



Copyright Risk Analysis and Mitigation Strategies for AI-Generated Content (AIGC) Works

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Abstract. The exponential growth of AI-Generated Content (AIGC) technology is awe-inspiring, yet this revolutionary innovation poses significant challenges to established legal frameworks. The swift proliferation of the AIGC market has precipitated an increase in copyright infringements, encompassing violations of reproduction rights, adaptation rights, network information dissemination rights, modification rights, and the right to preserve work integrity. These infringements have emerged as primary obstacles to the sustainable and healthy development of the AIGC industry. This paper aims to address these issues by first elucidating the operational mechanisms of AIGC (focusing on the GAN generative model), subsequently analyzing the copyright risks associated with AIGC works, and ultimately proposing risk mitigation strategies and legal framework enhancements.

Keywords: AI-Generated Content · Generative Adversarial Networks · Copyright Law · Infringement

The unveiling of OpenAI's video generation model Sora on February 16, 2024, has catapulted AI-Generated Content (AIGC) into the spotlight of contemporary discourse. In response to the rapid advancements in AIGC, China has promulgated departmental regulations, including the "Provisions on the Ecological Governance of Network Information Content" and the "Interim Measures for the Administration of Generative Artificial Intelligence Services" (henceforth "AIGC Measures"). However, these regulations predominantly fall within the purview of administrative oversight (i.e., public law domain) and do not offer comprehensive provisions or measures addressing the copyright issues and legal risks inherent to AIGC works. To bridge this gap, this paper will, following a concise overview of AIGC's operational mechanisms, conduct an in-depth analysis of the copyright risks associated with AIGC works and propose targeted risk mitigation strategies.

1 Overview of AIGC

1.1 Definition

The “Interim Measures for the Administration of Generative Artificial Intelligence Services” (henceforth “AIGC Measures”) in China, specifically Article 2, delineates AIGC as “services that employ generative artificial intelligence technology to furnish the public with content encompassing text, images, audio, and video.” This definition allows us to classify the outputs of artificial intelligence-driven creation as “AIGC works,” which encompass AI-generated textual, visual, auditory, and video content. AIGC works, produced by computer systems through machine learning algorithms and extensive data training, emulate and build upon existing artistic styles and techniques. These works bridge the domains of computer science and artistic creation, aiming to imbue computational systems with creative and expressive capabilities, thereby offering audiences novel experiences and innovative forms of artistic expression.

1.2 Operating Principle

AIGC predominantly employs Generative Adversarial Networks (GANs) as its operational framework. As illustrated in Fig. 1, a GAN is an advanced artificial intelligence algorithm capable of autonomously generating novel data, such as images and audio. Upon receiving fundamental input parameters (e.g., style, color), it can produce entirely original and distinctive works. GANs effectively “instruct” computational systems in the creation of high-fidelity, remarkably lifelike outputs. The GAN architecture comprises two primary components: the Generator network and the Discriminator network. The Generator’s role is to fabricate new works, process input data, and attempt to create outputs that align with this input. Conversely, the Discriminator network evaluates the similarity between these newly generated works and authentic creations. Through persistent “adversarial” interaction, these networks collaboratively refine the Generator’s ability to produce high-caliber works that incrementally approach human-level creative output.

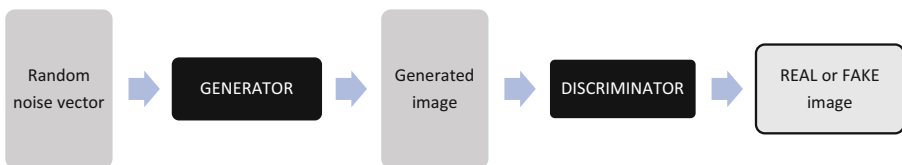


Fig. 1. GAN input-output overview

The operation process of AIGC encompasses three principal phases: input, learning, and output. The initial input phase involves AI algorithm model developers employing web crawlers and similar tools to amass and extract billions of works from the internet. Concurrently, they construct a comprehensive database requisite for deep learning by meticulously screening, categorizing, and annotating the prospective input works.

It is noteworthy that both the quantitative volume and qualitative aspects of the input works significantly influence the caliber of the generated content. Fundamentally, during this input phase, AI algorithm model developers must “feed” an extensive array of training samples (works) into the AI algorithm model for learning purposes. This process is complemented by iterative refinement through the adjustment of algorithms and parameters.

The second phase, encompassing the deep learning process, operates on principles analogous to human cognitive processes. The AI algorithm model initially dissects and processes the training samples, extracting and synthesizing patterns in pixel value arrangements. Subsequently, it leverages these identified patterns to generate novel images. AI algorithm model developers then undertake a verification process of the generated images, offering critical feedback. In response, the AI algorithm model recalibrates its synthesized patterns based on this developer input, proceeding to generate a fresh set of images utilizing these refined patterns. This iterative cycle persists until the AI-generated images satisfy the developer’s criteria, at which juncture the AI algorithm model can be deemed to have successfully assimilated the pertinent generative patterns.

The third stage is content output, where AIGC users initially articulate their creative requirements through prompts or reference images and text, inputting these into the AIGC tool. Concurrently, they configure various parameters, including sampling iteration steps and prompt relevance. Subsequently, the AI algorithm model conducts a search for pertinent images and text based on the user’s input. It then applies the patterns acquired during the deep learning phase to analyze and process this data, ultimately generating multiple content options that align with the specified requirements. The AIGC user then exercises discretion in selecting their preferred works from among these generated outputs.

Taking AI painting as an example, the initial phase involves the AI assimilating the correlation between “linguistic descriptions” and “artistic visual representations” from an extensive corpus of image and textual data. Subsequently, when a user provides a linguistic description of their envisioned new artwork, the AI activates its acquired knowledge and capabilities to endeavor to create a piece aligning with the user’s specifications. This creative process potentially traverses hundreds of iterative refinement cycles, each meticulously evaluating the congruence between the draft and the linguistic description, thereby progressively aligning the final rendition more closely with the input linguistic description. Through this iterative refinement process, the AI’s compositional logic becomes increasingly refined, ultimately culminating in a finished product that demonstrates high congruence with human aesthetic experiences and knowledge.

2 Examination of Copyright Risks Associated with AIGC Works

2.1 Vulnerability to Lack of Copyright Protection

A contentious issue in the field of AIGC is whether the outputs produced by users through prompts in the final stage (output) qualify as “works” under copyright law. This matter remains subject to significant debate. One perspective posits that AIGC works, being machine-generated, lack the requisite human subjective consciousness and creativity, thereby disqualifying them from copyright protection [1]. Conversely, another

viewpoint argues that the process of creating AIGC works inherently involves human intellect, encompassing the contributions of programmers and data scientists, and should consequently be afforded copyright protection [2].

2.2 Challenges in Copyright Acquisition

Assuming AIGC works are acknowledged as copyrightable works, it is crucial to note that AI, lacking legal personhood, cannot be a copyright holder. Only the “human” behind the AI output can claim copyright ownership. However, the question of who precisely should hold this copyright remains highly contentious [3]. One school of thought posits that copyright should vest in the developers of the AI model. This argument stems from the fact that AIGC emerges from a process of data input, AI learning, and work output. Moreover, current AI models lack genuine cognitive and creative capabilities (i.e., they cannot produce works solely through independent algorithms) and instead operate according to the programmed intentions of their developers. An alternative perspective suggests that AIGC copyright should belong to the AI users. This view is predicated on the notion that the output of AI works bears little relation to the developers and instead predominantly reflects the individual creative ideas of the users. To obtain outputs aligning with their psychological expectations, users must continually refine keywords and select optimal results.

2.3 Vulnerabilities to Copyright Infringement

The inherent high similarity and replicability of AIGC works render the determination of copyright infringement in this domain a particularly intricate matter [4]. To illustrate, AI-generated paintings are susceptible to the following copyright infringement risks.

Initially, the input phase necessitates the harvesting of an enormous volume of images to “feed” the algorithmic model. This process invariably encompasses works under copyright protection, including widely recognized cartoon characters (e.g., Ultraman, Mickey Mouse, Spider-Man). These works fall within the protective scope delineated in Article 3 of China’s Copyright Law. In accordance with Article 10 of the same law, copyright holders of these works are legally entitled to rights of publication, reproduction, adaptation, and dissemination via information networks. The process of inputting images into the AI algorithm model entails digital processing of image information and characteristics (aimed at converting them into a standard format comprehensible to the AI algorithm model). This process inherently involves replication of the original images’ information and features, potentially constituting copyright infringement of the original works.

Secondly, during the learning phase, the AI algorithm model must employ machine translation to convert image information into machine-readable format, a crucial step in transforming the vast image dataset into training material for the algorithmic model. Consequently, the images utilized in the learning phase are derivatives of the input images; thus, if the latter infringes copyright, the former inherently constitutes infringement. However, a pertinent question arises: if the input material is non-infringing, does the processing during the learning phase still pose a risk of copyright infringement? The operational principle of AI algorithm model learning involves innumerable iterations

of copying, simulating, and re-copying input image data, during which the input image data exists in a transient state [5]. In light of this, the U.S. Federal Second Circuit Court of Appeals, in *Cartoon Network LP, LLLP v. CSC Holdings, Inc.*, ruled that transient copying per se does not constitute copying as defined by copyright law, and therefore does not infringe upon the right of reproduction. Conversely, non-transient copying does constitute infringement as it fulfills the requisite elements of violating the right of reproduction.

Thirdly, during the output phase, if the generated works bear substantial similarity to the image works supplied in the input phase, they may potentially infringe upon the copyright of the original works. In the event such infringement is established, a critical question arises: should liability be ascribed to the AI algorithm model developers or AI painting operators? Presently, the Chinese judicial system offers pertinent precedents for consideration. In case No. (2024) Yue 0192 Min Chu 113, the Guangzhou Internet Court adjudicated that an AI painting operator, by generating content incorporating Ultraman copyright elements, infringed upon the reproduction and adaptation rights of the original Ultraman work. Consequently, the court mandated the operator to cease the infringement and assume civil liabilities, including compensation for damages incurred.

3 Copyright Attribution for AIGC Works

3.1 Assessing Copyrightability

The foundational step in determining the copyright status of AIGC works is to establish whether they qualify as “works” as defined by Copyright Law. This qualification hinges on three essential characteristics: they must be creative intellectual achievements, capable of expression in a tangible form, and possess originality [6]. Considering the current operational paradigm of AIGC (which involves creating final works by extracting requisite data after crawling extensive databases and analyzing work logic), it is imperative to differentiate copyright eligibility based on the varied methodologies of AIGC production [7].

Primarily, AIGC works autonomously generated by AI models through keyword descriptions, or complete works produced by feeding AI models with self-drafted manuscripts, should align with the definition of “works” under the Copyright Law and consequently warrant copyright protection. This assertion is predicated on the premise that the generation of these works (particularly in the selection of keywords and style) is contingent upon users engaging in personalized cognitive processes. Such works, emanating from the creator’s intellectual faculties, inherently possess originality and minimally fulfill the creativity criteria stipulated by the Copyright Law for works. In essence, if the AI model serves merely as a tool, the resultant AIGC works represent the intellectual labor product of the user and should, therefore, be afforded copyright protection. A recent landmark ruling by the Beijing Internet Court on an AI painting copyright infringement dispute has set a precedent as China’s first case addressing copyright infringement of AI-generated images. Pertaining to the question of whether such creations constitute “works”, the Beijing Internet Court, in case No. (2023) Jing 0491

Min Chu 11279, emphasized two critical elements of AI-generated paintings: “intellectual achievement” and “originality”. Based on these criteria, the court concluded that AI-generated paintings qualify as works and should be safeguarded under copyright law.

Conversely, AIGC works produced through the simple act of inputting others’ works into AI models via one-click generation should not be afforded copyright protection. This determination is grounded in the fact that the AI model user fails to contribute the requisite minimum threshold of creative intellectual activity, thereby not fulfilling the originality criterion for works as delineated in the Copyright Law. Essentially, the AI model user, by not engaging in creative cognition, does not produce a work that qualifies as an intellectual labor product. Consequently, such outputs do not align with the definition of works under the *Copyright Law* and, by extension, do not merit copyright protection.

3.2 Attribution of Copyright

As deduced from the preceding copyrightability analysis, the paramount prerequisite for AIGC works to possess copyright is their status as products of users’ intellectual labor. Consequently, the copyright of these works should be attributed to the AI model users who “employ intellect in the creative process”. Illustrating this with AI painting, the creative process encompasses database filtration and amalgamation. Concurrently, the pathways to produce an AI painting are multifarious, with AI content obtained through diverse methods involving multiple stages such as software development, keyword extraction, big data collection, screening, and compilation. Succinctly, AI painting represents an artistic work where creators express ideas through lines and colors, with this idea expression forming the work’s essence. In the AI painting process, the AI model serves merely as a creative tool, designed to generate AI works aligning with user expectations based on user-provided keywords and images. Essentially, during the painting generation process, the AI model functions analogously to traditional tools like brushes. Therefore, the copyright of AI paintings should rightfully belong to the AI model user rather than the AI model developer.

In the context of Chinese domestic legislation, this paper posits that the *Copyright Law* should explicitly codify the attribution of AIGC works’ copyright to AI model users. Such a provision would facilitate the delineation of liability in instances of AIGC infringement and furnish copyright holders with a legal foundation for rights protection. This stance is predicated on the current landscape of the Chinese AIGC market, where copyright ownership, liability allocation, and commercial terms predominantly stem from user agreements drafted by AI software developers. The pertinent clauses within these agreements may lack rationality, precipitating frequent copyright disputes concerning AIGC works, for which extant laws fail to provide unequivocal adjudication criteria. Consequently, statutorily establishing that AIGC works’ copyright belongs to AI model users would mitigate confusion arising from ambiguous copyright ownership, thereby effectively curtailing infringement occurrences.

4 Copyright Risk Prevention for AIGC Works

4.1 Characteristics of Copyright Risks

In terms of creation speed and quantity, AIGC far surpasses the average human level. As a result, the sheer quantity of potentially infringing works in this category is substantial, and the determination of infringement and associated liabilities diverges from historical precedents.

Initially, the identification of copyright infringement poses significant challenges. Chinese courts typically employ the “access plus substantial similarity” doctrine to establish copyright infringement. This doctrine stipulates that unless the allegedly infringing work can be demonstrated to be substantially similar to the copyrighted work, and evidence exists that the rights holder of the work in question (the defendant) had prior opportunity or actual access to the original work, the work cannot be deemed to infringe copyright. Evidently, this principle is not applicable to AIGC works produced through AI algorithmic models.

Furthermore, difficulties arise in identifying the entities responsible for infringement and delineating liability. AI algorithmic models, lacking legal personhood, cannot bear legal responsibility. AI algorithm model developers, AIGC operators, and AIGC users all contribute to the development and utilization of AIGC. The production of AIGC works typically encompasses three phases: content input, machine learning, and content output, each harboring potential copyright infringement risks. When original work’s copyright owners seek to enforce their rights, they face considerable challenges in determining which entities to pursue and how to apportion responsibility among these parties.

4.2 Risk Prevention at the Content Input Stage

To mitigate copyright risks during the content input phase, the following strategies can be implemented: Primarily, AI algorithm model developers can investigate and adopt lawful data acquisition methodologies within the confines of the current legal framework. However, this presents significant challenges. For instance, developers may encounter difficulties in distinguishing protected works, identifying legitimate rights holders, and determining whether other parties possess the authority to license specific images. While obtaining authorization through collective copyright management organizations is theoretically viable, it would entail prohibitive licensing costs. Furthermore, in the absence of an extended collective licensing regime, a majority of works may fall outside the purview of collective management authorization. In response to these challenges, this paper proposes innovations built upon existing systems to establish a legal foundation for utilizing works in AI algorithm model training. Two principal approaches are suggested: first, the introduction of fair use exceptions or data mining exceptions specifically tailored for AI algorithm model training within copyright law; second, the implementation of a statutory licensing system to enhance the authorization mechanism in the AIGC domain. This latter approach would eliminate the need for AI algorithm model developers to secure prior permission from rights holders, instead requiring them to provide reasonable compensation subsequent to the utilization of the work.

Furthermore, to minimize the probability of copyright infringement when utilizing AIGC, users are advised to refrain from incorporating references to renowned authors or their works in AIGC prompts. In cases where the AIGC's creative objective is to mimic the style of a celebrated writer or their works, it is crucial to meticulously compare the resultant works with those of the author in question. This comparison should aim to preclude "substantial similarity" between the two, thereby reducing the potential for copyright infringement.

4.3 Mitigating Risks in Content Output

In the realm of AIGC operations, drawing upon the perspective presented in Case No. (2024) Yue 0192 Min Chu 113 of the Guangzhou Internet Court, AIGC service providers are obligated to diligently exercise reasonable care during the content output phase. This obligation primarily encompasses two key aspects: Firstly, the establishment of a robust complaint and reporting mechanism, as mandated by Article 15 of the "AIGC Measures," to facilitate copyright protection for rights holders. Secondly, in compliance with Article 4 of the "AIGC Measures," providers must educate and remind users about respecting intellectual property rights, typically through service agreements. Moreover, after thorough consideration of their unique technological features and rights protection requirements, providers should, in line with prevailing industry practices, inform users about potential intellectual property risks associated with generated content and establish contractual terms delineating responsibilities and obligations pertaining to intellectual property infringement risks.

5 Conclusion

In response to the challenges posed by AIGC advancements to the current legal framework, particularly the copyright risks potentially introduced by emerging technologies, it is imperative for the state to enhance existing legislation and intensify regulatory oversight of AIGC research and development entities. Concurrently, all stakeholders in the AIGC ecosystem, encompassing AI algorithm model developers, AIGC operators, and end-users, must remain vigilant about copyright risks and proactively implement preventive measures to mitigate potential legal issues.

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