

Artificial Intelligence Evidence: Concepts, Nature and Applications

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Abstract

Artificial intelligence (AI) has been widely applied in assisting judicial proceedings, but there remains some ambiguity and controversy regarding the use of machine opinions generated by AI as criminal evidence. AI evidence refers to materials formed through the use of AI to analyze and produce opinions such as voice recognition, image recognition, natural language processing, and expert systems, which are then used to prove case facts. It is characterized by generativeness, informativeness, and complexity. AI evidence is distinct from big data evidence and algorithmic evidence, as it manifests in the application of technologies like facial recognition, intelligent trajectory analysis, and generative AI in criminal cases. The admissibility of AI evidence can be judged based on its objectivity and legality, while its probative force can be analyzed in terms of relevance and admissibility. AI evidence should not be automatically categorized into existing statutory types of evidence, but rather, a miscellaneous provision could be added to the existing categories of statutory evidence. The review of AI evidence should involve improving the disclosure system and expert testimony rules, as well as drawing on the rules of corroboration, to ultimately promote a more scientific and widespread application of AI evidence in the judicial field.

Keywords

AI evidence; facial recognition; machine opinions; evidence attributes; evidence types.

1. The Connotation and Extension of AI Evidence

1.1. Connotation

1.1.1. Conceptual Definition of AI Evidence

Artificial intelligence (AI) refers to the study, development, and application of technologies and systems designed to simulate, extend, and enhance human intelligence. AI can produce intelligent machines capable of responding similarly to human intelligence. Its research areas include robotics, voice recognition, image recognition, natural language processing, and expert systems. Based on this concept of AI and in conjunction with China's "materials theory" definition of evidence, AI evidence consists of materials used to prove case facts, formed through machine opinions generated by AI technologies such as voice recognition, image recognition, natural language processing, and expert systems. The role of AI in criminal litigation, particularly its technological core, is emphasized, focusing on the characteristics and functions of AI technology. AI evidence is distinguished from other traditional types of evidence by its generative, informative, and complex nature, as it involves substantial analysis and judgment made by machines, not humans. Due to the use of massive data and complex algorithms, AI evidence often solves problems that traditional evidence cannot resolve.

1.1.2. AI Evidence and Big Data Evidence, Algorithmic Evidence

On one hand, AI evidence, big data evidence, and algorithmic evidence are related concepts and can be categorized as "scientific evidence," which refers to materials that contain scientific or technological content used to prove case facts, such as expert opinions. However, AI evidence,

big data evidence, and algorithmic evidence differ from traditional scientific evidence in their generativeness and informativeness, as they are produced by machines. Therefore, AI evidence, big data evidence, and algorithmic evidence all represent materials used to prove case facts through the application of different scientific technologies.

On the other hand, the relationship between AI, big data, and algorithms needs to be clarified to distinguish between the three types of evidence. AI analysis results rely on massive data and complex algorithms. Through AI technology, big data is labeled, extracted, mined, collided, and analyzed to form data conclusions. Further clarifying the concepts of big data evidence and algorithmic evidence, big data evidence refers to analytical results or reports based on massive electronic data, including both big data analysis reports and the raw electronic data itself. Algorithmic evidence refers to materials that integrate and process massive case information data to form structured and automated interpretations and reasoning results. These concepts are general summaries from different scholars, and there is no unified definition in academia regarding the three types of evidence. Combining these general concepts, the analysis results produced by AI are based on big data, use intelligent algorithms as the core element, and are essentially machine-generated opinions. Therefore, big data and algorithms are parallel concepts as elements of AI; this does not mean that AI evidence completely encompasses big data and algorithmic evidence, but using the concept of AI evidence better reflects the characteristics of big data and algorithms and is easier for the general public to understand, breaking semantic barriers.

1.2. Extension

AI evidence, presented in the form of analytical results, has entered criminal cases as evidence. However, the term "AI evidence" is not explicitly stated in recent rulings; rather, it is reflected in the scope of objects associated with AI evidence. In judicial practice, common forms of AI evidence include facial recognition, intelligent trajectory analysis, and generative AI.

1.2.1. Facial Recognition Evidence

Facial recognition, also known as face recognition systems or intelligent facial recognition, refers to machines extracting features and classifying faces from still images or videos to identify individuals. In criminal justice, facial recognition evidence is understood as using facial recognition technology to prove the identity of a crime subject. This is especially true for unclear photos that humans or traditional machines cannot recognize, where facial recognition systems analyze the images to establish the relationship between the photo subject and the suspect.

1.2.2. Intelligent Trajectory Analysis Evidence

In a search through Wolters Kluwer, there were 1049 criminal judgments found with the condition of "intelligent trajectory analysis," 53.2% of which were issued in Yunnan Province and the proportion of judgments made by railway courts was 43.2%, indicating that AI evidence, specifically intelligent trajectory analysis, is still limited in widespread acceptance and application.

Intelligent trajectory analysis is widely used in criminal cases involving drugs, smuggling, theft, and border-crossing crimes that require the identification of the suspect's or specific items' trajectories. It is also used to assist in proving the time and location of criminal acts, such as in cases of rape and fraud. By analyzing data from identity recognition records at airports, stations, hotels, and road checkpoints, investigators can trace the suspect's activities. For example, in cases involving drug trafficking, such as the smuggling, sale, transport, and production of narcotics, intelligent trajectory analysis is used to demonstrate the criminal subject's movement. Similarly, it has been used in border-crossing crimes to prove the flight details of defendants. However, it's worth noting that intelligent trajectory analysis is rarely used as

standalone evidence. It is usually presented alongside other raw evidence, such as surveillance video snapshots, hotel records, or immigration records, highlighting that intelligent trajectory analysis still faces challenges in becoming a fully reliable form of evidence.

1.2.3. Generative Artificial Intelligence Evidence

Generative AI refers to AI technologies that automatically generate various types of content, such as text, images, videos, and audio. Examples include OpenAI's ChatGPT, Deepseek, and Baidu's Wenxin Yiyan, which use large-scale data learning to create new original content. Some scholars categorize generative AI materials into three types: "machine opinion-type," "human-machine opinion-balanced type," and "human opinion-type" large language models. It can be argued that generative AI can be classified into two types of evidence: as a tool used in the crime or as a tool used in the investigation. Both types of materials can be presented as evidence in court. However, whether they should be regarded as AI evidence remains unclear.

Generative AI used as a tool in the crime does not have the characteristics of informativeness and complexity typical of AI evidence. For example, in cases where the criminal uses generative AI to translate illegal articles for improper publicity or to generate spam information for "internet water army" activities, these materials should not be considered AI evidence. They are simply human-generated outputs, not machine opinions, and should be classified as documentary evidence.

On the other hand, materials formed using generative AI as an investigative tool do meet the characteristics of AI evidence. For example, in financial crimes involving fraudulent tax invoices or illegal public deposit collection, large volumes of bank statements, chat records, and other data need to be analyzed. With the current technology, judicial expertise center form opinions based on such data, but these opinions can be less detailed or targeted. AI, particularly generative AI, when used for analysis, can drastically reduce the time required for proof and improve litigation efficiency.

Apart from the commonly used forms of AI evidence such as facial recognition, intelligent trajectory analysis, and generative AI, other technologies like "smart personal risk assessments" produced by prosecution agencies and systems used in autonomous vehicles (e.g., drowsiness detection systems) or smart drunk-driving detection systems may also appear in court as key evidence in sentencing. As the technology develops, further research is needed to determine their classification and application as AI evidence.

2. The Evidence Capability and Probative Force of AI Evidence

Criminal evidence has dual attributes: evidence capability and probative force. The general view is that the basic attributes of evidence are objectivity, relevance, and legality. It is commonly believed that evidence capability corresponds to objectivity and legality, while probative force corresponds to relevance, and some scholars argue that probative force corresponds to the admissibility of evidence in common law systems. The discussion of AI evidence should focus on whether machine opinions generated by AI meet the requirements of evidence capability, which we will explore under the framework of AI evidence's three key attributes.

2.1. Evidence Capability of AI Evidence: Objectivity and Legality

Evidence capability, also known as evidence qualification, refers to the necessary conditions that factual materials must meet to be admissible as litigation evidence. Thus, whether machine-generated opinions formed by AI meet the qualifications to be presented in court is a key issue that must be examined. On one hand, evidence capability requires objectivity, meaning that the material must reflect objective facts that have occurred and should not be based on subjective imagination or fabrication. On the other hand, evidence capability requires

legality, meaning that the form, collection, presentation, and verification of evidence must comply with legal standards.

In practice, AI-generated materials often gain legitimacy through their transformation into legally recognized forms of evidence. Most of these AI-generated opinions represent new forms of evidence, and their classification and review procedures need further clarification. Even though there is no explicit legal provision for AI evidence yet, it should not be entirely rejected simply because it is a new form of evidence.

The main concern with AI evidence lies in its objectivity. AI evidence's objectivity can be influenced by three factors: data objectivity, algorithm objectivity, and process objectivity. If the underlying data is incomplete, inaccurate, or biased, the resulting AI opinion will lack objectivity. Similarly, if the AI algorithm has flaws or biases, the conclusions it generates may not reflect the true facts. Finally, the process of handling the data, particularly in cases of proprietary algorithms, is also susceptible to human interference. Therefore, AI technologies, such as facial recognition, require careful assessment of data sources, algorithm design, and processing reliability. Clear standards and transparent processes must be established to ensure the objectivity of AI evidence.

2.2. Probative Force of AI Evidence: Relevance and Admissibility

Probative force refers to the substantive force that evidence has in proving the facts of a case, i.e., whether it establishes or strengthens the likelihood of the facts. The strength of AI evidence's probative force impacts its classification and application: On one hand, whether AI evidence can be classified as a new statutory form of evidence, independent from the existing types, largely depends on whether it has characteristics and probative functions that are not found in the other statutory forms of evidence. On the other hand, if AI evidence is highly replaceable, the prosecution might prefer to use traditional forms of evidence, such as the aforementioned intelligent trajectory evidence, which can also be verified through other types of evidence, like transportation or accommodation records.

Probative force can be assessed from two perspectives: relevance and admissibility. Relevance means that the evidence must have a substantial connection to the case facts. The stronger the connection, the stronger the relevance, and the higher the probative force. By using AI technology for big data collection, processing, and analysis, a connection between the AI opinion and the case facts can be established, increasing its relevance. For example, using AI to generate audit reports based on case-related data can strengthen the relevance of AI evidence to proving specific facts.

Admissibility concerns whether evidence can be accepted based on its authenticity. If AI evidence produces errors due to flawed algorithms or machine learning mistakes, it may undermine its authenticity and reduce its probative force. In comparison to evidence capability, probative force assessment is more subjective and depends on the court's discretion in interpreting the strength of the evidence.

3. Statutory Classification of AI Evidence

The eight statutory categories of evidence have legal binding power. It is generally believed that only materials that comply with legal standards can be used to determine the outcome of a case. Understanding the classification of AI evidence is crucial to understanding its nature. In one example, a scholar reviewed 386 criminal rulings that involved facial recognition results. Among them, 69 were recorded as documentary evidence, 6 were identified as audio-visual materials or electronic data, 14 were expert opinions, 2 were witness testimony, and 8 were identification of transcripts. The issue of how to classify AI evidence, especially facial recognition and intelligent trajectory evidence, remains a topic of debate.

3.1. As Documentary Evidence

From a definitional standpoint, documentary evidence refers to written materials or other materials that use text, symbols, or images to express ideas in order to prove case facts. AI evidence, which is based on machine opinions formed by AI analysis, such as voice recognition, image recognition, natural language processing, and expert systems, also serves to prove case facts. Although AI evidence may contain text or symbols and may have an information format similar to documentary evidence, there are significant differences in both the essence and the way in which it is generated. On one hand, AI evidence has technical characteristics that ordinary documentary evidence does not possess. On the other hand, the process of generating AI evidence differs from that of documentary evidence, which highlights its unique generative and informative features. Some scholars also argue that the main difference lies in the fact that documentary evidence is formed before the litigation begins, while AI-generated opinions are formed during the litigation process.

This distinction applies to most forms of AI evidence, but AI evidence that serves as a tool for committing a crime, such as using generative AI to create content, does not fall under the category of evidence generated during litigation. For example, in cases where generative AI is used to create spam messages for "internet water army" activities, the resulting content would still be classified as documentary evidence, as it is based on written information, not machine-generated opinions.

3.2. As Expert Opinion

Expert opinion refers to the written conclusions made by experts who have examined specialized issues in criminal cases. Many scholars believe that AI-generated opinions should be classified as expert opinions, as they are similar in form and technological nature to expert testimony. Both involve opinions formed after the occurrence of an incident and require experts with specialized knowledge to analyze and validate the data. This classification is also more acceptable in practice since AI-generated opinions are often reviewed by experts. In criminal investigations, AI evidence can be treated similarly to expert opinions, which also helps in facilitating the economic and efficient use of judicial resources.

However, the main distinction between AI evidence and expert opinion is that AI-generated opinions are produced by an algorithmic program running independently, while expert opinions come from human knowledge. This difference creates confusion between AI-generated evidence and expert opinions and may limit the use of AI-generated opinions. From a theoretical classification perspective, expert opinions are considered oral evidence rather than physical evidence, as they are presented in a verbal form, which contrasts with AI evidence, which is generated by machines. If AI evidence is categorized as an expert opinion, the definition of expert opinion itself would need to be reconsidered.

3.3. As Audio-visual Materials or Electronic Data

Electronic data refers to data formed during the course of a case that is stored, processed, and transmitted in a digital format and can be used to prove case facts. Audio-visual materials and electronic data both involve the use of electronic information technology to record case-related data in digital form. AI evidence can be stored as electronic data, but there are key differences. Audio-visual materials and electronic data do not require processing and can be directly transmitted to fact finders. They simply present the facts of the case or involved actions, without including opinions or judgments. Examples include emails or online chat logs, which directly reflect stored information.

In contrast, AI evidence is not raw data but a processed form of information. It involves "secondary development," including verification, identification, and reasoning on the original data, which generates machine opinions. Additionally, electronic data is generated during the

case, while AI-generated evidence is produced during the litigation process, meaning that the timing of their formation differs significantly.

3.4. As a New Statutory Form of Evidence

Regarding the classification of AI evidence, a more conservative viewpoint suggests that it should temporarily be categorized under existing forms, such as expert opinions, electronic data, or documentary evidence. A more progressive viewpoint proposes adding AI evidence as an independent, ninth statutory category of evidence outside of the existing eight categories.

However, I argue that AI evidence can initially be classified under a "catch-all" clause in Article 50 of the Criminal Procedure Law, which includes "other" types of evidence. As AI technology continues to develop and achieves higher levels of sophistication, there may be a need to consider adding it as an independent statutory category of evidence. There are three main reasons for this view:

The generative nature of AI evidence fundamentally distinguishes it from existing forms of statutory evidence, which affects the applicability of evidence review rules. Thus, it is not appropriate to simply categorize AI evidence under any existing category.

(2) Given that the current technology is not sufficiently advanced, it is not advisable to hastily create a new statutory category of evidence. For example, while cassette recorders and radios were once popular, their role was largely replaced by the rapid development of computers, leading to the creation of electronic data as a new category. Similarly, AI evidence may face similar challenges until its nature and use in judicial contexts are more clearly defined.

(3) Existing laws and practices do not exclude the possibility of new types of evidence being created. The Criminal Procedure Law's provision that "evidence includes" rather than "only includes" suggests that the law does not strictly limit the types of evidence. In practice, materials such as traffic accident responsibility determinations and social investigation reports are not classified as statutory evidence, yet courts still recognize their evidentiary force.

4. Review and Judgment Rules for AI Evidence

The successful application of AI evidence in judicial settings requires not only evaluating its evidence capability and probative force, as mentioned above, but also the establishment of comprehensive and reasonable review and judgment rules. Drawing from the evidentiary rules and review systems in common law system, the review and judgment of AI evidence can be approached from four key perspectives: evidence disclosure, expert testimony, corroborative evidence rules, and the broad application of AI evidence.

4.1. Improving the Evidence Disclosure System

As a tool for criminal investigation, AI-generated opinions that are presented as evidence in court often face challenges due to the "black box" nature of algorithms and the complexity of AI evidence. These issues may cause defense parties or the public to lose trust in the results produced by AI algorithms. AI evidence can also be costly, making it difficult for financially disadvantaged parties to access such evidence. In this context, a robust evidence disclosure system should be established to enhance the right to cross-examine. On one hand, AI evidence should be subject to mandatory disclosure, clearly defining the responsibilities and scope of both the prosecution and defense for disclosure, and specifying the legal consequences for failing to disclose such evidence. On the other hand, referencing the evidence disclosure system for electronic data in common law system, technology companies, as monopolistic actors in the information domain, should be made responsible for evidence disclosure.

At present, cases involving AI evidence can also be reviewed during the pretrial stage or during hearings, where expert opinions or public opinions can be sought to demystify AI's role and

usage. This would help dispel any mysteries surrounding AI evidence and provide clarity for all parties involved.

4.2. Strengthening Expert Testimony in Court

Although AI evidence takes the form of machine-generated opinions, human involvement is integral in the generation of algorithms, the acquisition of data, and the handling of case-specific information. According to the establishment and vicissitude of the principle, judges must hear oral statements from parties, witnesses, and other participants in the trial. Since it is impossible to cross-examine AI itself, it is necessary to strengthen the system of expert testimony in court to ensure the effectiveness of evidence review. Experts who participate in generating or validating AI evidence should be called to testify in court. These experts could include algorithm engineers, data annotators, or forensic experts who participated in the case examination. Their expertise will help ensure that the data and AI models used are reliable and accurate.

Referring to Article 192 of the Criminal Procedure Law, which governs expert testimony, if an expert refuses to appear in court, the AI evidence should not be accepted as the basis for the judgment. Furthermore, to protect the rights of the defense, they should be granted the right to request expert testimony and allow cross-examination to ensure unbiased explanations regarding the generation of AI evidence.

4.3. Applying the Rule of Corroboration

For AI evidence, the principle of limited use should be adopted. It should primarily serve as corroborative evidence in sentencing or as auxiliary evidence rather than as primary evidence in criminal convictions. For example, intelligent trajectory analysis may be used to confirm whether a suspect was present at the crime scene or to track their movements, but it is often not presented as the sole evidence. Instead, other forms of unprocessed evidence, such as transportation records or accommodation information, are also presented, which not only makes the evidence easier to understand but also strengthens its credibility and admissibility.

For facial recognition evidence, the result is often expressed in terms of identity matching, such as the percentage of similarity between faces A and B. Since it is difficult to avoid imperfections in facial recognition, and matching similarity may not always exceed 90%, it is necessary to corroborate the facial recognition evidence through other methods, such as expert testimony, recognition procedures, witness testimony, or interrogation of the defendant. This will strengthen the probative force of the facial recognition evidence and ensure its role in supporting criminal charges.

4.4. Promoting the Widespread Application of Scientific Evidence

Currently, both academic and practical concerns about AI evidence revolve around its lack of standardization, scientific rigor, and practical utility. When the algorithms are sufficiently mature, the use of AI to process data should not only reduce errors seen in manual forensic analysis but also improve the accuracy of the results. This would save judicial resources and enhance the efficiency of litigation.

To this end, it is necessary to increase technological research and development, improve algorithms, and strengthen data processing capabilities to enhance the reliability and accuracy of AI evidence. It is also essential to improve the legal and judicial understanding of AI evidence by equipping judicial personnel with the necessary knowledge and skills. Public education and awareness should also be promoted to help society understand the advantages and applications of AI evidence. This will lay a solid foundation for the legal and social acceptance of AI evidence in future judicial practices.

5. Conclusion

Due to the research-driven focus, scholars often approach AI evidence with a positive or even enthusiastic attitude, but the technical requirements for AI-generated machine opinions to meet the objectivity and admissibility criteria for criminal litigation are still evolving. The "black box" problem with algorithms and the highly specialized nature of AI technology creates a significant gap in understanding between the technology and judicial personnel. Whether AI evidence can be classified as a new type of evidence, whether it violates the principles of evidence review, and whether it conflicts with the rules for excluding illegal evidence are all points that require case-by-case examination. The practice is still in its early stages, and the theoretical foundations have yet to be fully established. Thus, while we cannot dismiss AI evidence entirely, we should exercise caution and not rush to fully integrate it into the judicial system. The balance between respecting traditional litigation processes and technological advancements is key as we move forward.

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