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Artificial Intelligence and Copyright: Challenges and Regulatory Models

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Abstract: The explosive development of artificial intelligence (AI) technology has launched an all-around challenge to the traditional copyright legal system rooted in "human creativity". Its data-driven creative paradigm and algorithm-dominated communication logic have created structural conflicts with the subject theory, determination of rights objects, and interest distribution mechanism of the current copyright system. This paper cuts in from the perspectives of normative analysis and comparative law, deconstructs the copyright jurisprudential crisis triggered by AI technology, systematically combs the differentiated global governance paths, and proposes a Chinese solution of "technology-law-ethics" co-evolution.

Key words: Artificial Intelligence; Copyright Law; Originality; Data Compliance; Global Governance

1 Challenges of Artificial Intelligence to Traditional Copyright Law

1.1 The Fundamental Controversies Surrounding AI-generated Creation

In the theoretical framework of traditional copyright law, creativity is regarded as a unique ability of human beings. Authors carry out intellectual activities in the fields of literature, art, and science based on their own knowledge reserves, life experiences, emotional experiences, and unique thinking, producing works with unique forms of expression. Such creation emphasizes the author's subjective initiative and personalized expression, and works bear the author's thoughts and personal mark. However, the creative process of AI presents completely different characteristics, which is mainly based on data-driven and algorithmic models. By learning and analyzing massive data such as texts, images, and music, it extracts patterns, rules, and features, and then generates content according to preset algorithms and user instructions. AI itself does not have real emotions, consciousness, or subjective experience, and lacks the inspiration and emotional drive from the depths of the heart in human creation.

The originality of a work is one of the core elements protected by copyright law, requiring that the work must be

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independently created by the author and reflect personalized expression. There are many controversies in academic and practical circles about whether AI-generated content meets this requirement. Formally, different AI models, training data, and user instructions can make AI generate content with a certain degree of uniqueness. However, the determination of the originality of AI creation is full of controversies in essence. Some argue that AI has no human thinking or creativity, and the content it generates is merely a mechanical combination of data and algorithms, lacking true intellectual input and personalized expression, thus failing to meet the originality requirements of copyright law for works. Another view points out that although AI itself does not have independent creativity, human participation and intervention in the AI creation process can endow the generated content with a certain degree of originality. In Chinese judicial practice, the Beijing Internet Court recognized the latter in the judgment of the "AI Text-to-Image Copyright Case," holding that when the plaintiff used AI painting software to generate the involved image, he designed elements such as the characters in the picture, presentation method, layout, and composition by selecting models, designing prompt words, and adjusting parameters, which reflected his own aesthetic judgment and personal expression. The AI-generated image met the originality requirements and should be recognized as a work protected by copyright law. However, there is currently no unified understanding or clear rules on the criteria for judging the degree of human participation and how to accurately define the proportion of human originality in AI-generated content. This has led to different views and interpretations among different courts, scholars, and legal practitioners on whether AI creation meets the originality requirements of works, making the copyright protection of AI creation complex and full of uncertainty.

1.2 Copyright - Related Issues in AI Model Training

1.2.1 Copyright Issues of Data Use

The invention of Artificial Intelligence (AI) has posed numerous legal challenges across various fields. The training of AI models highly depends on a large amount of data, which comes from a wide range of sources and contains many copyrighted works, such as literary works, music, images, and film and television clips. When AI developers use these copyrighted data for model training, a series of complex and controversial copyright issues are triggered.The rapid progress of generative AI technology has sparked significant copyright concerns, leading to numerous lawsuits filed against AI developers.

From the perspective of copyright infringement, using copyrighted data for AI model training without the authorization of copyright owners has the risk of constituting infringement. According to the provisions of traditional copyright law, copyright owners enjoy a series of exclusive rights over their works, such as the right of reproduction, the right of distribution, and the right of information network dissemination. In the process of AI model training, the large - scale reproduction and use of copyrighted data without the permission of copyright owners may be regarded as an infringement of the right of reproduction.

There are also views that the use of data in AI model training can, under certain conditions, apply the fair - use principle in copyright law. Fair use is an important system in copyright law, aiming to balance the rights and interests of copyright owners with the public's access to and use of knowledge and information. In the context of AI model training, proponents believe that training AI models is for the purpose of technological innovation and progress. This use is not aimed at directly disseminating and using the content of works but rather enabling AI to learn the patterns, features, and knowledge in the data, thereby enhancing the performance and intelligence level of the model. This way of using

is similar to the reasonable citation of others' works by researchers in academic research. Although copyrighted data are used, the purpose is to promote the development of science and technology, which has a positive significance for society.

However, in practice, it is a difficult problem to accurately define the scope of fair use of data in AI model training. Currently, there are no clear and unified regulations on the fair - use standards for data use in AI model training, either domestically or internationally. Different countries and regions, and even different courts, may adopt different considerations and judgment criteria when determining whether the data use in AI model training constitutes fair use. Some countries may focus on the purpose and nature of data use, emphasizing whether it is for non - profit scientific research and educational purposes; while others may comprehensively consider factors such as the quantity and proportion of data used and the impact on the market of copyrighted works. Even within the same country, different judges may have different understandings and judgments of fair use, which leads to uncertainty in the judgment results of whether the data use in AI model training constitutes infringement in actual cases.

In order to seek a balance between data use and copyright protection, some scholars and institutions have proposed various solutions. One idea is to establish a data authorization mechanism. By negotiating with copyright owners, AI developers can obtain legal authorization for data use. AI developers can sign data - use license agreements with copyright owners, clearly defining the scope, method, duration of data use, and corresponding fee payments, so as to use data within a legal and compliant framework. Although this method can effectively protect the rights and interests of copyright owners, in actual operation, it faces problems such as cumbersome authorization processes and high costs. Especially when a large amount of dispersed copyrighted data is needed, it is difficult to negotiate and obtain authorization from numerous copyright owners one by one, which may hinder the rapid development of AI technology.

Another solution is to establish a copyright compensation system. According to this system, when AI developers use copyrighted data for model training, they do not need to obtain the authorization of copyright owners one by one, but need to pay a certain fee to a specially established copyright compensation fund. The fund then distributes the compensation to copyright owners according to certain distribution rules. This method can simplify the authorization process for data use, reduce the costs of AI developers, and also protect the rights and interests of copyright owners to a certain extent. However, how to determine a reasonable compensation standard and ensuring that the compensation is distributed fairly and reasonably to copyright owners are the key issues to be solved in the implementation of this system.

1.2.2 Copyright Ownership of Open - Source Code and Algorithms

In the field of AI development, open - source code and algorithms are widely used, which provide powerful impetus and support for the rapid development and innovation of AI technology.

The copyright ownership of open-source code and algorithms usually follows the provisions of open-source agreements. An open-source agreement is a legal contract that stipulates the conditions and rules for the use, distribution, and modification of open-source code and algorithms. Different open-source agreements have different provisions on copyright ownership and use rules. Among common open-source agreements, the MIT license is the most permissive. It allows users to freely use, modify, and distribute the code, and even use the open-source code in commercial projects, as long as the original author's copyright notice is retained in the code. This means that under the MIT license, the copyright of the open - source code still belongs to the original author, but users have great freedom of

use. The GPL (General Public License), on the other hand, is more restrictive. It requires that derivative works based on GPL-licensed open - source code, when modified and distributed, must also be open-sourced under the GPL license, and their source code must be made public. This ensures the openness and sharing of open - source code and prevents others from privatizing it. Take the Linux operating system as an example. It is open - sourced under the GPL license. Many developers have modified and developed on its basis, forming various Linux distributions, but these distributions must all follow the GPL license and make their source code public.

In AI development, when using open - source code and algorithms, developers need to strictly abide by the corresponding open - source agreements and use rules. If they violate the open - source agreements, it may trigger copyright disputes and face legal liability.

Open - source code and algorithms play an important role in AI development. Their copyright ownership and use rules are crucial for ensuring the healthy development of the open-source community and the innovation of AI technology. Developers should fully understand and abide by relevant open - source agreements and rules when using open - source code and algorithms, respect the copyright of original authors, actively participate in the construction and development of the open - source community, and jointly promote the progress of AI technology. At the same time, with the continuous development of AI technology and the increasing complexity of open - source projects, relevant laws and policies need to be continuously improved to better regulate the copyright ownership and use of open - source code and algorithms and balance the interests of the open - source community and developers.

1.3 Copyright Protection of AI - Assisted Works

1.3.1 The Role Positions of Human Authors and AI in AI - Assisted Creation

In the process of AI - assisted creation, human authors and AI play distinct but interrelated roles. Accurately defining their roles is of great significance for determining the copyright ownership and protection of works. Take AI - assisted music creation as an example. Human creators usually play a leading role in the initial stage of creation. With their rich music knowledge, unique artistic styles, and insights into life, they determine the key elements of music works, such as the theme, emotional tone, and overall style. For example, a musician who wants to create a music work expressing awe for nature will first conceive the general framework of the work in his mind, including which musical instruments to choose to represent different elements of nature. Whether to use the melodious violin to depict the breeze or the majestic symphony to show the storm.

During the creation process, human creators guide AI to provide creative materials and inspiration by inputting instructions and setting parameters. They will input information such as specific melody fragments, harmonic progressions, and rhythm types into the AI music - creation software. Based on its powerful data - processing capabilities and learning algorithms, AI will retrieve and analyze relevant information from a vast amount of music data and provide various possible music ideas and suggestions for human creators. AI can generate multiple melody - continuation schemes of different styles based on a few simple notes input by human creators or recommend rhythm patterns that match a given chord sequence.

AI mainly acts as a tool and assistant in the process of assisted creation. It can quickly process and analyze a large amount of music data, discover the rules and patterns in it, and provide rich creative resources and inspiration for human creators. AI can also help human creators improve their creative efficiency and achieve complex tasks that are difficult to

complete by traditional creative methods. In the arrangement process, AI can quickly generate a complete arrangement plan according to the music style and instrument configuration set by human creators, including the playing parts of various instruments, volume balance, and timbre matching, greatly shortening the time required for arrangement.

In the field of AI - assisted painting, human creators also play a core role. They use their aesthetic concepts, artistic accomplishments, and creativity to determine the key elements of painting works, such as the theme, composition, and color use. A painter who wants to create a painting depicting an ancient palace scene will first conceive the layout of the picture in his mind, determine the positions, postures, and expressions of the main characters, as well as the elements and color tones of the background. During the creation process, the painter will use the AI painting software as an auxiliary tool, input descriptive text instructions such as "A magnificent ancient palace with palace maids in brocade clothes dancing in the courtyard", and adjust various parameters such as the style of the picture, color saturation, and brushstroke effect to guide AI to generate a preliminary painting sketch. AI will extract relevant image elements and style features from its training data according to these instructions and parameters and generate corresponding painting content.

Human creators will further modify and improve the sketches generated by AI. They will adjust and optimize the character images, color matching, and detail expressions in the sketches according to their own artistic concepts and aesthetic judgments, integrating their unique artistic styles and emotional expressions to make the work finally become an original art work. In this process, although AI provides the basis and inspiration for creation, the creative labor of human creators is the key to endowing the work with soul and value.

1.3.2 Copyright Ownership Principles and Identification Difficulties in Practice

At present, there are mainly the following principles for the copyright ownership of AI - assisted works: One is the principle of taking human authors as the dominant. This principle holds that in the process of AI - assisted creation, human creators play a core role, and their intellectual labor and creative thinking input are the key factors for the production of works. Therefore, the copyright should belong to human authors. This principle has been widely recognized and applied in most cases because it conforms to the definition and protection concept of authors in traditional copyright law. In many actual cases, such as the above - mentioned AI - assisted music creation and painting creation, human creators complete the creation process of works through their creative ideas, artistic expressions, and control and guidance of AI. According to this principle, they naturally enjoy the copyright of the works.

Another principle is to allocate copyright according to the contribution ratio. This principle advocates that when determining the copyright ownership of AI - assisted works, the contribution degrees of human creators and AI in the creation process should be comprehensively considered, and the copyright should be allocated according to a certain ratio. This principle attempts to more accurately measure the roles of all parties in creation to achieve fairness in copyright ownership. In some complex AI - assisted creation projects, AI may not only provide creative materials and inspiration but also conduct a large amount of algorithm processing and data operations in the process of work generation, playing an important role in the final formation of the work. In this case, allocating copyright according to the contribution ratio can more reasonably reflect the labor achievements of all parties. However, it is a challenging problem to determine the contribution ratio of human creators and AI, and there is currently a lack of clear standards and methods. In actual operation, it is difficult to accurately quantify the intellectual input of human creators and the technical contributions of AI, which makes the application of this principle in practice face many difficulties.

In practice, there are many difficulties and disputes in the identification of the copyright ownership of AI - assisted works. Due to the complexity and diversity of AI technology, the interaction methods and degrees of influence between human creators and AI vary in different AI - AI-assisted creation scenarios, making it difficult to develop a unified identification standard. In some simple AI - assisted writing scenarios, human creators may only use AI software for grammar checking and vocabulary suggestions, and their dominant role in work creation is relatively obvious, so the copyright ownership is relatively easy to determine. However, in some highly AI - dependent creative fields, such as AI art creation based on deep - learning algorithms, AI may play a key role in the process of work generation, and the role of human creators is relatively weak. At this time, the identification of copyright ownership becomes complex and difficult.

There are also disputes over the judgment of human originality in AI - assisted works. Although most viewpoints believe that the intellectual input and creative expression of human creators are the core elements of the originality of works, in actual judgment, it is a difficult problem to accurately define the manifestation and degree of human originality. In AI - assisted painting, human creators influence the generation of works by adjusting parameters and selecting models, but whether these operations are sufficient to constitute original intellectual labor is open to different views. Some people think that as long as human creators make certain choices and judgments during the creation process, their originality should be recognized; while others believe that a higher degree of creative input is required to meet the requirements of originality.

The identification of the copyright ownership of AI - assisted works also involves the balance of interests among AI developers, users, and other relevant parties. If the copyright completely belongs to human creators, it may ignore the investment of AI developers in technology research and development and data training; while if the role of AI is over - emphasized and the copyright is overly allocated to AI - related parties, it may damage the enthusiasm and rights of human creators. In practice, how to find a balance among different interest parties and develop reasonable copyright ownership rules is an urgent problem to be solved.

1.4 The Debate Over the Protectability of Works Entirely Created by an AI

The views supporting the copyright protection of AI works are mainly based on the following considerations. From the perspective of innovation incentives, granting copyright protection to AI works can stimulate the enthusiasm for the research, development, and application of AI - creation technology. In today's digital age, AI technology is developing rapidly, and a large amount of human, material, and financial resources are invested in the field of AI creation. If AI - generated works can obtain copyright protection, AI developers and users will be more motivated to carry out technological innovation and application expansion due to the expected economic returns. Some AI companies are committed to developing more advanced AI painting and music - creation technologies. If the works generated by them can be recognized by copyright, these companies can obtain economic benefits through authorization, sales, etc., and thus further increase investment in technology research and development, promoting the continuous upgrading of AI - creation technology.

AI works themselves have certain value and should be protected by copyright. With the continuous progress of AI technology, the quality and innovation of AI - generated works are increasing day by day. Many AI - created paintings, music, and literary works are in no way inferior to human - created works in terms of artistic expression and aesthetic value. Some AI - painted works have been exhibited in art exhibitions and highly praised by the audience; AI - created

music works have also received a large number of plays and downloads on music platforms. These works not only bring economic benefits to the creators but also enrich the cultural market and meet the spiritual and cultural needs of the public. From this perspective, granting copyright protection to AI works is a legal recognition of their value, which helps to maintain fair competition in the cultural market.

The views opposing the copyright protection of AI works also have a solid theoretical basis. From the perspective of legal personality, AI lacks legal personality and cannot be a copyright subject. Copyright law is based on human creation. Traditionally, an author must be a natural person or a legal entity, such as a legal person, with independent thinking ability, emotional experience, and creativity. AI is essentially a program operating based on algorithms and data. It has no self - awareness, emotions, or subjective initiative and cannot think creatively like humans. When AI generates works, it only performs mechanical operations according to preset algorithms and input data and does not have an understanding of the works and creative intentions. Therefore, from the perspective of legal personality, AI cannot be an author in the sense of copyright law, and the works it generates should not be protected by copyright.

The advent of artificial intelligence (AI) has complicated the relationship between creative ideas and their expression, introducing a third-party intermediary labelled “AI” that blurs traditional distinctions between creator and tool. The issue of liability assumption is also an important reason for opposing the copyright protection of AI works. If copyright is granted to AI works, it is difficult to determine the liability - bearing subject when legal disputes such as infringement occur. In the traditional copyright field, once an infringement occurs, the copyright owner can claim rights from the infringer, and the infringer needs to bear the corresponding legal liability. For AI works, if they are found to be infringing, since AI itself does not have the ability to bear legal liability, it is controversial who should bear the liability. Whether it is the AI developer, user, or other relevant parties, there is currently no clear legal provisions and theoretical consensus. This uncertainty in liability assumption may lead to chaos in the legal order and increase the difficulty of resolving copyright disputes.

2 Current Legal Frameworks

2.1 EU

The differences in positions among different countries on AI intellectual property issues mainly stem from economic development levels, technological maturity, legal systems, cultural traditions, policy objectives, global competition dynamics, as well as public awareness and the influence of stakeholders. The European Union has developed relatively early and comprehensive legal regulations in the field of artificial intelligence (AI) copyright, issuing a series of legislative acts and regulations that address various aspects of AI governance. The European Union’s (EU’s) Artificial Intelligence Act (AI Act), published on 12 July 2024, seeks to establish a consistent legal framework for AI systems within the EU, promoting trustworthy and human-centric AI while safeguarding various fundamental rights.

Regarding the regulatory framework for generative AI and intellectual property, the EU Artificial Intelligence Act (2024/1689) establishes specific provisions. As the first comprehensive legal framework for AI regulation, the EU AI Act (Regulation (EU) 2024/1689) imposes stringent intellectual property (IP) compliance obligations on General-Purpose AI (GPAI) systems. Article 105 mandates that text and data mining (TDM) activities in generative AI training must comply with the Copyright in the Digital Single Market Directive (CDSMD) (Directive (EU) 2019/790). It

explicitly rejects the "non-expressive use" doctrine, affirming that unauthorized reproduction of copyrighted materials constitutes infringement unless covered by CDSMD exceptions (e.g., scientific research under Article 3 or commercial TDM under Article 4 where rightsholders can opt out). Article 106 extends extraterritorial jurisdiction, requiring GPAI providers outside the EU to comply with EU copyright law when placing models on the EU market, aiming to prevent circumvention of compliance through relocation to low-protection jurisdictions. Article 107 imposes transparency obligations, obliging providers to publish machine-readable "training data summaries" for copyright verification. While technical details (e.g., model weights) may remain confidential, summaries must distinguish protected content from public domain materials.

Article 53(1)(c) operationalizes these principles through three requirements: First, policy formulation: GPAI providers must establish internal policies to ensure compliance with EU copyright law, particularly regarding opt-out declarations under CDSMD Article 4(3). Second, technical safeguards: Providers must implement "state-of-the-art technical measures" to identify and exclude copyrighted materials subject to opt-out requests, necessitating proactive filtering rather than post-hoc remedies. Third, full lifecycle coverage: Compliance obligations span the entire GPAI lifecycle, though enforcement prioritizes the training phase with the highest IP risks.

The Act further specifies requirements for AI-generated creations. It strengthens rightsholders' control over TDM activities: First, by establishing an opt-out mechanism (akin to the E-Commerce Directive's notice-and-takedown regime), compliance burdens shift from rightsholders to AI enterprises. Second, it increases extraterritorial compliance costs: Non-EU providers must redesign global data pipelines to filter EU-flagged content, potentially raising development costs by 15–30%. Regarding transparency-trade secret conflicts, the Act balances accountability and confidentiality: While Article 53(2) permits redaction of "commercially sensitive information," ambiguities persist. Providers may obscure data sources under the Trade Secrets Directive (Directive (EU) 2016/943), potentially undermining copyright enforcement.

For originality determination, EU legislation and jurisprudence favor the "author's own intellectual creation" standard. Copyright protection arises when works reflect unique human intellectual input and personalized expression. In AI-generated content, this standard triggers debates: If human developers/users demonstrate substantial intellectual contributions—such as algorithm design, data selection, or parameter adjustment guiding AI outputs—resulting content may qualify for copyright. For instance, AI-assisted artworks incorporating meticulously crafted prompts and parameter adjustments exhibiting unique artistic styles might meet originality thresholds under EU case law.

Practical challenges persist. Divergent legal traditions, cultural contexts, and industrial development across Member States lead to uneven implementation. Some jurisdictions adopt conservative approaches, strictly applying traditional authorship/originality criteria to AI outputs, while others embrace innovation with more flexible interpretations. This inconsistency risks fragmenting the EU's unified AI market.

As AI evolves, existing frameworks struggle with emerging issues: Blockchain-based AI platforms require clarification on copyright ownership and transaction rules; hybrid AI systems demand precise originality assessments. These challenges necessitate ongoing legal refinement and judicial interpretation.

2.2 China

At present, China's artificial intelligence (AI) sector is showing a strong development momentum. According to a report by the World Intellectual Property Organization (WIPO), China has become one of the world's largest holders of

AI patents, accounting for 60% of the global total. When dealing with the challenges brought by artificial intelligence, China's current copyright law is mainly based on the traditional copyright legal framework and is applied in practice combined with the characteristics of AI technology. In terms of computer software copyright protection, the Copyright Law of the People's Republic of China clearly regards computer software as a work and protects it under copyright law. The developers of computer software enjoy the copyright of the software, including the rights of publication, signature, modification, reproduction, distribution, leasing, and information network dissemination. For open - source code used in AI development, if it follows the open - source agreement, developers can freely use, modify, and distribute it under the conditions specified in the agreement. However, it should be noted that even for open - source code, when using it, the copyright statements and relevant rights of the original author should be respected to avoid copyright disputes caused by violating the open - source agreement.

In terms of the copyright ownership of work - made - for - hire, China's copyright law stipulates that generally, the copyright of a work - made - for - hire is owned by the author, but the legal person or other organization has the right to use it preferentially within the scope of its business. Within two years after the completion of the work, without the consent of the unit, the author may not license a third party to use the work in the same way as the unit. In AI - related work - made - for - hire, if AI is used as a tool to assist employees in completing the creation and the creation task falls within the scope of the employee's work, then the work may be recognized as a work - made - for - hire. In this case, the employee, as the author, enjoys the copyright, but the unit has the right to use the work preferentially within the scope of its business. For example, an employee of an Internet company creates a commercial promotion copy using the company - developed AI writing tool during the work process. The copyright of this copy belongs to the employee, but the company has the right to use it preferentially for commercial promotion within the scope of its business.

Regarding the copyright protection of AI - generated content, although there is currently no clear and specific legislation in China, positive exploration has been carried out in judicial practice. In the "AI Text - to - Image Copyright Case" heard by the Beijing Internet Court, through a detailed analysis of the creation process of AI - generated images, considering the degree of human participation and creative contribution, the court determined that the AI - generated images in question met the originality requirements and were works protected by copyright law. The court believed that when the plaintiff used the AI painting software to generate images, by selecting the model, carefully designing the prompt words, and continuously adjusting the parameters, the plaintiff designed and controlled key elements such as the characters in the image, their presentation methods, and the layout and composition, reflecting the plaintiff's aesthetic judgment and personal expression, which met the requirements of work originality. This judgment provides an important judicial practice example for the copyright protection of AI - generated content, clarifying that under certain conditions, AI - generated content can obtain copyright protection, and the key lies in the creative participation of humans in the creation process.

China's copyright law also faces some problems in practice. Regarding the judgment standard for the originality of AI - generated content, there is currently no unified and clear regulation. Different courts may have different judgment ideas and standards when hearing similar cases, resulting in uncertainty in judicial practice. In the use of data for AI model training, although the fair - use system can provide a legal basis for AI developers' data use to a certain extent, there is a lack of clear definition and guidance on the specific scope and boundaries of fair use, making AI developers face great legal risks in the process of data use.

2.3 United States

The United States has developed distinctive characteristics in legal regulation and practice regarding artificial intelligence (AI) in the copyright field, exerting significant influence on global developments in related areas. When addressing AI-related copyright issues, U.S. copyright law primarily relies on traditional legal frameworks and principles, continuously exploring and adapting through judicial practice.

According to the Copyright and Artificial Intelligence Report Part II released by the U.S. Copyright Office (USCO) in 2025 and other relevant documents, the copyright protection stance for generative artificial intelligence (AI)-created content has been clarified. The core principles reflected in these documents are human authorship and creative control.

The U.S. Copyright Office adheres to the principle of "human authorship" under the current copyright law framework, meaning only works created by humans qualify for copyright protection. The key criterion lies in the degree of human control over the creative process, which includes the following elements: First, purely AI-generated content lacks copyrightability. Content entirely autonomously generated by AI without substantial human involvement (e.g., outputs produced solely through inputting prompts without subsequent modifications or arrangements) is deemed "non-human creation" and thus ineligible for copyright protection. Second, human-assisted creations may receive partial protection. If humans use AI tools to assist in creation and demonstrate substantial contributions in the following aspects, copyright protection may apply. Specifically, this includes three dimensions: First, input of expressive content. Users input their original works (e.g., sketches, texts) into AI systems, and such content remains discernible in the output. For example, if a user uploads a hand-drawn sketch and instructs AI to render it into a complete image, copyright protection applies only to the human-created sketch portion. Second, modification and arrangement. Creative selection, adjustment, or reorganization of AI-generated content (e.g., altering image details, restructuring text) may constitute a new "derivative work" eligible for copyright protection. Third, complex prompting and iterative optimization. If users employ multi-round prompt adjustments combined with technical parameter settings (e.g., tuning hyperparameters of generative models), such actions may be regarded as exerting control over the creative process, though case-by-case evaluation is required.

Taking controversies in U.S. patent law as an example: Under current U.S. patent rules, inventors must be natural persons. U.S. courts emphasize "conception" as the critical factor in determining inventorship in judicial practice. This concept is defined as "the complete performance of the mental part of the inventive act," which constitutes "a definite and permanent idea of a complete and operative invention formed in the inventor's mind before reducing it to practice." Concurrently, the current Patent Examination Guidelines stress that conception requires both "recognition and understanding of the invention." In contrast, while generative AI can produce novel and improved outputs, it lacks human-like consciousness and does not "recognize" or "understand" its outputs. Under this standard, AI-generated content is categorized as unconscious machine output, rendering AI incapable of qualifying as an inventor under U.S. patent law.

Currently, to address the surge in intellectual property disputes and risks arising from the rapid expansion of generative AI applications, the U.S. has begun establishing regulatory frameworks. By emphasizing "human control" and "originality of expressive elements," the U.S. Copyright Office seeks to balance creator rights protection with technological innovation. This stance profoundly impacts the AI industry, requiring further clarification of standards through judicial precedents and policy refinements. For creators, the key to claiming copyright lies in rationally utilizing AI as an assistive tool while preserving documentation of the creative process.

3 Future Directions and Possible Recommendations

3.1 Suggestions for Improving the Legal System

3.1.1 Clarifying the Copyright Ownership Rules for AI - Created Works

With the wide application of AI technology in the creative field, it has become urgent to clarify the copyright ownership rules for AI - created works. Special legal provisions should be formulated. For works completely created by AI, if there is no substantial human participation in the generation process, a new type of right can be considered to protect their rights and interests. For example, an "AI - Generated Content Right" can be established, granting AI developers or owners exclusive rights to use AI - generated works for a certain period, including the rights of reproduction, distribution, and information network dissemination. The grant of this right aims to encourage the research, development, and application of AI technology and also provide a legal guarantee for the market circulation and utilization of AI - generated works. At the same time as granting rights, the responsibilities and obligations of AI developers or owners should also be clearly defined. They should ensure that AI - generated works do not infringe on the legitimate rights and interests of others and indicate that the works are generated by AI during the dissemination process.

Balancing the rights and interests of creators with public interests, while ensuring innovation and the dissemination of knowledge, is a fundamental principle of copyright law. For AI - assisted creative works, the copyright ownership should be determined according to the actual contribution degrees of human creators and AI in the creation process. If human creators play a dominant role in the creation process, such as providing core ideas and making substantial modifications and improvements to the content generated by AI, then the copyright should mainly belong to human creators. In AI - assisted painting, if a human creator carefully conceives the theme, layout, and color matching of the painting, uses an AI software to generate a preliminary sketch, and then makes a large number of detailed adjustments and artistic processing to the sketch, making the work reflect a unique artistic style and the creator's personality, in this case, the copyright of the work should belong to the human creator. At the same time, AI developers or providers should also enjoy certain rights according to their contributions in the creation process, such as obtaining reasonable remuneration or being credited in the work.

To accurately determine the contribution degrees of human creators and AI, a professional evaluation mechanism can be established. An evaluation team composed of copyright experts, technical experts, and professionals in related fields can conduct a detailed analysis and evaluation of the creation process of AI - assisted creative works. The evaluation team can consider factors such as the creative ideas of human creators, their control and guidance over AI, the modification and improvement of the work, as well as the technical support and data - processing capabilities of AI in the creation process, and comprehensively judge the contribution ratio of both parties to determine a reasonable copyright ownership.

When clarifying the copyright ownership rules for AI - created works, it is also necessary to balance the interests of creators, developers, and the public. While protecting the rights and interests of creators and developers, the needs of the public for access to and utilization of knowledge and culture should also be considered. By reasonably setting the copyright protection period, stipulating circumstances of fair use and statutory license, it can ensure that the public

can legally use AI - created works under certain conditions, promoting the dissemination of knowledge and cultural exchanges. For some AI - created works with public - interest nature, such as those used in education, scientific research, and cultural inheritance, the use restrictions can be appropriately relaxed, allowing the public to use them for free within a reasonable range to maximize social benefits.

3.1.2 Standardizing the Copyright License Mechanism in AI Model Training

Technological advancement has brought changes to many professions across the world.The copyright license mechanism for data use in AI model training is a key link in balancing copyright protection and AI technology development. It is necessary to establish a reasonable copyright license mechanism for data use, and the collective - management - organization model is a feasible option. The collective management organization, as the representative of copyright owners, is responsible for negotiating and authorizing with AI developers and uniformly managing copyright license affairs. AI developers only need to sign one license agreement with the collective management organization to obtain authorization to use a large amount of copyrighted data managed by the organization, which greatly simplifies the authorization process and reduces transaction costs.

The statutory - license system can also provide a legal basis for data use in AI model training. Statutory license means that in specific circumstances stipulated by law, AI developers can use copyrighted data without prior permission from copyright owners but need to pay reasonable remuneration to copyright owners according to law. When AI model training is for non - profit purposes such as scientific research and technological innovation, the statutory - license system can be applied.

To ensure the effective operation of the copyright license mechanism, it is also necessary to strengthen the supervision of data use in AI model training. A sound data - use monitoring and evaluation system should be established to conduct real - time monitoring and regular evaluation of AI developers' data - use behaviors. Regulatory authorities can require AI developers to submit data - use reports regularly, which should detail information such as the source, use method, use purpose, and usage volume of data, so that regulatory authorities can review the legality and rationality of data use. In addition, the supervision of copyright - license fees should be strengthened to ensure that the fees are collected and distributed fairly and reasonably. A unified copyright - license - fee standard can be formulated, and a reasonable fee level can be determined according to factors such as the type, quantity, and use period of data. The collective management organization or copyright owners should be supervised to collect and distribute fees in accordance with the standard to prevent over - charging or unfair distribution of fees.

3.2 Strategies for the Co - development of Technology and Law

3.2.1 Using Technical Means to Achieve the Balance between Copyright Protection and AI Development

Blockchain technology, with its characteristics of decentralization, immutability, and traceability, provides innovative solutions for AI copyright protection. In terms of copyright registration, a blockchain - based copyright - registration system can provide efficient, convenient, and credible copyright - registration services. When an AI - generated work or an AI - assisted creative work is completed, the creator can record relevant information of the work, including the work content, creation time, and creator's identity, in an encrypted form on the blockchain. Due to the distributed - ledger feature of the blockchain, this information is stored on multiple nodes, and no single party can

tamper with it alone, ensuring the authenticity and reliability of copyright - registration information. Once a copyright dispute occurs, the registration information on the blockchain can be used as strong evidence to prove the creation time and copyright ownership of the work. Some blockchain - based copyright - registration platforms have achieved good results in practical applications, providing fast and low - cost copyright - registration services for creators.

3.2.2 Establishing an Interdisciplinary Cooperation Mechanism to Promote the Integration of Law and Technology

To address AI copyright issues, collaboration among the legal, tech, and industrial communities is vital. They should establish regular communication platforms like interdisciplinary seminars, where legal experts share copyright law updates and judicial practices, tech experts introduce AI trends and tools like blockchain or digital watermarking, and industry representatives raise practical challenges. Joint research projects can integrate law and technology—exploring blockchain for copyright management, digital watermarking for ownership tracking, and AI algorithms for infringement detection—with industries providing real-world cases. In talent cultivation, universities and institutions should offer interdisciplinary curricula combining AI technology and copyright law, such as courses on "Artificial Intelligence and Intellectual Property Law," and partner with enterprises for internships to enhance practical problem-solving skills. This collaborative framework of dialogue, research, and education will help align legal frameworks with technological innovation and industry needs, fostering sustainable solutions for AI copyright challenges.

3.3 International Cooperation and Coordination

3.3.1 Participating in the Formulation of International Rules to Promote the Consistency of Global AI Copyright Protection

In the context of the rapid development of AI technology, international cooperation plays an irreplaceable role in AI copyright protection. With the wide application of AI technology, the copyright issues it generates have crossed national borders and involve the interests of creators, developers, enterprises, and users on a global scale. There are differences in the legal regulations and practices of AI copyright protection among different countries and regions, which not only lead to an increase in cross - border copyright disputes but also pose obstacles to the global development of the AI industry. Establishing unified international rules can provide clear guidance for AI copyright protection, reduce legal uncertainties, and promote the healthy development of AI technology and related industries on a global scale.

As an important participant in the global AI field, China should actively participate in the formulation of international rules and play an important role. China has achieved remarkable results in AI technology research, development, and application, with a large-scale AI industry and rich practical experience. In key technical fields such as AI chips, natural-language processing, and computer vision, Chinese enterprises and scientific research institutions are at the leading level in the world. The wide application of these technologies has enabled China to accumulate a large number of practical cases and valuable experience in AI copyright protection. Chinese AI enterprises conduct business globally, involving a large number of cross-border copyright transactions and cooperation, and there is an urgent need for international AI - AI-copyright rules.

3.3.2 Strengthening International Copyright Enforcement Cooperation to Address Cross - Border Infringement Issues

Strengthening international copyright enforcement cooperation is a key measure to effectively address cross-border

AI copyright infringement issues. With the globalization of AI technology, cross-border infringement has become increasingly rampant, as lawbreakers exploit legal disparities across countries to commit infringement and evade sanctions, making it difficult for single countries to combat alone. To address this, establishing an effective international information-sharing mechanism is crucial: copyright enforcement agencies should exchange infringement clues, evidence, and experience through dedicated platforms to coordinate crackdowns. Meanwhile, building international law enforcement cooperation mechanisms is indispensable, with countries supporting each other in investigation, evidence collection, and judicial assistance, leveraging treaties to enhance efficiency. Additionally, international organizations like WIPO and INTERPOL must strengthen coordination: WIPO can provide guidance through international norms, while INTERPOL can assist cross-border investigations via its global network and organize training exchanges. Finally, countries should harmonize legal systems—on the basis of respecting sovereignty—by formulating unified standards for determining infringement and penalties, gradually achieving this through international treaties (e.g., the EU's copyright directive coordinating member-state laws), thereby enhancing global copyright enforcement effectiveness.

Conclusion

The rapid advancements in artificial intelligence (AI) are reshaping how copyright is created, shared, and protected, introducing both opportunities and challenges. Due to the complexity of training data, the tort liability for works generated by artificial intelligence (AI) currently resists clear demarcation in academic and legal discourse. AI technologies can enhance creativity and innovation, but they also raise complex legal and ethical questions about ownership, licensing, and the economic value of intellectual property. The rapid development of artificial intelligence has undoubtedly brought unprecedented challenges to traditional copyright law. From the controversy over the essence of AI creation to the ambiguous areas of copyright in AI model training, from the dilemma of copyright ownership of AI - assisted works to the controversy over the protectability of works completely created by AI, these issues have deeply impacted the foundation of traditional copyright law, revealing the limitations of traditional copyright law in the face of emerging technological changes. Traditional copyright law is based on the core assumption of human creation. When facing AI, a new creative subject and creative method, it is difficult to effectively define copyright ownership, determine the originality of works, and regulate data-use behaviors.

Although the current legal frameworks of various countries have responded to AI - related copyright issues to a certain extent, there are still many deficiencies. Whether it is the European Union, China, the United States, the United Kingdom, or Japan, their existing legal provisions and policy measures have not been able to comprehensively and effectively solve the copyright challenges brought by AI. The ambiguity of legal provisions, the inconsistency of policy implementation, and the uncertainty of judicial practice make it difficult to handle AI-related copyright issues in practice. In the issue of the copyright ownership of AI - generated works, the legal provisions of various countries are different, resulting in difficulties in determining a unified legal - application standard in cross - border copyright disputes.

The development direction of the AI and copyright fields will profoundly affect the balance between innovation and rights protection. To achieve this balance, joint efforts are needed at multiple levels, including legislation, judicature, and industry self - discipline. In legislation, the copyright law should be improved as soon as possible to clarify the copyright - ownership rules related to AI, the legal boundaries of data use, and new standards for originality

determination, providing clear legal guidance for the development of the AI industry. In judicial practice, it is necessary to continuously optimize the trial mechanism, improve the professional qualities of judicial personnel, unify judgment standards, and ensure the fair implementation of the law. Strengthening industry self - discipline and using technical means to support copyright management and protection are also important ways to solve AI - related copyright problems. Through industry self, organizations formulating norms and guidelines to guide enterprises to operate legally and compliant; with the help of blockchain, digital watermarking, and other technical means to strengthen copyright registration, transactions, and tracking, improving the efficiency and effectiveness of copyright protection.

Looking to the future, as generative AI gradually evolves toward general intelligence, the copyright system will undergo a transformation from "human exclusivity" to "human-AI co-benefit." This transformation is not a subversion of traditional copyright values but a sublimation of their core—when AI can simulate human creative techniques, copyright legislation needs to keep pace with the times. As humans, we possess unique emotional experiences, critical thinking, and freedom of cultural expression. Only by upholding the ethical bottom line that "humans are ends, not means" in technological innovation and maintaining the dynamic balance between "innovation incentives and public interests" in complex interest games can we build a vibrant and humanistic copyright governance ecosystem in the intelligent era. This is not only the mission of legal professionals but also humanity's persistence. and reconstruction of its civilizational identity amid technological change.

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