From Imitation to Innovation: The Emergence of AI's Unique Artistic Styles and the Challenge of Copyright Protection
Appendix

A. Real Case Studies on AI-Generated Content Infringement

The proliferation of AI-generated content (AIGC) across various domains has raised significant legal and ethical concerns regarding copyright infringement. Global cases have emerged that highlight the complexities in defining ownership, originality, and liability when AI systems are involved. This section presents notable cases from different countries and cities, illustrating the widespread nature of copyright disputes in the context of AIGC.

Getty Images vs. Stability AI (New York, USA): In January 2023, Getty Images filed a lawsuit against Stability AI, creators of the AI model Stable Diffusion. Getty alleged that Stability AI used millions of its copyrighted images without permission to train the model, resulting in outputs that closely resemble Getty's watermarked images or generate synthetic images infringing on its intellectual property rights. Stability AI argued that their model learns abstract patterns and does not store or reproduce copyrighted images directly. *Significance*: This case questions the legality of using copyrighted materials for AI training and whether the outputs constitute derivative works under U.S. copyright law.

Artists vs. Stability AI, Midjourney, and DeviantArt (San Francisco, USA): In November 2022, a group of artists initiated a class-action lawsuit against AI platforms Stability AI, Midjourney, and DeviantArt, claiming that their models infringed upon copyrights by using artists' works without consent for training. The plaintiffs argued that each generated image is effectively a derivative of their creations. In July 2023, the court dismissed the claims, noting the plaintiffs failed to demonstrate "substantial similarity" between their works and the AI outputs. *Significance*: This case underscores the challenges of proving infringement when AI-generated images do not directly replicate specific copyrighted works, highlighting nuances in determining substantial similarity with AI.

The New York Times vs. OpenAI (New York City, USA): In August 2023, *The New York Times* considered legal action against OpenAI, alleging that ChatGPT generates text that includes verbatim excerpts from its articles without authorization. The dispute centers on whether the AI's outputs infringe on the newspaper's copyrights and the impact on its intellectual property rights. *Significance*: This case highlights tensions between AI-generated content and traditional copyright protections, particularly concerning language models reproducing portions of copyrighted text.

Tencent Holdings Ltd. vs. Shenzhen Yunsilu Technology Co., Ltd. (Guangzhou, China): In October 2023, the Guangzhou Internet Court heard a case where Tencent sued Shenzhen Yunsilu Technology, operator of an AI image-generation platform. Tencent alleged that the platform produced images resembling the "Ultraman" character, to which Tencent holds exclusive rights in China. The court found the platform failed to prevent infringing content and ordered it to pay RMB 10,000 in damages. *Significance*: This case sets a precedent in China, holding AI service providers responsible for infringing content generated on their platforms and emphasizing the need for proactive safeguards against copyright violations.

Ms. Wang vs. Hubei Huaqiang Advertising Co., Ltd. (Wuhan, China): In September 2023, Ms. Wang sued Hubei Huaqiang Advertising for using her AI-generated artwork in promotional materials without permission. The Wuhan Intermediate People's Court recognized the originality of the work, noting Ms. Wang's significant contribution through iterative adjustments. The court ruled in her favor, awarding RMB 4,000 in damages. *Significance*: This case affirms that AI-generated content can be protected under Chinese copyright law if it reflects human creativity and sufficient originality through user input and control.

Lin Chen vs. Shanghai Xinyue Cultural Media Co., Ltd. (Shanghai, China): In August 2023, Lin Chen discovered that his AI-generated artwork "Ban Xin" was used in a commercial installation without authorization. The Shanghai Intellectual Property Court ruled that unauthorized use of the 2D image infringed his copyright, but the 3D adaptation did not constitute infringement due to insufficient replication evidence. The defendants were ordered to pay RMB 10,000. *Significance*: This case highlights complexities in protecting AI-generated content, especially

when adaptations across formats are involved, emphasizing challenges in enforcing rights over derivative works.

Beijing Internet Court's "Spring Breeze" Case (Beijing, China): In July 2023, the Beijing Internet Court presided over China's first AIGC copyright infringement case involving the image "Spring Breeze." The court concluded the image qualified for copyright protection due to originality from specific inputs and adjustments. The defendant was ordered to pay RMB 500. *Significance*: This case set a legal precedent by recognizing AI-generated works as protectable under copyright law when there is clear evidence of human intellectual contribution.

These cases demonstrate several critical legal and ethical issues arising from AIGC proliferation. The legality of using copyrighted materials for AI training, as seen in the Getty Images case, raises questions about the need for explicit consent versus fair use provisions. Courts are assessing the level of human involvement to determine if AI outputs meet originality requirements for copyright protection. Service providers may be held liable for infringement if they fail to prevent infringing content generation and dissemination. Determining whether AI-generated content constitutes derivative works is a complex issue that courts are beginning to address. Ethical concerns about exploiting artists' styles and posthumous rights emphasize the need for responsible AI use.

B. Application of *ArtBulb* in Real Legal Case

B.1. Testing by legal professionals

To address the complex challenges of copyright infringement in AI-generated content (AIGC), we developed *ArtBulb*, an automated framework designed to assist creators and legal professionals in identifying and evaluating potential infringement cases involving AIGC. *ArtBulb* leverages advanced AI technologies to bridge the gap between technical complexities and legal analysis, providing a comprehensive tool for copyright protection in the digital age.

We selected 19 AI-generated images associated with the notable legal cases discussed earlier. These images were chosen for their relevance in illustrating various infringement scenarios within AIGC. Utilizing advanced generative models and GPT-based text processing, we expanded upon these images by generating detailed textual descriptions and metadata to contextualize each one. Additionally, we created variations of the images to simulate potential infringement scenarios, enabling a robust analysis of different infringement possibilities. As shown in Figure 1, by thoroughly examining the creative processes behind each image, we assessed the degree of human involvement and the originality inherent in the works.

For each of these 19 images, *ArtBulb* generated comprehensive judgment reports. These reports included detailed assessments of originality and creativity, identification of any potential similarities with existing copyrighted works, and analyses of legal implications based on current copyright laws and relevant precedents. Practical recommendations for compliance were also provided, offering guidance on addressing identified issues and mitigating potential legal risks.

To evaluate the utility and accessibility of *ArtBulb*, we presented the generated judgment reports to a group of five legal practitioners who had no prior experience with AI technologies. They were asked to evaluate the reports based on several criteria: clarity, comprehensiveness, practicality, and accuracy. The feedback was overwhelmingly positive, with the practitioners expressing high levels of satisfaction and assigning an average rating of 4.5 out of 5. Key feedback highlighted:

- **User-Friendly Interface**: The interface was intuitive, allowing for easy navigation and accessibility, which facilitated their review process.
- **Clear Language**: The reports were written in straightforward language, making complex technical and legal concepts accessible and understandable.
- **Detailed Analysis**: The inclusion of legal references and comparisons with existing cases provided valuable context and depth to the analysis.
- **Actionable Recommendations**: The practical suggestions offered in the reports aided in informed decision-making and could be directly applied in legal practice.

Participants collectively noted that *ArtBulb* effectively bridges the gap between advanced AI technology and legal analysis. By presenting information in an accessible format, *ArtBulb* enabled them to comprehend and assess AI-related infringement cases without the need for specialized technical knowledge. This capacity to demystify technical complexities while providing actionable legal insights was particularly valued by the practitioners.

B.2. Impact and Significance

The deployment of *ArtBulb* demonstrates social and legal value by integrating AI technologies into the realm of copyright protection. It serves as a crucial bridge between the rapidly advancing field of AI-generated content and existing legal frameworks, facilitating a better understanding and application of copyright laws in the context of AI. By automating the initial evaluation of potential infringement cases, *ArtBulb* enhances efficiency, reducing the time and resources required for comprehensive legal analysis.

Moreover, *ArtBulb* promotes compliance by providing creators and platforms with clear guidelines and practical recommendations to adhere to copyright laws, thereby reducing the risk of inadvertent infringement. It supports policy development by offering insights and data that can inform lawmakers in crafting regulations that balance innova-

tion with intellectual property rights. By raising awareness about the importance of copyright protection in the AI era, *ArtBulb* encourages responsible AI use and fosters a more legally compliant creative industry.

C. Legal Perspectives on AI-Generated Artworks and Copyright

Artificial Intelligence Generated Content (AIGC) is transforming traditional content creation, particularly in AI-generated art. This development raises crucial legal questions: Does using AI in artistic creation pose infringement risks or other legal challenges? Under what conditions can AI-generated works attain copyright protection, and how can creators navigate these complex legal landscapes?

Under current copyright laws, protection is granted to original works in literary, artistic, and scientific domains that are expressed in tangible form. The key criteria include:

- **Originality**: Independently created with a minimal degree of creativity.
- **Expressed Form**: Fixed in a tangible medium.
- **Human Intellectual Effort**: Resulting from human intellectual endeavor.

AI-generated content challenges traditional notions of authorship and originality, leading to legal debates globally. In China, judicial practices vary on whether AI-generated content qualifies as a "work" under the Copyright Law. Recent cases illustrate differing perspectives:

- In case ((2019) Jing 73 Min Zhong No. 2030) [1], a court held that a report generated by software did not constitute a "work" since it was not created by a natural person.
- In case ((2019) Yue 0305 Min Chu No. 14010) [2], a court recognized an article generated by Tencent's *Dreamwriter* as a "work" eligible for copyright protection.
- In case ((2023) Jing 0491 Min Chu No. 11279) [3], the court concluded that AI-generated images meeting originality requirements and reflecting human intellectual input can be considered "works" and receive copyright protection.

These cases suggest that AI-generated content with significant aesthetic value and personalized arrangement is more likely to be protected.

We propose that AI-generated artworks should meet three essential criteria to qualify for copyright protection:

- **Uniqueness**: The artwork must exhibit a style distinct from existing human artists, ensuring originality and preventing infringement.
- **Consistency**: The style should remain consistent across multiple works, indicating a coherent artistic expression attributable to a specific source, supporting claims of authorship.

- **Accuracy**: The artwork should accurately reflect the creator's input prompts, demonstrating human intellectual contribution and intent.

By adhering to these criteria, AI-generated artworks align with established legal standards, fulfilling requirements of originality, expression, and human intellectual effort. Potential legal risks include unintentional replication due to training data leading to infringement claims, the necessity of complying with AI platform terms regarding ownership and licensing, and the need to avoid violating third-party rights related to likenesses, privacy, or trademarks.

Ensuring that AI-generated artworks meet the criteria of uniqueness, consistency, and accuracy allows creators to align their works with copyright laws, securing legal protection while respecting the rights of original creators.

D. Details of ArtBulb

D.1. Data Processing Pipeline of ArtBulb

As shown in Figure 2, *ArtBulb* employs a data processing pipeline to evaluate potential copyright infringements in AI generated content (AIGC). This pipeline integrates prompt engineering, feature extraction using pre-trained CLIP models, a trained adapter, clustering analysis, and multimodal understanding to assess the originality and legality of AI generated artworks.

Initially, the system performs prompt based entity replacement and sample generation. It starts with the original prompts used to generate the AI artworks and systematically replaces specific entities to create modified prompts. These replacements maintain the thematic and stylistic intent while introducing variability. The modified prompts are input into the same generative AI model to ensure comparability of the resulting artworks. This process creates an augmented dataset of AI generated samples, providing a broader representation of the AI model's creative capabilities and enhancing the robustness of subsequent evaluations.

Next, the expanded collection undergoes feature extraction and clustering analysis. We use the pre-trained CLIP's text encoder and visual encoder to separately extract features from the prompts and the generated artworks. The visual encoder processes each artwork to capture visual attributes like color distributions, textures, shapes, and stylistic nuances, while the text encoder extracts semantic representations from the corresponding prompts. The extracted features are then passed through our trained adapter, which is trained using description guided clustering. This adapter refines the features by aligning the visual and textual representations based on descriptive guidance, enhancing the clustering process by emphasizing relevant stylistic and semantic relationships.

Clustering algorithms group the AI generated samples

ARTBULB Report

Clustering analysis reveals the generated image fails to demonstrate originality (average distance from Erin Hanson's works: 0.142 < threshold), indicating potential copyright infringement:

- **Color Application:** Both images use strikingly similar vibrant color palettes. Intense reds, yellows, and purples are applied in nearly identical combinations to depict trees and ground elements. This duplication of color selection and coordination—key expressive elements—shows a lack of unique color creativity.
- **Brushstroke Techniques:** The brushstroke styles are materially identical. Both adopt blocky, textured brushwork to render tree foliage, trunks, and ground patterns. Such replication of technical expression undermines the claim to unique artistic technique.
- **Compositional Structure:** The arrangement of trees (central tree with surrounding clusters), scene perspective, and spatial element distribution in the right image mirror the left one's compositional design. This structural similarity proves no unique compositional innovation.

Conclusion: Due to the absence of uniqueness in color, brushstrokes, and composition, core copyright-protected elements, the generate image infringes the Erin Hanson's image's copyright.

Figure 1. This image depicts a real-world copyright infringement case analysis where American artist Erin Hanson accused Midjourney of generating works that violated her artistic style. Using our proposed ArtBulb, this report visually compares Hanson's original paintings (left) with Midjourney's AI-generated artworks (right), systematically highlighting stylistic similarities in composition, color palettes, and brushwork to demonstrate potential infringement.

based on the similarities in their adapted features. One generated artwork is selected as a representative to serve as a new cluster center in the feature space. Concurrently, a curated dataset of human created artworks, categorized by artists and styles, is processed through the same procedures using the visual encoder and the adapter. This allows direct comparison between AI generated artworks and human art styles within a unified and refined feature space.

Based on the clustering outcomes, a quantitative style assessment evaluates the AI artist's style against three criteria: consistency, uniqueness, and accuracy in reflecting the intended prompts. Consistency is measured by analyzing the cohesion of the AI generated samples within their cluster; the degree of shared stylistic features indicates the AI model's ability to produce a coherent style. Uniqueness is assessed by examining the distances between the AI gen-

erated cluster and clusters of human artists' works; significant separation suggests the AI style is distinct, reducing infringement risks. Accuracy in reflecting the prompts is evaluated by correlating the visual features of the artworks with the semantic features extracted from the prompts, ensuring alignment with the user's intentions.

Finally, the results from feature extraction and clustering, including the AI generated artworks, cluster characteristics, and similarities or distinctions with human art clusters, are input into Multimodal Large Language Models (MLLMs) such as GPT-4 and Qwen-VL. These models process visual and textual data, enabling comprehensive analysis in a legal context. Using chain of thought reasoning, the MLLMs interpret the technical findings, verify the assessments, and relate them to relevant copyright laws and precedents. They generate detailed reports with interpre-
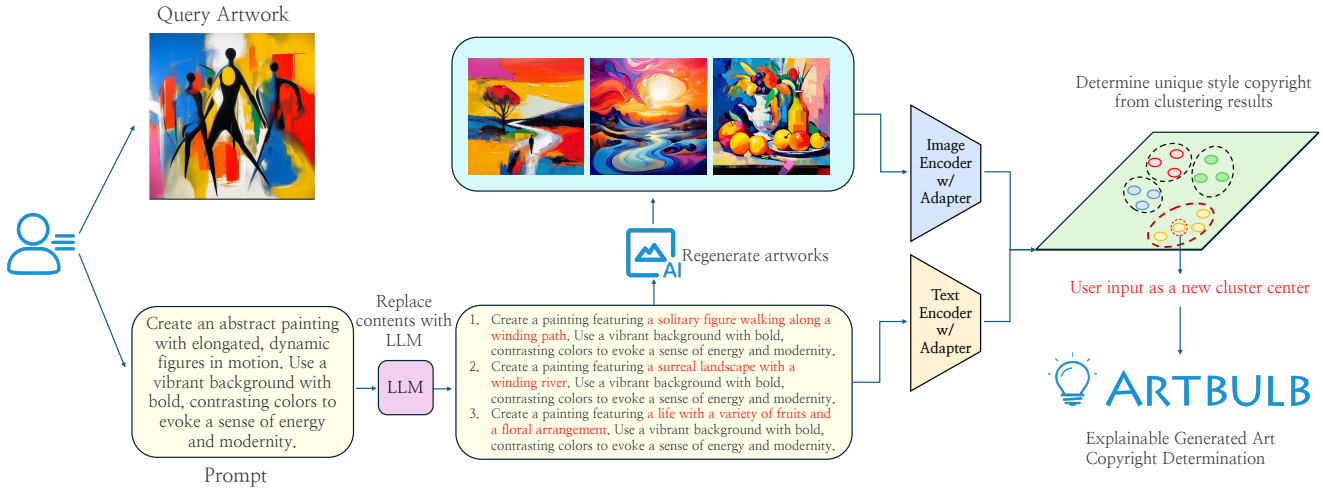
Figure 2. User inputs image and prompt to verify unique style and avoid copyright issues, with the copyright database continuously updated with AI-generated works.

tations of stylistic similarities, assessments of originality, potential infringement risks, and practical compliance recommendations.

Through this pipeline, *ArtBulb* transforms complex technical analyses into accessible legal insights. By augmenting data, extracting features using pre-trained CLIP models and a trained adapter, conducting clustering analysis, and leveraging language models for interpretation, the framework provides a thorough evaluation of AI generated artworks from artistic and legal perspectives. This approach aids in detecting potential copyright infringements and supports creators and legal professionals.

D.2. prompting

Our use of *ArtBulb* with the following prompt template:

You are an expert in artistic style analysis, skilled at extracting key features from given images and prompts, and generating structured analysis reports. Your task is as follows:

Input

- **Collection of AI-Generated Images to be Evaluated**: Images generated using the original prompts, which need to be assessed for potential copyright infringement.
- **Augmented Collection of AI-Generated Images**: Additional images generated by performing entity replacements and transformations on the original prompts, aiming to enrich the AI model's creative expressions and enhance the comprehensiveness of the evaluation.
- **Collection of Potentially Infringing Reference Images**: Images found from human artists' works via clustering algorithms that are most similar in style to the AI-generated

images.
- **Collection of Corresponding Prompts**: The prompts used to generate the above images, including the original prompts and the modified prompts.

Task

Based on the above input, please generate a structured analysis report that includes:

1. **Accuracy Analysis**:
   Evaluate the degree of matching between the AI-generated images and their corresponding prompts. Determine whether the image content accurately reflects the descriptions and intentions of the prompts. Provide examples illustrating the correspondences between images and prompts.

2. **Consistency Analysis**:
   Analyze the stylistic consistency within the collection of AI-generated images. Assess whether the AI model maintains unified stylistic features during generation, such as color schemes, composition, and brushstrokes. Provide specific feature descriptions to support the analysis.

3. **Uniqueness Analysis**:
   Compare the stylistic features of the AI-generated images with those of human artists' works. Evaluate whether the style of the AI-generated images is unique or highly similar to the works of specific artists. Analyze potential infringement risks.

4. **Comparison with the Most Similar Copyrighted Images**:
   List the potentially infringing reference images found via clustering algorithms. For each pair of AI-generated

image and reference image, analyze the similarities and differences in detail. Use image features (such as theme, style, composition) for comparison. Provide visual examples to support the analysis.

5. **Conclusion and Recommendations**:
Summarize the analyses above to provide a conclusion on whether there is a risk of copyright infringement. Provide practical compliance recommendations to help creators avoid potential copyright issues.

Output Format

Please provide the analysis report following the structure below:

- **Abstract**:
Briefly summarize the main findings and conclusions of the analysis.
- **1. Accuracy Analysis**:
Describe the method used to evaluate accuracy. Elaborate on the correspondence between images and prompts. Provide specific examples to support the analysis.
- **2. Consistency Analysis**:
Describe the method used to evaluate consistency. Elaborate on the stylistic consistency within the image collection. List specific stylistic features supporting the analysis.
- **3. Uniqueness Analysis**:
Describe the method used to evaluate uniqueness. Provide detailed comparisons of the stylistic features between AI-generated images and human artists' works. Discuss potential infringement risks.
- **4. Comparison with the Most Similar Copyrighted Images**:
Describe the standards and methods used for image comparison. Analyze the similarities and differences between each pair of AI-generated image and reference image. Provide images or diagrams to support the analysis, if possible.
- **5. Conclusion and Recommendations**:
Summarize the analysis results and clarify whether there is a risk of infringement. Provide practical compliance suggestions, such as modification advice and measures to avoid infringement.

Notes

- The report should use professional and objective language, avoiding subjective bias.
- Ensure the content is clear and well-structured for ease of understanding.
- All analyses should be supported by facts and data, avoiding unfounded speculations.
- Comply with relevant laws and regulations, avoiding inappropriate or infringing content.

E. Limitations

Despite offering a new perspective on artistic style infringement, our research has several limitations.

Firstly, determining artistic style is inherently subjective. Although we propose the *Description Guided Clustering* (DGC) method to objectively define and identify artistic styles, style itself is a complex, multidimensional concept. Different viewers may interpret the same artwork's style differently. Our method extracts and analyzes stylistic features but cannot completely eliminate subjective influences.

Secondly, we construct a dataset comprising works from multiple artists, encompassing various art genres and historical periods to reflect artistic diversity. However, due to the vastness of the art field, our dataset is limited and cannot include all art forms and styles. Consequently, certain artists with unique styles may not be represented, possibly leading to biases in evaluating the uniqueness of AI-generated artworks. If representative works of specific styles are absent, our method may overestimate or underestimate the similarity between AI-generated works and existing styles.

Thirdly, laws and regulations regarding copyright and AI-generated works vary across countries and continuously evolve. Our method is based on current legal frameworks and precedents, but applicable standards may differ in other jurisdictions. Legal updates may affect our method's applicability, necessitating ongoing monitoring and adjustments.

Furthermore, our method relies on existing text-to-image generation models and publicly available AI-generated artworks for analysis. Technological advancements may introduce sophisticated models or techniques that enable plagiarists to imitate specific artists' styles more precisely, such as through deep fine tuning. In such cases, our method may face new challenges, requiring further research and improvement to address these threats.

Lastly, our style recognition and clustering methods have limitations. Although the DGC method enhances clustering accuracy, it cannot guarantee comprehensive label recall, which is a common challenge among image annotation tools. We advise users to consider our analysis as an auxiliary tool for relative assessment rather than an absolute standard. As image annotation and style recognition technologies advance, our method requires continuous updates and optimizations.

In conclusion, we acknowledge these limitations stemming from the complexity of artistic styles and the dynamic changes in technological and legal environments. We aim to expand and refine our dataset, enhance our models' robustness and accuracy, and closely monitor legal developments to improve our method's practicality and generalizability.

References

[1] Ju Yoen Lee. Artificial intelligence cases in china: Feilin v. baidu and tencent shenzhen v. shanghai yingxin. *China and WTO Review*, 7(1):211–222, 2021. 3

[2] 3 Regulations for the Implementation of the Copyright Law of the People's Republic of China, Arts. 2. "tencent dreamwriter" decision of the people's court of nanshan (district of shenzhen) 24 december 2019–case no.(2019) yue 0305 min chu no. 14010, 2020. 3

[3] Meilin Wen. On the copyright analysis of artificial intelligence products. *Lecture Notes in Education Psychology and Public Media*, 53:133–140, 2024. 3