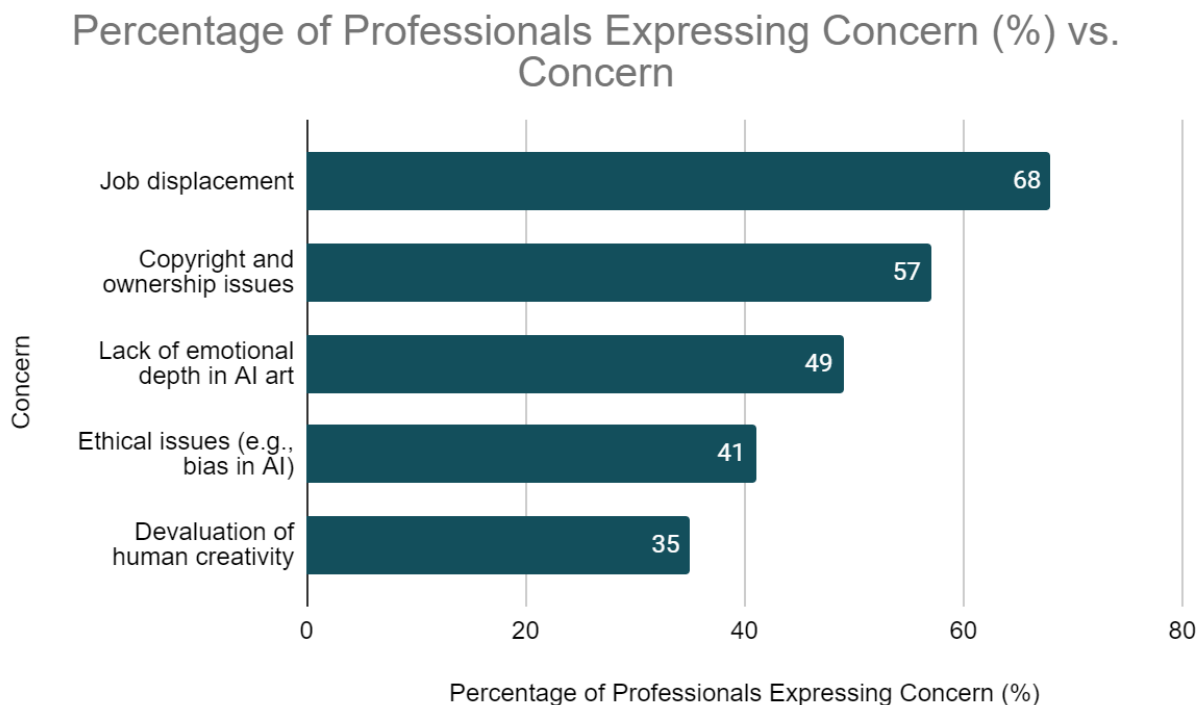


Fig. 2: Concerns About AI in Creative Industries (2020) [10, 13]

A. Authenticity and value of AI-generated art

The question of authenticity in AI-generated art is multifaceted and philosophically complex:

1. Emotional authenticity: Coeckelbergh argues that while AI may lack human-like emotions, this doesn't necessarily preclude it from creating authentic art. The question is whether the emotional response in the viewer, rather than the emotional state of the creator, is what truly matters [12].

2. **Intentionality:** Traditional notions of art often emphasize the artist's intent. With AI, the concept of intentionality becomes distributed among the AI system, its creators, and its users, challenging our understanding of artistic intention.
3. **Originality:** AI models trained on existing artworks raise questions about the nature of originality. Coeckelbergh suggests that all art, human or AI-generated, involves some level of recombination of existing elements [12].
4. **Artistic value:** The art market has traditionally valued originality, scarcity, and human creativity. AI-generated art challenges these value propositions, potentially disrupting established valuation methods and forcing us to reconsider what we value in art.

B. Potential for AI to replace human artists

The increasing sophistication of AI in creative fields has sparked concerns about the potential displacement of human artists:

1. **Job displacement:** In commercial fields like graphic design or music composition, AI could potentially automate certain tasks, leading to job losses.
2. **Democratization vs. devaluation:** While AI tools may democratize art creation, making it accessible to more people, this could potentially devalue the skills and training of professional artists.
3. **Collaborative potential:** Coeckelbergh suggests that rather than replacing human artists, AI is more likely to become a collaborative tool, leading to new forms of human-AI co-created art [12].
4. **Redefinition of artistic skills:** As AI takes over certain technical aspects of art creation, the value of human artists may shift towards conceptual and curatorial skills.

C. Bias and representation in AI-generated art

AI systems, being trained on existing data, can perpetuate and amplify biases present in their training sets:

1. **Cultural bias:** AI trained predominantly on Western art may underrepresent or misrepresent non-Western artistic traditions.
2. **Gender and racial bias:** Biases in the art world regarding gender and race can be reflected and amplified in AI-generated art.
3. **Homogenization:** There's a risk that AI could lead to a homogenization of artistic styles, particularly if a few AI models become dominant in the field.
4. **Representation in datasets:** The choice of data used to train AI models is itself an ethical issue, as it determines whose art and which styles the AI learns from. This ties into broader issues of representation and power in AI systems [13].

These ethical considerations highlight the need for ongoing dialogue between artists, technologists, ethicists, and policymakers. As AI continues to evolve and integrate into the creative process, it's crucial to develop frameworks that can address these ethical challenges while harnessing the potential of AI to expand the boundaries of human creativity.

Potential solutions and areas for future work include:

1. Developing more diverse and representative datasets for training AI models.
2. Creating transparent AI systems that can explain their creative decisions.
3. Establishing clear guidelines for the attribution and ownership of AI-generated art.
4. Fostering interdisciplinary collaboration to ensure that the development of AI in art is guided by diverse perspectives.

As we navigate these complex ethical territories, it's clear that the integration of AI into art will continue to challenge our conceptions of creativity, authorship, and the very nature of art itself. As Coeckelbergh

suggests, this may lead us to a more inclusive understanding of art and creativity, one that recognizes the potential for meaningful artistic expression in various forms of human-AI collaboration [12].

Consideration	Description	Potential Impact
Authenticity	Questions about the emotional depth and intentionality of AI art	Challenges traditional notions of artistic value
Authorship	Unclear attribution of AI-generated works	Legal and ethical implications for copyright
Bias	AI systems may perpetuate cultural, gender, or racial biases	Potential for misrepresentation in AI-generated art
Artist Displacement	AI could automate certain creative tasks	Potential job losses in creative industries

Table 2: Ethical Considerations in AI Art [12, 13]

VIII. Future Prospects

As AI continues to evolve and integrate into creative processes, the future of art and creativity promises to be both exciting and challenging. This section explores potential advancements in AI art technologies, the growing potential for human-AI collaboration, and the emergence of new forms of creative expression enabled by AI.

A. Advancements in AI art technologies

The rapid pace of AI development suggests several potential advancements in AI art technologies:

1. More sophisticated generative models: Future AI models may be able to generate increasingly complex and nuanced artworks across various mediums.
2. Enhanced understanding of aesthetics: AI systems may develop a more profound "understanding" of aesthetic principles, potentially leading to more sophisticated and culturally aware art generation.
3. Improved interaction with physical mediums: Advancements in robotics and AI could lead to AI systems that can create physical artworks, expanding beyond digital creations.
4. Personalized art generation: AI models might become capable of creating art tailored to individual preferences and experiences, potentially revolutionizing personalized art and design.

B. Potential for human-AI collaboration in art

The future of AI in art is likely to be characterized by increased collaboration between human artists and AI systems:

1. AI as a creative partner: Artists may increasingly view AI as a collaborative tool, using it to explore new ideas and push the boundaries of their creativity.
2. Interactive AI art systems: We may see the development of more sophisticated interactive systems where human input guides AI art creation in real-time.
3. AI-assisted curation and critique: AI could play a growing role in art curation and criticism, helping to analyze and contextualize artworks within broader artistic movements and cultural contexts.

4. Hybrid art forms: New art forms may emerge that seamlessly blend human and AI contributions, challenging traditional notions of authorship and artistic process.

C. New forms of creative expression enabled by AI

AI is poised to enable entirely new forms of creative expression:

1. Dynamic and evolving artworks: AI could create art that changes over time, responding to data inputs or viewer interactions.
2. Multi-sensory art experiences: By integrating various technologies, AI might create immersive, multi-sensory art experiences that go beyond visual or auditory stimuli.
3. Personalized narrative experiences: In literature and interactive media, AI could generate personalized stories or game experiences that adapt to individual users.
4. AI-human improvisation: In performing arts, we might see real-time collaborations between human performers and AI systems, creating unique, improvised performances.
5. Data-driven art: AI could transform complex datasets into visual or auditory artworks, offering new ways to perceive and interact with information.

These advancements and possibilities suggest a future where the boundaries between human and machine creativity become increasingly blurred. As Ramesh et al. note in their work on DALL·E 2, an advanced AI system for generating and editing images, these technologies are rapidly advancing and have the potential to significantly impact creative workflows across various domains [14].

However, this future also presents challenges. As AI becomes more integral to the creative process, questions of authorship, originality, and the value of human creativity will continue to be debated. There will likely be an ongoing need to balance the potential of AI with the preservation of human artistic expression and cultural diversity.

Moreover, as these technologies advance, there will be an increased need for interdisciplinary collaboration between artists, technologists, ethicists, and policymakers to ensure that the development of AI in art is guided by diverse perspectives and ethical considerations.

IX. Conclusion

The integration of Artificial Intelligence into the realm of art and creativity represents a paradigm shift that is reshaping our understanding of creative processes, authorship, and the nature of art itself. Throughout this exploration, we have witnessed AI's transformative impact across various creative domains, from visual arts and music to literature and beyond. While AI demonstrates remarkable capabilities in generating novel and aesthetically pleasing works, it also raises profound questions about authenticity, originality, and the role of human artists in an increasingly automated world. The ethical considerations surrounding AI-generated art, including issues of bias, representation, and the potential displacement of human artists, underscore the need for careful reflection and interdisciplinary dialogue as we navigate this new frontier. Looking ahead, the future of AI in art promises exciting possibilities for human-AI collaboration, personalized creative experiences, and entirely new forms of artistic expression. However, realizing this potential will require a delicate balance between embracing technological advancements and preserving the unique value of human creativity and cultural diversity. As AI continues to evolve, it is clear that the art world must adapt, not only in its creative practices but also in its legal, economic, and philosophical frameworks. Ultimately, the story of AI in art and creativity is not one of replacement, but of expansion – expanding the boundaries of what we consider possible in creative expression and challenging us to reconsider the very essence of creativity itself.

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