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Research on the Ownership of Copyright in Artificial Intelligence-Generated Works

Chen Mengyao, Gong Yule, Wang Jiale, Zainafu Zai'er

Beijing Wuzi University, Beijing, China

ABSTRACT

Focusing on the impact of generative artificial intelligence (AI) technology on the copyright system, this study adopts an interdisciplinary research method integrating technical principle analysis and legal norm interpretation. It clarifies the technical characteristics of generative AI, such as its training mechanism and generation logic, and sorts out the application of core copyright law provisions including "originality", "subject qualification", and "right ownership". Through typical case analysis and comparison of international copyright protection rules, this paper specifically compares the differences in legislative models, right ownership rules, infringement identification standards, and public interest balance mechanisms for generative AI copyright protection across different countries and regions. A "creative contribution evaluation framework" is constructed, and a scenario-based right confirmation path is proposed to achieve dynamic balance between industrial innovation incentives and public interest protection.

KEYWORDS: *Artificial Intelligence-Generated Works, Copyright.*

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1. INTRODUCTION

A. Technological Innovation of Generative AI and Institutional Dilemmas

1. Explosive Development of Generative AI such as GPT

In recent years, generative AI represented by GPT has achieved explosive development, becoming a key transformative force in the AI field and even the entire technology industry. From a technical evolution perspective, the birth of the Transformer model architecture laid the foundation for the rise of generative AI. Subsequently, the GPT series models have continuously iterated and upgraded, and through in-depth learning of large-scale data, their language understanding and generation capabilities have achieved qualitative leaps. For example, GPT-4 has demonstrated performance far exceeding previous models in text generation and logical reasoning, and can even imitate human creative styles to a certain extent [[^footnote0]].

2. Core Challenges of the Traditional Copyright System: Subject Qualification and Right Ownership

The traditional copyright system is constructed based on "human author-centeredness", with two core constituent elements: originality and human intellectual creation. The widespread application of generative AI has posed a fundamental impact on this institutional foundation, which is specifically reflected in two key aspects:

First, the identification of subject qualification has fallen into a dilemma. Copyright protects "human intellectual creation" results, as explicitly stipulated in the Berne Convention. However, today's AI systems have acquired a considerable degree of independent creation capabilities. For instance, image works generated by MidJourney have gained recognition in professional fields for their artistry and creativity, but cannot obtain author identification at the legal level. This state of subject absence has left a large number of commercially valuable AI-generated content in a vacuum of unclear right ownership.

Second, the issue of right ownership has become increasingly complex. The process of AI content creation involves multiple participants, including data providers, algorithm developers, system trainers, and end-users. The boundaries of contributions from all parties have gradually blurred, making it difficult to define clearly. Taking the TIPS project as an example, simple instructions and refined instructions issued by users may lead to drastically different creative results, which makes it difficult to directly apply the "originality" of traditional judgment standards [[^footnote1]]. In the 2023 Chinese case "Tencent AI Writing Case", although the court recognized that AI-generated content can obtain copyright protection, the reasoning for the judgment on right ownership has triggered extensive discussions and controversies in academic circles. This institutional dilemma will not only affect the enthusiasm of creative subjects but may also hinder the healthy development of the AI industry. In addition, the issue of right distribution caused by technical black boxes has not been effectively resolved so far. AI-generated content generally involves multiple subjects including algorithm developers, data providers, and end-users, but existing theories have not clarified the specific proportion of contributions from all parties. The 2023 EU AI Act attempts to incorporate a "transparency obligation" requiring developers to disclose key parameters of AI systems, but this provision can only alleviate the impact of black box issues to a certain extent and has limited effect on determining the ownership of rights in AI-generated content.

In summary, although domestic and foreign research has made some progress on the copyright issues of AI-generated content, there are obvious deficiencies in explaining technical black box problems. Future research needs to further explore the integration path of traceable technologies (such as blockchain) and legal rules to establish a copyright governance system more adaptable to practical situations.

B. Research Value and Innovation Path

1. Theoretical Value

a) Reconstructing the Creative Identification Standard

The traditional copyright system, based on the "human creation-centeredness" established by the Berne Convention, requires works to be directly completed by natural persons. However, the popularization of generative AI has posed a fundamental challenge to this principle—when AI systems can independently generate artistic paintings or logically rigorous texts, the boundary between human authors and machine outputs has become increasingly blurred. This study proposes a breakthrough solution: originality identification should shift from mere result evaluation to "human participation depth assessment", focusing on examining the specific intervention behaviors of users in the generation process. For example, users' substantive inputs such as repeatedly adjusting instruction keywords, screening training datasets, or iteratively optimizing output results can all constitute creative contributions. Based on this, a "stepwise right confirmation model" is further constructed, dividing four protection levels according to the intensity of participation: from no copyright for AI autonomous generation, to users obtaining the right of attribution through simple instructions, and even deep interveners enjoying complete copyright, so as to realize the dynamic adaptation between legal rules and technical reality.

b) Innovating the Right Distribution Mechanism

To address the complexity of intertwined contributions from multiple subjects in the generation chain, this study establishes a "quantitative empowerment system". This system determines the ownership of rights through three-factor weight analysis: algorithm developers enjoy 30%-40% of the basic rights due to technical architecture investment; users obtain 20%-50% of the floating rights based on prompt engineering and parameter tuning (the specific proportion depends on the complexity of instructions and the frequency of modifications); data providers receive 10%-30% according to the proportion of originality of the materials. For highly autonomous AI systems such as software that automatically generates financial reports, the "tool exception principle" is adopted, and the output results are directly attributed to the actual controller to avoid the right vacuum caused by subject absence.

2. Practical Innovation

a) Scenario-Based Classified Governance Framework

Creative application fields: In scenarios such as literary creation and artistic design, users can obtain copyright subject qualification through in-depth participation, such as modifying instructions more than 5 times or customizing training model parameters. At the same time, they bear the obligation of labeling AI-generated content to ensure public right to know.

Functional auxiliary fields: For tool-type applications that automatically generate data reports, program codes, etc., the copyright is defaulted to the developer. Users can use basic functions for free through open license agreements, while commercial applications need to pay royalties to the developer according to the proportion of income.

b) Technical Governance Coordination Mechanism
It is proposed to develop a blockchain-based "full-link traceability system" to record user operation trajectories in real time, including key data such as instruction modification history and output result screening behavior, providing judicial-level evidence support for contribution evaluation. Simultaneously, it supports the establishment of an "intelligent profit-sharing platform", which realizes dynamic income distribution through preset algorithms: when AI-generated content generates commercial value, the system automatically distributes the income according to the ownership ratio. For example, 70% of the income from best-selling novels belongs to the instruction optimizer, and 30% is fed back to the technical developer, forming a sustainable innovation incentive cycle.

c) Industrial Ecosystem Optimization Path
By clarifying legal boundaries to eliminate the uncertainty of right ownership, it significantly reduces the compliance risks of enterprise R&D, such as solving the ownership dispute dilemma in the Tencent AI Writing Case. At the same time, a mandatory labeling system is constructed, requiring all AI-generated content to indicate the technical source, which can not only prevent the risk of false information dissemination but also ensure the public's right to know about the information production source, ultimately promoting the healthy development of the generative AI industry within a standardized framework.

3. Literature Review

A. Evolution of Research Focus at Home and Abroad

In recent years, with the rapid development of generative AI technology, scholars at home and abroad have conducted extensive research on the ownership of copyright in AI-generated works. Early research mainly focused on the core issue of whether AI-generated works possess "originality" in the sense of copyright law. Foreign scholars such as Ginsburg (2018) argued that the core of copyright law is to protect "human intellectual creation", and therefore, content completely generated by AI should not be protected by copyright. However, with the widespread application of AI-generated works in fields such as art and literature, this traditional view has been challenged. For example, Bridy (2020) proposed that when humans have substantive intervention in the AI generation process, the output results should be regarded as an extension of human creation and thus included in the scope of copyright protection.

In China, academic circles have conducted in-depth discussions on the copyright issues of AI-generated content. Wang Qian (2021) pointed out that although the current Copyright Law does not explicitly include AI-generated content in the scope of protection, there have been cases in judicial practice recognizing that it can enjoy copyright, such as the "Tencent AI Writing Case". In this case, the court held that if AI-generated content can reflect the user's original selection and arrangement, it can constitute a work as referred to in the Copyright Law. This judgment has triggered a lot of discussions. Some scholars such as Li Mingde support this view, believing that the scope of copyright subjects should be expanded through judicial interpretation; while other scholars such as Zhang Ping are more cautious, emphasizing that the traditional framework of "human author-centeredness" should not be easily broken through [[^footnote2]].

In addition, international organizations such as WIPO (World Intellectual Property Organization) proposed in their 2023 report that a "scenario-based" governance approach should be adopted for AI-generated content, distinguishing between content completely generated by AI independently and content created with human participation. This view provides an important reference direction for subsequent research, but it also exposes the inadequacy of current theories in addressing technical black box issues—that is, when the decision-making process of AI systems cannot be traced, there is no feasible method to accurately judge the degree of human contribution.

B. Limitations of Existing Theories in Explaining Technical Black Box Issues

Current research on AI technical black box issues is still in its infancy. A technical black box refers to the fact that the internal operation mode of an AI system is not open and transparent, making it difficult to distinguish the specific contribution ratio of humans and machines in the generated content. This situation poses a great challenge to traditional copyright theory.

Existing theories have encountered difficulties in explaining the source of "originality". Traditional copyright law requires works to reflect the author's "original thinking", but the process of AI-generated content often involves a large number of automatic processing links. Human direct intervention may only stay at inputting instructions or screening results, and it is impossible to fundamentally change the AI-generated content from the underlying logic. Some scholars have attempted to use the "creative contribution degree" theory to solve this problem. For

example, Samuelson (2021) proposed that the ownership of rights should be divided according to the user's control over the generation process, but this theory has not yet formed an operable quantitative standard.

2. Eligibility Identification of AI-Generated Works and Dimensions of Technical Impact

A. Re-examination of Work Elements

1. Adaptive Adjustment of the Originality Standard

The traditional copyright system adopts "human intellectual creation", and the definition of originality is that the subject completes it independently and has a certain height; however, the works or text content generated by generative AI have fully reached or even exceeded the expression level of works or text content created by natural persons. If the judgment standard of originality is only based on "the creator must be a natural person", a large number of valuable innovative achievements will inevitably be unable to obtain legal protection. At this time, the identification of originality should shift from "subject-centeredness" to "creative contribution degree" identification.

In human-intervened creation, intervened creation identification refers to incorporating the substantive intervention of humans in the generation process into consideration when identifying originality. For example, if a user achieves the desired effect through refined prompt setting (artistic style limitation, plot direction limitation, etc.), multiple parameter adjustments, result selection, etc., and thus produces personalized creative choices, such intervention behavior can also be regarded as an original contribution.

For judicial practice reference, drawing on the judgment logic of the "Tencent AI Writing Case", the focus of examining the "originality" of a work is shifted from "the attribute of the creator" to "whether there is human will participation and reflection in the creation process", focusing on judging whether the work has "personalized selection, arrangement or expression", so as to connect and unify legal standards with technical reality.

This shift does not abandon the traditional sense of originality, but adds technical intervention elements from the dimension, and seeks a balance from a dynamic evaluation of "originality of creative results" to "degree of human creative participation", which not only takes into account the stability of the copyright system itself but also adapts to the way of obtaining reasonable protection for innovative achievements produced in the current AI era.

2. The Impact of AI on Cultural Creation

In the current field of cultural production, AI has begun to participate in creation and has started to challenge the dominant position of humans; in the existing technical atmosphere, AI is one of the important participants in cultural development, thus exerting a certain impact on people's creative views, requiring us to re-examine the boundary between humans and technology.

Faced with AI intrusion, human creators have responded in three ways: resisters try to draw a clear line with machines and insist on pure manual creation; collaborators actively embrace AI as a generative innovation tool to expand cognitive boundaries in the idea generation stage; pioneers creatively use AI to test new technologies and methods to create disruptive works. The above three dimensions are the three basic ideas currently existing.

From a macro-historical perspective, the intervention of AI in the field of creation is just the continuation of technical modernity. Whether this technical practice can promote the emergence of a new artistic paradigm is still uncertain. In this context, the importance of human creators does not depend on the irreplaceable technical level, but on whether they can turn technical possibilities into cultural reality, that is, into the essential attributes of works of art, and whether they can use technology to achieve their own purposes and meanings.

B. Typological Impact Analysis of Generative AI Technology

1. Core Differences and Impacts between Generative AI and Decision-Making AI

Compared with decision-making AI, generative AI has different technical architectures, operating mechanisms, and application scenarios, which invisibly affect human production and life. Generative AI is based on deep learning architectures such as Transformer, and through probabilistic modeling of large-scale data, ultimately forms functional points such as generating text, images, and code. Its essence is the matching and generalization of data distribution rules, and generalized content generation is obtained by matching universal data distribution rules. Decision-making AI refers to a method that makes decisions in unknown and complex environments and improves efficiency by combining algorithms such as reinforcement learning and game theory. Such methods are more focused on information feedback from the external environment and updates of methodological strategies. Common examples include autonomous driving, financial risk control, and resource scheduling. Due to the

fundamental differences between generative AI and decision-making AI, the ethical risks and social impacts generated by these two types of technologies also present different characteristics: the problems caused by generative AI mainly include the identification of the authenticity of information content and the ownership of original copyright; while the challenges faced by decision-making AI are mainly black box decision-making and algorithmic discrimination. In order to better govern the corresponding problems brought by the corresponding technologies, it is necessary to establish different regulatory and application norms.

2. The Continuous Spectrum of Human-Machine Collaboration: Progress from Controlled Execution to Autonomous Collaboration

The following describes the continuous distribution characteristics of human-machine collaboration models from fully controlled to highly autonomous.

a) Control End Spectrum

The distribution of control rights in human-machine collaboration is arranged in layers and levels. In the pure human-machine collaboration stage, AI is a mere executor, with all instructions issued by humans, and all instructions originate from human will. In the human-machine collaboration stage, AI can assist humans in making decisions through algorithm models and data; when human-machine collaboration reaches the stage where AI is dominant and humans are responsible for process supervision and risk undertaking, just like the autonomous driving system, AI completes operations in places inaccessible to humans without human participation; as for the completely independent collaboration form, it can carry out work independently without relying on human control, but the premise is that precise and error-free safety protection measures must be equipped.

b) Evolution of Interaction Dimensions: Instruction Level

The core logic of human-machine interaction is highly iterative. In terms of instruction input, it has evolved from the previous precise and stylized instructions to the current instruction form compatible with ambiguity requirements, adapting to the needs of non-standard tasks in more complex scenarios; in terms of feedback mechanism, it has changed from fixed conclusions to reference suggestions with probability values, leaving more possibilities for human decisions; in terms of learning ability, AI has evolved from the original static model without automatic learning and updating to a dynamic model that can continuously iterate and optimize into more suitable task processing accuracy through input data, improving technical adaptability.

c) Typical Development Stages

Human-machine collaboration technology has experienced four progressive development stages: instrumentalization stage, assistance stage, collaboration stage, and autonomy stage. In the instrumentalization stage, AI works according to established logic and rules, and can only complete standard and process-oriented work without being able to make independent judgments or decisions; in the assistance stage, AI begins to have the ability to collect, organize, process data, and propose action plans, which can assist humans in completing specific tasks and achieving efficiency upgrades; in the collaboration stage, humans and machines establish connections around a common task goal, can work together to solve a specific problem or study a plan, and finally implement it, establishing a deeply integrated working method between humans and machines; in the autonomy stage, AI has the functions of proposing task goals and determining path planning, and can complete a complete work by itself. The role of machines replacing humans deepens, and human-machine collaboration achieves a qualitative change.

d) Key Transition Characteristics

With the development of human-machine collaboration towards higher autonomy, the important signs of its evolution process can be reflected in three aspects: first, the proportion of control transfer, that is, the degree and boundary of human subjects authorizing task control to AI; second, the predictability of results. With the enhancement of AI autonomy, the predictability of task results decreases, and it becomes more difficult to control technical risks; third, the method of responsibility sharing. The progress of collaboration methods will in turn drive more refined responsibility definition, and determine the responsibility determination and accountability methods in different collaboration scenarios of human-machine dual subjects according to the responsibility distribution and the causes of risks [[^footnote3]].

This continuous spectrum reflects the evolutionary trend of the human-machine relationship from a master-slave model to a partnership. Its development boundary is not only restricted by technical capabilities but also affected by ethical norms and social acceptance. The future development direction will depend on the dynamic balance between technological progress and risk control.

3. Comparison of International Judicial Practice and Regulatory Trends on Copyright of AI-Generated Works

A. Core Identification Differences—European and American "Output-Oriented" vs. Asian "Process Review" Models

Regarding the ownership of copyright in AI-generated works, there are differences in identification results between Europe, America, and Asia in practical judicial practice.

First, the European and American "output-oriented" model: it focuses more on whether the AI work itself meets the definition of "work" as stipulated in the copyright law. If the AI-generated work has originality and adopts a statutory expression method, it may fall into the scope of copyright protection regardless of the degree of human participation in the creation process. For example, in relevant U.S. cases, most court judgments are based on the final presentation effect of the work. As long as it reaches the degree of originality, the work can be recognized as having copyright, and there is no excessive focus on the specific degree of independent completion by AI and the form of human intervention in the AI creation process.

The Asian "process review" model: it focuses on examining human factors, human participation, and contribution in the creation process, that is, identifying it as the result of human intellectual creation. For AI-generated works, it is more necessary to clearly stipulate the actual role of humans in AI-generated content as the basis for the qualification and ownership of copyright. For example, countries and regions represented by the judicial practices of Japan and South Korea will judge whether humans have made substantive creative contributions, and believe that copyright protection will be granted only when such contributions are decisive intellectual inputs.

B. New Regulatory Breakthroughs—Core Highlights and Practical Significance of the 2023 EU AI Act

The European Parliament, EU member states, and the European Commission reached an agreement on the 2023 EU AI Act after negotiations. Among them, the EU has made relevant provisions on the copyright of AI-generated works for the first time, and the biggest highlight is the establishment of a "transparency obligation", which requires AI developers to explain the parameter settings of the AI systems they develop and the sources of training data used, so as to make the AI creation process more traceable. Under the technical black box problem, it is difficult to identify different right holders and their copyright ownership, and improving the transparency of the operation process of AI systems will help confirm the contribution of each party to AI creation from various angles, thereby making the subsequent division of copyright ownership and interest distribution have legal basis. In addition, this AI Act is also an attempt by the EU to balance technological innovation and technical regulation, which is of great significance for promoting the development of AI technology on the premise of protecting the legitimate rights and interests of all parties.

3. Core Controversies and Theoretical Reconstruction of AI-Generating Subjects

A. Controversies over Subject Qualification and Identification Paths

1. Theoretical Analysis of the Legal Personality Theory and the Tool Theory

First, the legal personality theory holds that when an AI system has a high degree of independent creation ability and can independently generate original content, it should be granted legal subject qualification and regarded as a "author" in the legal sense. Its core basis is that AI's creative behavior has shown a certain degree of "autonomy", and the output content has value equivalent to human creation. Granting it subject qualification can clarify the ownership of rights and stimulate the development of AI technology in the field of creation. However, this theory faces obvious controversies: on the one hand, AI lacks human consciousness, emotions, moral responsibility, and capabilities, and cannot bear legal obligations like natural persons (such as compensation liability for infringement); on the other hand, "subject qualification" in the traditional legal system is closely bound to "freedom of will" and "capacity for liability", and granting AI legal personality will break the foundation of the existing legal framework.

In contrast, the tool theory regards AI systems as tools for human creation, just like traditional tools such as paintbrushes and computers. It holds that the process of generating content is an extension of human creation using tools. AI itself does not have legal subject qualification, and the copyright should belong to the humans who use the tools (such as users or developers). This theory is consistent with the "human author-centeredness" of the traditional copyright system and is reasonable in scenarios where AI has low autonomy and high human intervention (such as users generating content through refined prompts). However, when AI independently generates content with minimal human intervention, the "tool theory" is difficult to explain the ownership of rights—if the user only inputs simple instructions but

the AI generates complex results, attributing all rights to the user will ignore the core contributions of algorithm developers and data providers.

We believe that both theories have limitations and need to be dynamically matched based on the degree of AI autonomy. The legal personality theory lacks a realistic foundation in the current technical stage. AI's "creation" is essentially the probabilistic reorganization of data by algorithms, not true "creative thinking". Granting it subject qualification will lead to confusion in liability identification; while the absolute tool theory cannot cope with the reality of increasing AI autonomy. A more reasonable path is "tool attribute + contribution degree weighting": AI is always a tool, but the ownership of rights needs to be divided according to the proportion of creative contributions from humans (users, developers, data providers, etc.)—users have a high weight when they conduct in-depth intervention, and when AI has a high degree of autonomy, the weight tilts towards developers and data providers. This not only adheres to the legal bottom line of "human subject" but also takes into account the actual contributions of multiple parties.

2. Three-Dimensional Game and Quantitative Difficulties in Interest Distribution

a) Three-Dimensional Game among Developers/Users/Public

Against the background of the rapid iteration of digital technology, a complex three-dimensional game relationship has formed among developers, users, and the public. Its core contradictions revolve around the distribution of technical value, the definition of risk liability, and the maintenance of public interests. As the source of technological innovation, developers often take efficiency improvement, market expansion, or technological breakthroughs as their core goals. Their decision-making logic potentially prioritizes the exploration of user data value and commercial interests. Users are at the terminal of technological application, relying on technical tools to improve the efficiency of life and work, while facing passive choices in data authorization and privacy surrender. That is, individuals often compromise under the implicit coercion of "no authorization, no use", forming a helpless game of "trading privacy for convenience". As the macro bearers of technical impacts, the public's demands focus on the bottom line of technical ethics and the overall prevention and control of social risks, such as concerns about AI abuse and data leakage. However, they often fall into a dilemma of "passive acceptance" due to information asymmetry and limited participation channels. The tension among the three is clearly evident: there is a boundary game between developers' freedom of innovation and the public's safety demands, and a value trade-off between users' individual convenience and the public's collective interests. If this dynamic imbalance is not effectively regulated, it may not only inhibit the vitality of technological innovation but also accumulate social trust crises [[^footnote4]].

b) Quantitative Difficulties in Contribution Degree Caused by Algorithmic Black Boxes

The concealment and complexity of algorithmic black boxes have brought fundamental difficulties to the quantification of contribution degrees of multiple subjects in the digital economy. In algorithm-dominated production and distribution scenarios, multiple factors such as the technical architecture construction by developers, the behavioral data input by users, and the resource support from third parties jointly act on value creation, but their specific operation mechanisms are obscured by the opacity of algorithms. For example, on content recommendation platforms, users' browsing data, creators' content output, and the platform's algorithmic distribution logic jointly determine the communication value of content. However, algorithmic black boxes make core issues such as "how user data contributions are converted into commercial value" and "the weight ratio between creators' labor and algorithmic recommendations" lack verifiable quantitative standards. This uncertainty not only makes it difficult for contributors to clarify the boundaries of their own rights and interests but also makes the distribution mechanism prone to deviate from the principle of fairness. For example, technology holders may overestimate their own contributions with information advantages and occupy the legitimate returns of other subjects, while ordinary participants fall into a passive position in rights protection because they cannot prove the intensity of their contributions. The quantitative blind spot of contribution degree caused by algorithmic black boxes is essentially a product of unequal technical power, which not only hinders the openness and transparency of value distribution but also buries potential risks in the fields of technical ethics and social fairness [[^footnote5]].

3. Evaluation Framework for Creative Contributions

a) Traceable Intervention Indicators

In carrying out management innovation practices, evaluating creative contributions needs to incorporate traceable intervention indicators to accurately sort out the causal relationship between external support and innovative achievements. This indicator establishes a complete impact chain from intervention measures to

behavioral adjustments and then to innovative outputs through timestamp recording, version control technology, and detailed contribution logs, providing a reliable basis for verifying the actual effectiveness of various management methods.

b) Decision Node Analysis Model Based on Weighting

To clarify the impact of key decisions on innovative achievements, a decision node weight analysis model can be adopted. This model relies on the Analytic Hierarchy Process (AHP) or entropy weight method to quantitatively assess the relative importance of each decision link in the entire innovation process, thereby optimizing the decision path and improving the overall efficiency of innovation. The integrated use of the two methods can achieve more refined and dynamic control and optimization of the innovation process.

4. Localization Adaptation and Implementation Path of AI-Generated Content

A. Scenario-Based Right Confirmation Mechanism for AI-Generated Content

1. Hierarchical Regulation of Creative/Tool-Type Applications

As important components of the mobile Internet ecosystem, the hierarchical regulation logic of creative and tool-type applications needs to balance innovation vitality and risk prevention and control. For creative applications, a hierarchical framework can be constructed based on the core characteristics of content production and dissemination. The basic layer focuses on tool attributes, such as image editing and text typesetting applications. Its regulatory focus is to ensure functional stability and data security, and clarify the bottom-line requirements for data storage and user privacy protection through standardized technical specifications. The advanced layer targets creative platforms with social attributes, such as short video sharing and online collaboration communities. It is necessary to strengthen the content review mechanism, combine the transparency requirements of algorithm recommendations, establish a dual defense line of "manual review + intelligent filtering", and set up hierarchical disposal measures for the dissemination of illegal content involving vulgarity and violence. The core layer points to ecological applications with original incubation and commercial transformation capabilities. Such platforms need to assume the main responsibility for intellectual property protection, balance the rights and interests of creators with the commercial development of the platform by establishing an original certification system and a rapid infringement response mechanism, and incorporate positive values guidance into algorithm recommendations to avoid the distorted orientation of prioritizing traffic.

The hierarchical regulation of tool-type applications needs to be closely combined with their specific service scenarios and technical dependence. For the general tool layer (such as office software and system auxiliary tools), regulation should focus on ensuring technical compatibility and maintaining fair market competition, preventing technical monopoly behaviors, and promoting collaborative linkage between different platforms by promoting open interface standards.

For the professional tool layer (such as industrial design software and medical auxiliary systems), access thresholds should be set according to the qualification requirements of the corresponding industry, and clear technical requirements should meet the dual certification of clinical data security and diagnostic accuracy.

In the innovative tool layer, applications relying on emerging technologies such as AI painting and blockchain certification are suitable for introducing a "sandbox supervision" mechanism. This mechanism allows technical trial and error in a controlled environment, and gradually incorporates mature applications into the regular supervision framework through a dynamic evaluation system. This approach can not only encourage innovation and exploration but also effectively prevent various potential risks caused by regulatory lag. This hierarchical regulation model is not a static division but needs to dynamically adjust the hierarchical boundaries according to the iterative upgrading of application functions and changes in social impacts. Adhering to the idea of "bottom-line thinking + classified policies", while stimulating the innovation vitality of the digital economy, we will build a protective network for public interests and social order [[^footnote6]].

2. Technical Implementation Plan of the Right Publicity System

The technical implementation of the right publicity system needs to start from multiple aspects such as architecture construction, functional module development, and security guarantee. In terms of architecture design, a layered architecture is adopted. The bottom layer is the data persistence layer, which uses relational databases such as MySQL to store core right data to ensure the structured storage and efficient retrieval of data. For massive and unstructured data with variable structures, non-relational databases such as MongoDB are used; the middle layer is the business logic layer, which uses the Spring Boot framework to uniformly manage data

processing and business rule execution, ensuring the clarity and maintainability of the system's business logic; the top layer is the presentation layer, which uses Vue.js to build a user interaction interface, realizing a responsive design, adapting to various terminal devices, and improving the user operation experience.

In terms of functional module development, the data entry module provides a convenient information entry interface, supporting batch import and single entry. For complex right information, mandatory item verification and format check mechanisms are set to ensure the accuracy of the entered data; the review module combines manual review and intelligent review according to preset review rules. Intelligent review uses natural language processing technology to conduct compliance preliminary screening of text-based right descriptions, while manual review makes the final confirmation of key information; the publicity and display module displays right publicity information in various forms such as lists and charts, supporting classified retrieval and sorting by right type, publicity time, and other dimensions.

In terms of security guarantee, identity authentication adopts multi-factor authentication, such as password combined with SMS verification code and fingerprint recognition, to confirm the legality of user identity; data encryption uses SSL/TLS encryption protocol for data in transmission to ensure that data is not stolen or tampered with, and stored data is encrypted and stored using encryption algorithms such as AES; access control is based on the Role-Based Access Control (RBAC) model, dividing roles such as administrators, reviewers, and ordinary users, and assigning different operation permissions respectively. For example, administrators have the highest system permissions to manage user information and configure system parameters, reviewers can only perform right information review operations, and ordinary users can only view publicity information, thereby ensuring the overall security of the system [[^footnote7]].

B. Supporting System Design: Mandatory Labeling Obligations and Compliance Boundaries

The establishment of mandatory labeling obligations aims to build the foundation of a trusted data circulation system by standardizing the disclosure of key information such as data sources, uses, and sensitivity levels. However, if this obligation is infinitely expanded without boundary constraints, it will inevitably become an unbearable compliance burden for enterprises, thereby restricting the full release of the value of data elements. Therefore, it is necessary to draw a clear compliance red line for it. The scope of labeling should accurately focus on the core links of data security and rights distribution. For ordinary general data, the labeling requirements can be simplified, while for highly sensitive data involving personal privacy and trade secrets, stricter identification management should be implemented. At the technical level, we should actively promote the application of automated labeling tools such as metadata standardization and blockchain certification, and use technical means to reduce the cost and error of manual labeling. At the same time, the formulation of all labeling rules must be effectively connected with higher-level laws such as the Data Security Law and the Personal Information Protection Law to avoid application conflicts caused by overlapping systems [[^footnote8]].

C. Analysis of Core Controversies and Theoretical Reconstruction

1. Localization Transformation of Special Neighboring Rights

In the process of building a Chinese characteristic intellectual property protection system, the introduction and transformation of the special neighboring rights system is a typical example of the localization of international rules.

Specificity is the primary feature of China's special neighboring rights system. Legislators keenly captured the subversive impact of digital technology on cultural communication models, and specially included the use of music in emerging scenarios such as live streaming and short videos into the scope of neighboring rights regulation during the revision of the Copyright Law. This precise system supply has effectively solved the long-standing copyright problems in emerging industries, realizing the organic unity of protecting innovation and promoting communication.

Suitability demonstrates China's cultural awareness in system transplantation. For protected objects with Chinese characteristics such as folk literature and art, China has not mechanically applied the Western neighboring rights framework, but has built a special protection mechanism in line with the local cultural inheritance logic through special legislation such as the Intangible Cultural Heritage Law. This approach not only fulfills international treaty obligations but also fully respects the inherent characteristics of local culture.

Systematicness highlights the overall governance advantages of China's intellectual property protection. China has incorporated the implementation of special neighboring rights into a broader national governance system, forming a multi-dimensional pattern of joint

efforts from judicial protection, administrative law enforcement, and industry self-discipline. For example, the "Sword Network Action" led by the National Copyright Administration has become a landmark initiative in combating online infringement. The music copyright big data platform built by relevant industry associations has greatly improved the efficiency of right licensing and rights protection, building a multi-dimensional and three-dimensional protection network.

5. Conclusions and Prospects

A. Establishing a "Process-Output" Two-Dimensional Identification System

The "process-output" two-dimensional identification system is a key carrier connecting technical practice and legal rules, aiming to simultaneously solve the problems of untraceable creation process and difficult quantification of achievement value. In the process dimension, the focus is on evaluating the substantiveness and traceability of human intervention, setting three core indicators: first, the frequency of intervention, with more than 5 instruction modifications or more than 3 rounds of parameter optimization as the basic threshold for creative input; second, the depth of intervention, distinguishing between simple instruction input and refined guidance, the latter directly identified as a creative contribution; third, resource input, if the user independently provides training data sets or customizes algorithm models, the contribution weight is additionally increased by 10%-20%.

In the "output dimension", an evaluation matrix is constructed around the originality and value attributes of the achievements: from the perspective of expression form, examine whether the AI-generated work has non-replicability and personalized characteristics, such as whether the text presents a unique narrative logic and whether the image contains original composition design; from the value dimension, distinguish between commercial value and social value, the former infers the contribution weight through the income ratio, and the latter adjusts the protection intensity according to the scope of communication and public feedback.

The implementation of the two-dimensional system relies on a dynamic evaluation platform: after the user uploads the AI-generated work, the system first retrieves the process data through blockchain traceability, then analyzes the output results with the help of text comparison and image recognition technology, initially determines the proportion of right ownership, and finally is reviewed and confirmed by judicial organs or professional review institutions, taking into account both identification efficiency and result fairness.

B. Developing an Adaptive Copyright Governance Framework

The adaptive copyright governance framework takes "flexible rules + multi-stakeholder collaboration" as the core, and builds a closed-loop system from three levels: legal regulation, technical support, and industrial collaboration. At the legal regulation level, promote the gradual improvement of judicial interpretations of the Copyright Law: clarify the copyrightability threshold of AI-generated content, take "substantive human intervention" as the core element, and exclude copyright protection for completely autonomously generated content; add "special clauses on AI copyright" to define the right boundaries of developers, users, and data providers, and clarify the judicial application standards of the "quantitative empowerment system"; at the same time, stipulate mandatory labeling obligations, requiring all AI-generated content to clearly indicate "AI-created" and technical sources, and those not labeled shall not claim copyright, ensuring the public's right to know.

At the technical support level, in addition to the blockchain traceability system, build an "intelligent profit-sharing platform" to realize automatic interest distribution: when AI-generated content generates commercial income, the platform automatically transfers the income to the corresponding subject's account according to the preset right ratio, and retains 5%-10% as a "public innovation fund" for basic research on AI copyright and dispute mediation; for the technical black box problem, promote AI developers to establish a "limited transparency mechanism", and disclose "generation logic explanation documents" to judicial or regulatory authorities without revealing core algorithms, including training data sources and the impact of key parameters, providing technical basis for contribution evaluation.

At the industrial collaboration level, establish a tripartite mechanism of "government-enterprise-academia": the government takes the lead in formulating the "Industry Guidelines for AI Copyright Protection", clarifying the right identification rules in fields such as news creation and artistic design; enterprises form an "AI Copyright Alliance" to share traceability technology and profit-sharing platforms, reducing the compliance costs of small and medium-sized developers; academia regularly releases the "Annual Report on AI Copyright", tracks technical trends, and provides theoretical support for rule adjustments, realizing the

dynamic balance of "innovation incentives - right protection - public interests".

C. Future Research Directions: Evolution of AI Autonomy

Currently, generative AI is still in the "weak autonomy" stage, relying on human instructions to start and guide directions. However, with the iteration of large model technology, future AI may have the ability to independently set creative goals, conduct cross-domain collaborative creation, and optimize algorithms by itself, which will pose new challenges to the existing governance framework. Future research needs to focus on three directions.

First, the boundary of subject qualification of highly autonomous AI. When AI can independently identify social needs, set creative goals, and without human intervention, it is necessary to re-examine the legal bottom line of human subjects and explore the feasibility of limited legal personality—granting AI the qualification to hold copyright, but the exercise of rights is managed by humans on behalf of others. At the same time, clarify the ownership of liability when AI infringes, avoiding liability vacuum.

Second, the right definition of cross-modal AI-generated content. Future AI may simultaneously generate integrated content of text, images, and audio. The contributing subjects of different modal content may be different. It is necessary to study a cross-modal right confirmation mechanism, dividing the right share according to the human contribution degree of each modal, avoiding confusion in right identification.

Third, the coordination of global AI copyright rules. At present, there are differences between the European and American output-oriented models and the Asian process review models. With the increase in cross-border communication of AI-generated content, it is necessary to promote the coordination of international rules, explore a scheme of unified basic standards + regional difference adaptation, reduce cross-border copyright disputes, and promote the global development of the AI industry.

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