https://doi.org/10.37420/j.mlr.2026.001

Artificial Intelligence Empowers Environmental Crime Investigation: Applications, Challenges and Optimization Strategies

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Abstract

The continuous advancement of industrialization has intensified global ecological and environmental pressures, making environmental issues increasingly severe in various countries, and environmental crime has become a key concern worldwide. Endowed with powerful data analysis, pattern recognition, and efficient processing capabilities, artificial intelligence (AI) is gradually penetrating the entire process of environmental crime investigation. It provides a new path to break through the limitations of traditional investigation models and improve crackdown efficiency, while also giving rise to multiple challenges such as technological adaptation, institutional regulation, and ethical balance. Based on the practical applications of AI in core links of environmental crime investigation—including clue mining, evidence collection and analysis, and criminal suspect tracking—this paper systematically analyzes key problems such as uneven data quality, insufficient algorithm reliability, lagging legal regulation, and shortage of interdisciplinary talents. Furthermore, targeted countermeasures are proposed from three dimensions: technological optimization, institutional improvement, and talent cultivation. This study aims to provide practical references for promoting the in-depth integration of AI and environmental crime investigation, as well as enhancing the modernization level of ecological environment governance.

Keywords: Artificial Intelligence;Environmental Crime Investigation;Data Governance

1.Introduction

Since the 18th National Congress of the Communist Party of China elevated ecological civilization construction to a national strategic height, China’s ecological civilization drive has entered a fast track. The system of ecological and environmental policies and institutions has been continuously improved, a series of major ecological protection and restoration projects have been implemented, and departments at all levels have intensified law enforcement efforts, jointly promoting the greening and low-carbonization of economic and social development. The Report to the 20th National Congress of the Communist Party of China emphasizes the need to “firmly establish and practice the concept that lucid waters and lush mountains are invaluable assets, and plan development from the perspective of harmonious coexistence between humans and nature,” marking that China’s ecological civilization construction has entered a stage of high-quality development and integration. With the high attention of the state and the active response of government departments at all levels, remarkable

achievements have been made in ecological protection and restoration. The detection and investigation rates of environmental crimes have increased, gradually forming a sound social atmosphere of jointly combating environmental crimes and safeguarding the ecological environment. However, in recent years, environmental crimes have evolved with increasingly diverse, concealed, and intelligent forms, along with more prominent cross-regional and transnational characteristics, which are difficult for traditional investigation models to address. [1]For instance, illegal discharge of pollutants using high-tech equipment and tampering with environmental monitoring data have made it hard for traditional investigation methods to obtain effective clues and evidence. Fortunately, the rapid development of artificial intelligence (AI) technology has brought new opportunities and transformations to environmental crime investigation.

The introduction of AI technology into environmental crime investigation can break through the limitations of traditional models. For example, big data and AI algorithms can automatically process and analyze massive amounts of data covering environmental monitoring, enterprise production, logistics and transportation, thereby mining clues, identifying patterns, and conducting predictive analysis. In cases where electronic evidence is deleted or damaged during investigations, data recovery technologies and algorithms can be used to retrieve it. Such applications of AI provide strong technical support for traditional investigation models, promoting their transformation into intelligent investigation models. This not only improves investigation efficiency and accuracy but also expands the scope of investigations and optimizes the allocation of relevant resources. Nevertheless, we must recognize the problems and challenges exposed in the application process: the massive volume and complex sources of data make it difficult to guarantee data quality and security; excessive reliance on algorithms leads to the hasty application of flawed algorithmic models; the rapid update of technology results in a shortage of qualified talents; and there is a certain lag in relevant laws and regulations. Only by addressing these difficulties can we improve the accuracy and efficiency of investigations, enhance their legality and impartiality, further expand the breadth and depth of environmental crime investigation, and provide a strong guarantee for ecological security and social stability.

2.Applications of Artificial Intelligence in Environmental Crime Investigation

The reshaping of investigation models by technology is often first reflected in its implementation in specific operational scenarios. Artificial intelligence has advanced rapidly in environmental governance and law enforcement precisely because it aligns deeply with investigative practice, providing incremental capabilities to traditional case-handling models across multiple key dimensions.

2.1. Clue Discovery and Mining

Environmental crimes involve a wide range of fields, including industry, mining, agriculture, forestry, marine affairs, waste disposal, and environmental monitoring, often leaving traces in various types of data. Consequently, environmental crime investigation involves massive and complex datasets that are difficult for traditional manual analysis methods to process within a short time frame. In contrast, AI technologies—such as remote sensing and the Internet of Things (IoT)—enable real-time monitoring of massive envi-

ronmental data. They can also quickly integrate, screen, classify, and comprehensively analyze data from diverse sources, including enterprise production data, environmental monitoring data, satellite remote sensing data, and logistics and transportation data. This multi-source data fusion analysis can identify potential abnormal fluctuations and correlations, thereby accurately mining clues related to environmental crimes.

For example, an AI-based satellite imagery analysis system developed by Politecnico di Milano has achieved an identification accuracy of over 90% for illegal landfills through the integrated application of satellite remote sensing and intelligent algorithms. This technology has been implemented in multiple European countries and significantly shortened the investigation cycle in pilot projects covering more than 100 cities in Lombardy, serving as a typical practice of large-scale environmental crime clue mining using AI. [2]The same logic applies to specific scenarios such as enterprise pollution monitoring: by constructing intelligent data models to compare and analyze enterprises' electricity consumption, water usage, and pollutant discharge data, anomalies—such as a significant increase in electricity and water consumption without a corresponding change in pollutant emissions—may indicate illegal discharge or data tampering by the enterprise. AI algorithms can complete data collection and analysis tasks in hours that would take humans weeks or even months, greatly reducing the time required to discover clues and improving the speed and accuracy of investigations. Additionally, machine learning algorithms can be trained on data from specific types of environmental crime cases to build crime prediction or investigation models, providing proactive clue guidance for law enforcement agencies.

2.2. Evidence Collection and Analysis

Environmental crime cases often involve a large number of electronic devices and data, featuring high professionalism and complexity. How to collect electronic evidence and ensure its validity has long been an urgent problem in investigative work. AI technology can assist investigators in quickly searching, extracting, and preserving such electronic evidence. For instance, data recovery software and AI algorithms can retrieve deleted or damaged environmental monitoring data; analyzing communication records can reveal contact information and criminal planning processes among suspects.

Furthermore, AI technology can be applied to the component analysis and identification of collected environmental samples (e.g., water, soil, and biological samples). For example, soil sample analysis can pinpoint the source of heavy metal pollution to a nearby illegal mining site, providing strong support for building a complete evidence chain. Leveraging the three-tier architecture (perception layer, network layer, and application layer) of AI-based environmental monitoring platforms enables rapid and accurate detection of pollutants in multiple media (atmosphere, water, and soil), [3]addressing the shortcomings of traditional monitoring methods such as insufficient timeliness and high costs.

2.3. Tracking and Locating Criminal Suspects

AI image recognition technology plays different roles depending on the type of collected images and specific technical characteristics. Firstly, it can identify satellite images or drone aerial images to perceive environmental changes and abnormalities, thereby accurately locating specific targets such as illegal mining sites and the diffusion range of polluted water bodies. Secondly, it can recognize features of specific

individuals and vehicles for trajectory tracking. For example, based on video data collected by surveillance equipment, facial and license plate recognition can be performed; connecting data from multiple surveillance points allows tracing transportation or escape routes, locking the suspects' activity scope, and defining the investigation range.

To enhance recognition precision, mobile phone positioning and vehicle GPS data can be integrated for comprehensive analysis, enabling the mapping of complete activity trajectory maps. Given the cross-regional nature of many environmental crimes, establishing cross-regional special case collaboration mechanisms and integrating image recognition and trajectory tracking data from multiple regions can break geographical barriers. This achieves full-chain tracking of suspects' transportation and escape routes, improving the effectiveness of cross-regional investigations.

3.Challenges Faced by Artificial Intelligence in Environmental Crime Investigation

The integration of any emerging technology into a traditional law enforcement system inevitably gives rise to issues of adaptability. While artificial intelligence demonstrates distinct advantages in environmental crime investigation, it also exposes a series of practical constraints stemming from technical characteristics, institutional supply, and ethical boundaries.

3.1. Technical Challenges: Uneven Data Quality and Errors Caused by Algorithmic Bias

Despite the comprehensive and in-depth application of AI technology in environmental crime investigation, certain technical bottlenecks persist. For instance, when processing complex environmental data, issues such as data overload and algorithmic deviation may arise, leading to inaccurate analysis results or misjudgments.

Data is the fuel for AI technology. Environmental crime investigation relies on data from a wide range of sources, resulting in massive datasets with uneven quality across different sources. This significantly impacts the training effectiveness and application performance of AI models. Errors, missing values, or tampering in data can distort the analysis results of AI algorithms, leading to misjudgments or broken evidence chains. Notably, more advanced technologies impose higher requirements on data resources, making improving data quality an inevitable prerequisite for ensuring the accuracy of analysis results.

While algorithms are the core of AI, blind faith in them is unwarranted. When the training data for an algorithm is biased, the algorithm itself may develop biases, resulting in misjudgments or omissions in practical applications. Although such algorithmic biases can potentially be addressed by optimizing data sources or improving data quality, the inevitable "algorithmic black box" phenomenon poses a significant challenge. Some complex AI algorithms, such as deep learning algorithms, have opaque and unexplainable decision-making processes, introducing inherent uncertainties that undermine investigation effectiveness.[4] Therefore, while utilizing these technologies, it is crucial to verify the reliability of algorithms and assess

their interpretability—specifically, whether the algorithm can continue to function effectively when environmental conditions or criminal patterns change.

3.2.Legal Challenges: Inadequate Legal Application and Unclear Legitimacy of AI-Generated Evidence

The Criminal Law and Civil Law contain partial provisions on the criminal liability of developers and users of AI systems. The Criminal Procedure Law also stipulates that evidence obtained by investigative organs using AI for auxiliary investigation must meet the requirements of legality, authenticity, and relevance as prescribed by the law. However, these regulations are far from sufficient to address the current status of technological application and judicial practice.

Firstly, AI-assisted investigation requires massive amounts of data for analysis, training, and learning. The process of data collection may involve enterprises' trade secrets and individuals' privacy. Nevertheless, relevant laws have not yet clearly defined the boundaries of data acquisition or specified the procedures for data collection, leading to practices such as data abuse or inadequate data collection and application in reality. Secondly, the standardized development of the current AI field relies on a multi-dimensional governance framework involving laws and regulations, national standards, and industry self-regulation. Although self-regulatory guidelines and voluntary technical specifications formulated by industry organizations or professional institutions can supplement the regulation of AI development and application, they lack legal enforceability. Meanwhile, some self-regulatory norms have poor connectivity with existing laws and regulations (such as the Data Security Law and the Personal Information Protection Law) and national standards (such as the National Artificial Intelligence Industry Comprehensive Standardization System Construction Guide (2024 Edition)), risking being ignored or not strictly followed in practical application. Thirdly, it is necessary to balance investigative needs with privacy protection. When using big data analysis to mine criminal clues, the collection and analysis of citizens' personal information may be involved; only by clarifying relevant legal procedures and boundaries can the legitimate rights and interests of citizens be prevented from being infringed.

In addition, there are information-sharing barriers between environmental protection departments and public security organs, and the conversion of administrative evidence to criminal evidence faces difficulties such as procedural and standard differences. The contradiction between the relatively short case filing review period for environmental crimes and the high professionalism of such cases further exacerbates the dilemma of legal application.[5] Notably, empirical studies have proven that the rigid threshold design commonly found in existing environmental laws has significant regulatory flaws. A field trial using AI satellite remote sensing technology in Wisconsin, USA, showed that rigid rules—such as distinguishing between large-scale and small-scale farms based on 1,000 animal units and setting February 1 as the starting point for the ban on winter manure spreading—resulted in 82% of verified environmental risk behaviors escaping regulation due to falling within the critical threshold range. In contrast, AI technology can accurately capture illegal clues in such legal gaps. [6]This contradiction of "technically detectable but legally unregulated" highlights the disjoint between the existing legal system and technical investigation capabilities.

There are no clear legal provisions on the evidential weight of AI-generated evidence. Issues such as the classification of AI-generated evidence and the evaluation of its reliability remain to be resolved. Therefore, it is necessary to further improve relevant evidence rules to ensure their effective admissibility in judicial practice.

3.3. Ethical Challenges: Conflicts Between Technological Application and Personal Rights, and the Imperative of Fairness and Transparency

The large-scale application of artificial intelligence technology in environmental crime investigation has markedly improved investigative efficiency, yet it also gives rise to multiple ethical conflicts, including inadequate protection of personal rights, imbalanced law enforcement fairness, and a lack of algorithmic transparency. First and foremost, the ambiguous boundaries of technological application are prone to infringe upon personal rights. Intelligent technologies widely adopted in environmental crime investigation, such as IoT monitoring, remote sensing imaging, and drone aerial photography, will easily cross the legal and ethical bottom lines of privacy protection if their scope of application and operational norms are not clearly defined. For instance, the use of drones for environmental monitoring and crime investigation may violate others' airspace privacy rights. Second, misjudgments and omissions caused by algorithmic biases in artificial intelligence can lead to unfair law enforcement. If the training data for an algorithm is one-sided, covering only certain types of regions or subjects, the algorithm is likely to perform poorly when applied to other regions or subjects. A typical example is that some small enterprises in impoverished areas, which have relatively backward equipment and technologies due to low economic development levels, are more likely to be identified by algorithms as having environmental crime risks. In reality, however, these enterprises fail to meet the same environmental protection standards as large enterprises merely due to objective constraints, resulting in unfair investigative outcomes.

The decision-making process of artificial intelligence algorithms is often an opaque "black box" operation. Insufficient public attention and awareness of such processes will arouse public doubts and dissatisfaction, eroding public trust in the technology. In the current artificial intelligence systems, the division of responsibilities among multiple stakeholders—including data providers, algorithm developers, system operators and users, and investigative organs—is not clear enough, which is likely to lead to mutual shifting of responsibilities and ambiguous accountability for relevant issues. Therefore, in the process of application, it is essential to prioritize fairness and transparency, take into account the economic conditions of different regions in a coordinated manner, and disclose relevant information in a timely manner. This is to prevent the exacerbation of social inequality, the disruption of the balance of enterprises' normal production activities, and the harm to the harmonious and stable social relations.

4.Optimization Strategies for the Application of Artificial Intelligence in Environmental Crime Investigation

Addressing the practical obstacles in technology application requires coordinated efforts across technical, institutional, and practical dimensions to build a more robust support system. Drawing on the problems and

shortcomings identified in the preceding analysis, this chapter proposes targeted and operable optimization approaches to inform the regulated, efficient, and sustainable application of artificial intelligence in environmental crime investigation.

4.1.Sustained Algorithmic Optimization and Data Quality Assurance

To address the current technical challenges of AI-assisted investigation, it is imperative to increase R&D investment in the application of AI technology in environmental crime investigation and encourage collaboration between law enforcement agencies and enterprises to jointly tackle technical bottlenecks. In terms of algorithm optimization, diverse training datasets should be adopted at the design stage, and rigorous data screening and preprocessing should be conducted to enhance data processing capacity and analytical accuracy, thus avoiding algorithmic bias caused by data deviation. Meanwhile, algorithm models need to be continuously refined to improve their accuracy and reliability. For example, in the development of algorithms for environmental sample analysis, it is necessary to collect and train on sample data from different regions and involving various types of pollution, and adopt methods such as cross-validation to evaluate algorithm performance and adjust algorithm parameters in a timely manner.

High-quality data is the foundation of effective investigation. In terms of improving data quality, a sound data quality management system should be established to implement strict quality control over the entire lifecycle of data involved in environmental crime investigation, from collection, transmission and storage to analysis, ensuring the authenticity, completeness and consistency of data. For data security assurance, advanced technical measures such as data encryption, access control and data backup can be adopted to safeguard data security at all stages. In the meantime, stringent data usage and management systems should be formulated to clarify data access permissions and operational procedures, preventing data leakage and abuse. For instance, data involving suspects' privacy should be stored in an encrypted form with a strict authorized access mechanism, whereby only legally authorized investigators can access and use such data within the scope of specific case investigations.

While advancing algorithm optimization and data management, attention should also be paid to the environmental sustainability of AI models themselves. The high energy consumption and carbon emissions generated during AI model training have become an unignorable issue— the training of complex deep learning models consumes an amount of energy equivalent to the daily electricity usage of a small town, with carbon emissions comparable to the annual emissions of thousands of motor vehicles. Studies have shown that different AI model architectures exhibit significant disparities in their environmental impacts. For example, compared with ResNet50, MobileNetV2 can reduce energy consumption by nearly 90% while ensuring a precision loss of no more than 3%.[7] Therefore, in the selection and development of AI algorithms for environmental crime investigation, energy efficiency and carbon footprint should be incorporated into evaluation indicators. Lightweight model architectures should be prioritized, and redundant computing should be reduced through algorithm optimization to achieve the dual goal of "addressing environmental crime with environmentally friendly technology", thus preventing the technical application from running counter to the original intent of ecological protection.

4.2. Improving the Legal System and Establishing Ethical Norms

We should accelerate the construction of a dual regulatory system of "law plus ethics" adapted to the application of artificial intelligence in environmental crime investigation. This system not only delineates the legal boundaries of technological application through legislation but also restricts the value orientation of technological application with ethical norms, thus achieving the unity of legality and legitimacy.

In terms of improving the legal system, it is necessary to focus on the core links of technological application to fill the regulatory gaps. First, refine the legal boundaries of data collection, clarify the statutory procedures, scope of authority and confidentiality obligations for artificial intelligence to obtain information such as enterprise production data, citizens' travel trajectories and environmental monitoring records in environmental crime investigation, so as to avoid data abuse and privacy infringement. Second, improve the identification rules for intelligent evidence. In the legislation related to electronic evidence, clearly define the evidence categories, authenticity review standards and distribution of burden of proof for artificial intelligence-generated or restored evidence (such as algorithm analysis reports and data repair results), as well as the applicable scenarios of the expert assistant system, so as to solve the practical dilemma of difficult admission of intelligent evidence. Third, strengthen the legal constraints on algorithm supervision. Supplement the liability clauses for illegal and irregular algorithmic acts in the Criminal Law, Criminal Procedure Law and relevant judicial interpretations, set corresponding penalties for acts such as algorithmic bias, malicious tampering with algorithms and concealment of algorithm defects, clarify the division of responsibilities among algorithm developers, users and supervisors, and realize the legalization of "algorithmic accountability". Fourth, connect with the existing environmental law enforcement norms, and embed the applicable conditions and approval procedures of artificial intelligence-based investigation into the existing systems such as the Environmental Protection Law and the Provisions on the Transfer of Cases Involving Suspected Crimes by Administrative Law Enforcement Organs to avoid regulatory disconnection.

In terms of establishing ethical norms, it is necessary to break away from the rigid framework of "principles plus clauses" and build a flexible constraint system oriented to practice. On the one hand, extract practical and enforceable ethical consensus based on investigation practice. On the basis of respecting human rights and protecting privacy, highlight the core orientation of algorithm transparency and interpretability as well as risk proportional adaptation—require the appropriate disclosure of the core logic and data sources of key algorithms in environmental crime investigation, so that investigators and investigated subjects can understand the basic basis for technical decisions. At the same time, emphasize the necessity of technological application. For example, drone aerial photography shall only target areas suspected of pollution to avoid indiscriminate global monitoring, and data mining shall not exceed the necessary scope of environmental crime investigation. On the other hand, resolve ethical conflicts through scenario-based governance and formulate flexible ethical guidelines for different investigation scenarios. For instance, in cross-regional environmental crime investigation, it is necessary to take into account the economic development levels of different regions to prevent algorithms from discriminating against enterprises in less developed areas due to the bias towards data from developed areas; when processing environmental data involving enterprises' trade secrets, establish a "minimum necessary use" mechanism, extract only the core information related

to crimes, and desensitize and destroy the remaining data in a timely manner. In addition, integrate ethical education into practical training. Through the analysis of real cases such as wrong cases caused by algorithmic bias and disputes arising from privacy infringement, enable investigators and technical personnel to intuitively perceive ethical risks instead of merely inculcating abstract principles. Meanwhile, establish an ethical consultation and appeal channel to provide professional support for front-line personnel in dealing with complex ethical dilemmas.[8]

4.3.Strengthening Talent Cultivation and Team Building

With the iterative upgrading of artificial intelligence and its largescale, scenariobased application in environmental crime investigation, investigative work has gradually shifted from traditional manpowerdriven models to intelligent technologyenabled models. This transformation has raised a series of interdisciplinary challenges involving criminal investigation, computer science, environmental science, and law. The professional competence and comprehensive quality of lawenforcement personnel have become core factors restricting the practical application of AI and the full release of its investigative effectiveness. Therefore, it is urgent to strengthen the cultivation of interdisciplinary and professional talents and build a highquality talent team adaptable to intelligent investigation.

At present, some domestic police universities, judicial officer colleges, and environmental lawenforcement training institutions have taken the lead in offering courses and specialized training programs related to artificial intelligence. Closely aligned with practical investigation needs, the training covers up-to-date environmental laws and judicial interpretations, on-site investigation techniques for environmental crimes, multi-source data collection and analysis, fundamentals and applications of AI algorithms, remote sensing image interpretation, and other core modules. Through a combination of theoretical instruction, case discussions, and practical training, the program helps frontline investigators continuously update their knowledge structure, improve technical capabilities, and cultivate interdisciplinary professionals who are proficient in environmental crime investigation, familiar with lawenforcement procedures, and skilled in using AI technologies for clue mining, evidence analysis, and target tracking.

Within public security organs and environmental lawenforcement agencies, efforts should be made to strengthen integrated talent planning and echelon construction. Backbones with rich practical investigation experience and technical personnel specialized in computer science and data analysis should be selected to form dedicated teams for the application of artificial intelligence. These teams will be responsible for coordinating technical research and development, adapting AI tools to investigation scenarios, providing technical training and guidance, and promoting application innovation. They will carry out field tests and iterative improvements of intelligent investigation technologies targeting typical environmental crimes such as illegal pollution discharge, crossborder waste smuggling, and illegal mining, so as to form a closed-loop mechanism of “technology development – scenario application – problem feedback – iterative optimization”.[9]

Meanwhile, a scientific performance appraisal system compatible with intelligent investigation should be established and improved. The capacity to learn and apply artificial intelligence, the practical effects of in-

telligent investigation methods, and technological innovation achievements should be incorporated into the evaluation system with detailed standards and clear incentive mechanisms. Police officers and teams that actively master AI technologies and achieve remarkable case-solving results should be rewarded through priority in performance evaluation, professional promotion, and special commendations. Such measures will fully stimulate the initiative and enthusiasm of lawenforcement personnel in learning new technologies and applying new methods, fostering a positive atmosphere of professional competition and continuous improvement.

In addition, talent development and technical equipment support are mutually reinforcing. It is necessary to increase investment in hardware facilities and equip frontline lawenforcement units with professional devices tailored to environmental crime investigation, including drone surveying systems, high-resolution remote sensing equipment, portable environmental monitors, and IoT data collection terminals. An integrated intelligent investigation data platform should also be built to realize interconnection and data sharing among different devices. On this basis, regular operational training and technical competitions should be organized to help investigators master the operation and application skills of various intelligent equipment.

By comprehensively enhancing the practical capacity of the team in environmental monitoring, clue screening, on-site evidence collection, and target tracking, and promoting the coordinated development of professional capabilities and technical equipment, a modern environmental crime investigation team that "understands professional work, masters technology, excels in application, and pursues innovation" will be established.

5.Conclusion

As a core technological engine driving the modernization of environmental governance, artificial intelligence has provided a revolutionary path for environmental crime investigation to break through the bottlenecks of traditional models. Its enabling role in investigative processes such as clue discovery, evidence collection and analysis, and suspect tracking has not only achieved dual improvements in investigative efficiency and accuracy, but also driven the paradigm shift of environmental crime investigation from post-hoc punishment to precautionary prevention and in-process regulation, injecting technological momentum into the defense of ecological security. However, technological innovation is invariably accompanied by risks and challenges. The application of AI is confronted with numerous issues including uneven data quality and data security risks, algorithmic bias and reliability defects, as well as lagging legal regulation and ethical dilemmas. Failure to effectively address these challenges will not only weaken the practical effect of technological application, but also potentially trigger secondary risks such as the infringement of legitimate rights and unfair law enforcement. Only by adhering to a systematic thinking, and forming a multi-dimensional collaborative governance pattern through technological optimization and data governance at the technical level, legal improvement and ethical construction at the institutional level, and talent cultivation and institutional innovation at the practical level, can AI fully unleash its potential within the framework of the rule of law and ethics, and realize the unity of technological efficiency and social value.

Looking ahead, the integrated development of AI and environmental crime investigation will trend toward greater depth and broader dimensions. With the iterative upgrading of technologies, interdisciplinary collaboration will become the key to solving complex problems, and the value orientation of technology for good will run through the entire process. Against the backdrop of the in-depth advancement of ecological civilization construction, AI is not only a powerful tool for combating environmental crimes, but also an important support for promoting the modernization of the environmental governance system and governance capacity. Through the continuous deepening of technological innovation, improvement of the regulatory system, and strengthening of practical application, we will advance the in-depth collaboration between AI and environmental crime investigation, which will ultimately provide a more solid, efficient and sustainable technological and legal guarantee for safeguarding lucid waters and lush mountains, and advancing the modernization drive toward the harmonious coexistence of humans and nature.

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