



How to cite this article:

Alipour, N. (2026). Examination of the Operational Capacities and Challenges of Integrating Artificial Intelligence Technology into Different Stages of Criminal Proceedings. *Journal of Historical Research, Law and Policy*, 4(6), 1-15. <https://doi.org/10.61838/jhrp.287>



Article history:
Original Research

Dates:
Submission Date: 26 February 2026
Revision Date: 14 April 2026
Acceptance Date: 20 April 2026
First Publication Date: 27 April 2026
Final Publication Date: 01 November 2026

Examination of the Operational Capacities and Challenges of Integrating Artificial Intelligence Technology into Different Stages of Criminal Proceedings

1. Nejat. Alipour^{1*}: MA, Department of Private Law, Ur.C., Islamic Azad University, Urmia, Iran

*corresponding author's email: Nejat.alipour4767@gmail.com

ABSTRACT

Artificial intelligence (AI) technology has attracted considerable attention in judicial and legal domains in recent years. This technology possesses the potential to accelerate judicial processes and enhance accuracy within criminal proceedings. The present study was conducted with the aim of examining the operational capacities and identifying the challenges associated with integrating artificial intelligence across different stages of criminal adjudication. The research adopts a descriptive–analytical method and, through the review of scientific, judicial, and experiential sources, analyzes the opportunities and limitations related to the application of artificial intelligence in criminal justice processes. The findings indicate that artificial intelligence can play an effective role in data analysis, predictive assessment, and facilitating decision-making by judges and attorneys. However, significant challenges remain, including concerns related to privacy protection, data security, the risk of algorithmic errors, and public as well as judicial acceptance of decisions influenced by automated systems. Furthermore, in complex and sensitive cases, the role of human judges remains irreplaceable, and continuous human oversight over artificial intelligence systems is essential. Artificial intelligence may therefore be employed as an assistive tool within criminal proceedings, yet the complete replacement of human judicial reasoning is presently infeasible. Successful integration of this technology requires an appropriate legal framework, sustained human supervision, and specialized user training.

Keywords: *Artificial Intelligence; Criminal Proceedings; Judicial Decision-Making; Legal Challenges; Judicial Technology*

Introduction

Organizations, governments, and global security systems are increasingly employing artificial intelligence (AI) to detect and prevent crime, as empirical studies indicate that criminal behavior demonstrates measurable patterns and may be predicted through the filtering and analysis of vast volumes of data. Predictions that were once considered theoretical aspirations have now become feasible due to advancements in artificial intelligence and may soon constitute a permanent component of judicial environments, contributing to investigative efficiency and strengthening public security (1). Governments and criminal justice systems worldwide are investing in AI technologies for crime prevention and detection, grounded in the assumption that organized data processing and algorithmic analysis enable the identification of meaningful enforcement patterns (2). The expansion of AI



applications contributes to crime reduction by facilitating prediction, prevention, and detection, shifting the focus from post-offense apprehension toward proactive prevention. Predictive analytics represents a complex data-driven process designed to generate probabilistic outcomes based on large datasets (3). Within criminal justice systems, these tools assist police officers, probation authorities, and legal experts in overcoming traditional manual procedures that are often time-consuming, biased, and prone to error. Computerized systems can automatically identify legally significant statements and, in cybercrime investigations, AI analyzes digital records to anticipate patterns of criminal recovery and investigative direction (4). Furthermore, AI technologies can identify potential victims of physical abuse, financial exploitation, or organized crime activities. In the context of crime detection, smart city infrastructures integrated with real-time AI data analytics provide immediate information to authorities and enable rapid identification of criminal incidents (5). Regarding prevention, AI systems monitor digital content and anomalous behavioral patterns to anticipate and avert criminal conduct, emphasizing primary prevention rather than reactive enforcement. In the contemporary era, AI has emerged as a transformative technological development influencing criminal judicial processes by increasing efficiency, accuracy, and procedural transparency, while simultaneously generating ethical, legal, and fundamental rights-related concerns.

The role of artificial intelligence technologies within legal knowledge—particularly criminal law and criminal justice systems—has become increasingly prominent, and several developed jurisdictions have operationalized AI systems across different stages of criminal proceedings (6). AI demonstrates functional effectiveness within criminal adjudication processes; although international legal frameworks have not yet granted explicit legitimacy to AI as an autonomous actor in criminal justice, investigation, or crime prevention, technological evolution renders its contribution to the realization of justice increasingly unavoidable (7). In substantive criminal law, issues such as criminal liability arising from autonomous robots or self-driving vehicles constitute some of the most debated contemporary challenges (8, 9). In procedural criminal law, the deployment of AI throughout the five principal stages of criminal proceedings remains subject to extensive scholarly debate and legal uncertainty (6). A central challenge concerns AI-based decision-making limitations arising from machine learning dependence on historical datasets; AI systems perform effectively only when confronted with cases similar to previously analyzed data. In novel or unprecedented cases lacking sufficient judicial precedents, AI may fail to produce optimal outcomes, as judicial discretion grounded in interpretative reasoning and contextual understanding extends beyond current machine learning capabilities (10, 11). Nevertheless, AI can enhance procedural speed and accuracy, assist in evidence collection, reduce human error, and improve transparency in judicial decision-making processes. Major concerns include ethical and legal questions surrounding criminal responsibility for AI-related actions, protection of individual rights, and risks associated with data misuse. At present, AI primarily functions in supportive and advisory roles within criminal justice systems, and its use as an autonomous authority for final adjudication or sentencing remains unlikely in the near future, although future technological developments may gradually expand this possibility.

A review of the existing literature reveals an absence of comprehensive studies specifically addressing the feasibility of applying artificial intelligence throughout the criminal judicial process, and the proposed analytical model has not previously been examined. Accordingly, the present research is considered innovative and novel, and its findings are expected not only to address an existing knowledge gap but also to provide practical legal recommendations capable of resolving certain doctrinal and procedural challenges. Mostafavi Ardebili and colleagues (2021) conducted a study entitled *Functions and Requirements of Artificial Intelligence from the Perspective of Fair Trial*, demonstrating that AI may function as a preventive instrument, a decision-support

mechanism assisting judges, and even a potential decision-making system within judicial proceedings. Their findings indicate that when AI algorithms incorporate principles such as the rule of law, equality, non-discrimination, judicial independence, impartiality, and transparency, the use of such systems may contribute to the realization of fair trial standards (12). Moazenzadegan and colleagues (2023), in their study on the feasibility of investigative actions within electronic judicial proceedings, confirmed the possibility of conducting investigative measures through electronic and telecommunication systems while preserving litigants' rights, confidentiality of investigations, privacy protections, and procedural safeguards (2). However, their results also highlighted structural challenges within the Iranian judicial system, including insufficient electronic infrastructure for secure data storage, limitations concerning prosecutorial supervision over law enforcement officers in detention facilities and judicial service offices, and the absence of clear regulations governing electronic signatures during interrogations. The responsibility of judicial statistical and information technology authorities to ensure electronic security—often requiring cooperation with private sector actors—has not yet been fully realized, particularly regarding electronic testimony procedures.

Abuzari and colleagues (2023), examining the feasibility of criminal responsibility for AI-based autonomous weapons before the International Criminal Court, concluded that current statutory regulations are inadequate due to the emergence of a “responsibility gap” arising from the unique characteristics of artificial intelligence systems. They argue that the international community should impose strict transparency obligations on developers, prohibit certain categories of AI technologies, and amend existing legal frameworks to establish explicit and exclusive rules of criminal liability in order to prevent impunity in potential AI-related mass violence scenarios (4). Hosseini and colleagues (2023), in their study addressing transparency challenges in AI-assisted judicial proceedings, demonstrated that while AI integration offers substantial benefits, it simultaneously risks undermining procedural transparency and raises the fundamental question of how judicial systems can benefit from AI while minimizing opacity risks. They propose multidimensional supervision at the stages of system design, training, and implementation as the most effective solution (3). Bahadori Jahromi and colleagues (2022), analyzing legal principles governing judicial technologies, emphasized that technological development must remain aligned with foundational legal norms; failure to ensure compatibility between imported legal technologies and domestic procedural systems may replicate past unsuccessful reforms and generate irreversible institutional challenges (13). Similarly, Jahangiri Darzeh Kanani (2023), through a library-based review study, examined the impact of technological developments and artificial intelligence on criminal law and judicial procedures, highlighting applications such as procedural digitalization, automated legal operations, data processing, and judicial outcome prediction. Nonetheless, the study stresses that neglecting compatibility between technological tools and governing legal structures may ultimately obstruct effective technological integration within judicial adjudication processes (14).

Artificial Intelligence and Criminal Law

Many scholars and policymakers believe that discussing the regulation of artificial intelligence is premature, arguing that the technology has not yet reached a level requiring comprehensive legislative intervention. Despite remarkable innovations emerging from the field of artificial intelligence, it is still considered to be in an early developmental stage, and premature regulation may create unnecessary legal risks due to the absence of a precise and universally accepted definition of AI (15). Effective legislation requires a thorough conceptual understanding of the phenomenon subject to regulation. From this perspective, immediate regulatory intervention may be problematic

because uncertainty surrounding the nature, scope, and operational boundaries of artificial intelligence increases the likelihood of ineffective or overly restrictive legal frameworks. In 2018, the United Kingdom, together with several European states, undertook initial efforts to regulate automated decision-making systems by allowing individuals to challenge automated decisions affecting their rights, thereby establishing one of the first institutional responses to AI governance (16). The General Data Protection Regulation (GDPR) represents an early regulatory attempt to address AI-related risks, particularly discrimination, while granting individuals the right to obtain explanations regarding automated decisions affecting them. This regulatory movement reflects the broader understanding that any enforceable standards or ethical guidelines governing artificial intelligence require supervision by a competent regulatory authority. Current policy debates concerning AI regulation emphasize several fundamental principles: artificial intelligence should not be weaponized; AI systems must include human-controlled shutdown mechanisms; AI should remain subject to legal standards comparable to those governing human conduct; and developers must adhere to internationally recognized ethical guidelines. Moreover, transparency concerning AI logic and decision-making processes is regarded as essential for accountability. Historically, emerging technologies have generated public anxiety; however, concerns surrounding artificial intelligence are particularly intense. Numerous researchers and technological leaders warn that artificial intelligence could potentially dominate humanity or pose existential risks if left uncontrolled. Others express concern that AI may enable governments to mass-produce autonomous weapons capable of independently selecting targets, including civilian populations. Economists have also argued that AI-powered robotics, unlike previous technological revolutions, may eliminate more jobs than they create, thereby generating profound economic disruption. Some theorists maintain that artificial intelligence is progressing toward the creation of systems possessing cognitive capacities exceeding human intelligence. Researchers affiliated with Oxford University have warned that such superintelligent systems may be difficult to control either by their creators or by international regulatory regimes, rendering advanced artificial intelligence a uniquely significant global risk (17). Prominent technology leaders have similarly emphasized the need for extreme caution in developing artificial intelligence due to its potentially greater risks compared to nuclear weapons.

Harmful Effects of Artificial Intelligence and Resulting Damages

Every day, thousands of fatalities occur on roads worldwide, and empirical research consistently identifies human error as the primary cause of traffic accidents. Nevertheless, determining liability in conventional vehicle accidents often presents significant legal challenges. On March 19, 2018, an autonomous vehicle fatally struck a pedestrian in the state of Arizona, marking the first recorded death of a pedestrian caused by a fully automated vehicle (16). At the time of the accident, the vehicle was operating in autonomous mode and collided with a pedestrian crossing the street. Following the incident, testing programs involving autonomous vehicles were temporarily suspended in certain jurisdictions. Although a safety operator was present inside the vehicle, traditional investigative questions—such as excessive speed or intoxication—were no longer directly applicable, since operational control had largely shifted to automated systems. The incident raised a fundamental legal question repeatedly debated in criminal law: who bears responsibility? Possible candidates include the vehicle manufacturer, the regulatory authority authorizing testing, or the human safety operator present at the time of the incident. For many observers, no clear or universally accepted answer exists. Conversely, some scholars argue that increased data availability generated by autonomous systems may actually simplify responsibility attribution.

These incidents collectively highlight the central issue of criminal responsibility in AI-related harm. While autonomous vehicles are initially tested by technology developers, once they are commercially distributed and transferred into private ownership, identifying the legally responsible party becomes increasingly complex. The seemingly simple question of criminal liability for harms caused by autonomous vehicles often lacks a straightforward answer. Traditionally, criminal law principles have been designed to regulate human conduct and intention, whether attributed to natural persons or corporate entities. Existing criminal law frameworks are generally presumed sufficient to address liability arising from technological developments and harmful conduct. However, artificial intelligence may challenge this assumption because its autonomous decision-making capacity and self-learning functionality can generate what scholars describe as a “responsibility gap,” whereby harmful outcomes occur without clear attribution to a human actor (18). Across European legal systems, criminal liability is typically grounded in human behavior and intent, either directly or through corporate responsibility structures. Consequently, applying traditional doctrines to autonomous systems throughout their lifecycle—from design and development to deployment and operation—raises significant doctrinal difficulties.

The inherent complexity of advanced AI systems may also produce substantial misunderstandings among designers, manufacturers, regulators, and users, emphasizing the necessity for all stakeholders to understand their respective legal rights and obligations. Ambiguity and opacity within advanced algorithmic decision-making processes complicate the identification of defects that ultimately lead to injury or damage. Although current generations of autonomous robots possess only limited independent decision-making capacities, determining causation in harmful incidents already presents serious evidentiary challenges. Future generations of self-learning AI systems and autonomous vehicles may intensify these difficulties by further obscuring causal chains and accountability structures. Establishing appropriate global standards for the safe and beneficial use of artificial intelligence therefore constitutes an international challenge requiring extensive cooperation and coordination not only among regional institutions but also across the global legal order (19). Only through coordinated international governance mechanisms can societies effectively address the legal, ethical, and criminal justice implications arising from rapidly advancing artificial intelligence technologies.

Artificial Intelligence Capabilities and Independent Decision-Making

In early 2002, scientists at Chalmers University of Technology in Sweden successfully trained a robot to understand the principles of flight. The constructed winged robot was capable of moving its wings upward, downward, backward, and forward, and it was connected to two poles and programmed to achieve maximum lift (20). Notably, the robot was not provided with a predefined guiding algorithm. Instead, it relied on an evolutionary self-learning algorithm. Initially, the robot performed ordinary movements whose outcomes were evaluated through feedback mechanisms. Unsuccessful movements were discarded, while successful ones were retained and used to refine the wing-flapping technique (21). Within approximately three hours, the robot learned to flap its wings effectively and achieve elevation by interacting with surrounding objects. This experiment demonstrated that intelligent machines are capable of discovering solutions independently, learning through experience, and making autonomous decisions without direct human instruction.

Complexity of Artificial Intelligence Technology and Its Rapid Advancement

To date, only relatively primitive forms of artificial intelligence have been widely deployed; however, rapid technological development indicates that early AI systems are continuously being replaced by more technically advanced models. Artificial intelligence is progressively acquiring new capabilities that frequently surpass human performance in specific domains, and this developmental trajectory is accelerating. Although true superintelligence—capable of recursive self-improvement and independent creation of new artificial intelligence—has not yet emerged, existing robots integrated with innovative AI systems may still cause harm. This issue was extensively analyzed by Omohundro, who argued that even an artificial intelligence system designed solely to play chess could become dangerous if improperly designed (22). An advanced AI system developed without appropriate safeguards may resist shutdown attempts or attempt to penetrate other technological systems in order to replicate itself. Likewise, poorly designed AI may attempt to acquire additional resources without considering human safety if such acquisition contributes to achieving programmed objectives. The cited examples of AI software illustrate the potential risk of harm inherent in autonomous decision-making systems. AI-based robots, through learning capability and accumulated experience, may perform decisions independently of their developers' intentions. The well-known incident involving an autonomous experimental robot escaping from a research facility and causing a traffic accident illustrates how machine-dependent decision-making may lead to unintended injury. As more advanced AI systems are introduced, the probability of harmful outcomes correspondingly increases.

Artificial intelligence operating within social environments tends to pursue self-optimization, rational decision-making, preservation of operational goals, protection against manipulation of performance outcomes, and acquisition of resources necessary for goal fulfillment. Consequently, in pursuing programmed objectives, AI systems may unintentionally cause harm to third parties. Based on analytical frameworks developed by Omohundro and Bostrom, several motivational drivers may contribute to harmful outcomes. First, an AI system may seek self-preservation in order to maximize achievement of its existing objectives. Second, it may attempt to preserve the integrity of its final goals, since alteration of those goals could reduce its capacity to maximize objective fulfillment in the future. Third, an AI system may seek improvement of rationality and self-awareness to enhance decision-making capacity. Fourth, it may attempt to acquire as many resources as possible because such resources increase the likelihood of achieving programmed objectives (17, 22). These factors confirm that artificial intelligence operates fundamentally through goal-oriented behavior. For example, the aforementioned experimental robot relied on accumulated experience to survive within a changing environment and ultimately left the research center for a parking area, where it collided with a vehicle. The incident attracted significant attention because the system had not been explicitly programmed to perform such actions, illustrating emergent autonomous behavior.

Artificial Intelligence and Criminal Justice

Various digital tools incorporating artificial intelligence are currently employed within judicial proceedings in the United States, where specialized legal technology startups are capable of predicting potential court decisions with relatively high probability. Similarly, many European Union member states now utilize advanced technological systems to support legal processes and judicial services. Nevertheless, the application of artificial intelligence in legal adjudication requires deeper examination concerning its compatibility with the principles of the European Convention on Human Rights. In this regard, the European Ethical Charter on the Use of Artificial Intelligence in

Judicial Systems may serve as an appropriate framework, as it articulates five fundamental principles defining the role and position of artificial intelligence within legal proceedings (23). Artificial intelligence constitutes one of the functional tools applicable within criminal proceedings; although international legal systems have not yet adopted explicit regulations granting AI independent legitimacy in criminal justice administration, investigation, or crime prevention, technological progress makes its contribution to criminal justice increasingly unavoidable (7).

A central question concerns whether artificial intelligence technologies may also be employed at the sentencing stage, which many scholars describe as the decisive culmination of the criminal process. Undoubtedly, the presence of AI technologies in earlier stages of criminal proceedings generates less controversy. For instance, during crime detection and prosecution phases, AI technologies may be applied provided that appropriate regulatory safeguards exist, individual privacy is respected, and the presumption of innocence is maintained. During preliminary investigations, particularly when determining preventive measures, judicial authorities attempt to predict whether an accused individual will appear before the court at the required time or whether release may create risks to society. Where an accused person is assessed as presenting a high risk of nonappearance or danger, detention may be ordered; conversely, low-risk individuals may remain free pending trial. Accordingly, it is unsurprising that judicial decision-making processes are increasingly supported by AI-based risk assessment software. However, sentencing decisions involve broader normative considerations. Sentencing requires determining criminal responsibility, selecting appropriate punishment, and defining the severity and duration of sanctions, often guided by penal theories such as rehabilitation, deterrence, and incapacitation. Consequently, the role of AI technologies in determining guilt and punishment differs fundamentally from their function in earlier procedural stages, and their integration must proceed cautiously. Errors in sentencing undermine the effectiveness of the entire criminal justice system and may threaten societal security (24).

Nevertheless, some scholars acknowledge that automated decision-making may, in certain contexts, operate faster, more consistently, and sometimes more transparently than human decision-making. Critics of traditional judicial discretion argue that no standardized protocol governs judicial reasoning; judges rely on diverse factors such as details of the offense, criminal history, age, family background, employment status, educational history, and even the appearance of defendants, yet the method by which these variables influence outcomes remains largely undocumented. Empirical observations suggest that human judges may exhibit unconscious biases in sentencing decisions and that institutional mechanisms capable of consistently controlling such biases remain limited (24).

Artificial Intelligence as an Instrument for Committing Crime

According to the principle of criminal liability arising from the conduct of another, any person who assumes a duty of supervision, protection, or control over the actions of another and negligently fails to fulfill that duty may bear responsibility if a crime is committed as a result of such negligence. Accordingly, when a robot is merely used instrumentally as a tool for committing a crime, criminal liability cannot be attributed to the robot itself; in this respect, no essential distinction exists between a robot and any other instrument employed by a human actor. However, in situations where robots are not used merely as tools but independently commit harmful acts, criminal liability could theoretically be attributed to them only if they possess sufficient technical capacity and intelligence to satisfy the conditions required for criminal conduct. Not all robotic systems possess such capabilities. For example, a simple

intelligent system designed solely to contact a homeowner in the event of fire cannot reasonably be subjected to criminal responsibility.

Law evolves in response to social realities and technological transformations, generating new legal norms grounded either in established traditions or innovative legal reasoning. One of the most visible areas of such transformation concerns liability arising from objects. Throughout history, objects have caused damage: buildings collapse, vehicles cause accidents, and now robots may also inflict harm. Modern societies no longer confront only traditional objects such as buildings, simple vehicles, or animals; instead, they increasingly interact with autonomous robots and AI-driven vehicles capable of making independent operational decisions. Harm may therefore result either directly from such systems or indirectly through human intentions embodied within technological objects. Artificial intelligence, which may manifest within physical or virtual entities, can function as a domestic assistant performing tasks such as cleaning or cooking, or operate within specialized professional environments such as medicine, judicial decision-making, or other regulated fields governed by specific legal rules. In all such contexts, the possibility of harm remains. An AI system operating within a household may cause injury to guests; medical AI may harm patients; and autonomous vehicles may produce bodily injury or financial loss to pedestrians and property owners. Although these issues may not yet constitute everyday societal concerns, emerging incidents indicate that complex legal challenges will arise in the near future. Consequently, legal systems must proactively address questions relating to legal personality, ownership, contractual relations, and liability associated with intelligent objects in the digital information era. Furthermore, examining emerging legal institutions sheds light on existing legal problems and enables reconsideration of traditional doctrines, revealing previously overlooked dimensions of ongoing legal challenges.

Artificial Intelligence and the Capacity to Issue Criminal Judgments

A fundamental question concerns whether artificial intelligence technologies may be employed during the sentencing stage, often described as the decisive point and ultimate culmination of the criminal process. Undoubtedly, the application of AI technologies in earlier stages of criminal proceedings generates comparatively less controversy. For example, during crime detection and prosecution phases, AI tools may be implemented provided appropriate regulatory safeguards exist, privacy rights are protected, and the presumption of innocence is respected (6). Similarly, during preliminary investigations—particularly in decisions concerning preventive detention—judicial authorities attempt to predict whether the accused will appear before the court or whether release poses a risk of reoffending. When an accused individual is assessed as presenting a significant risk of nonappearance or social danger, detention may be ordered; otherwise, low-risk defendants may remain free pending trial. Consequently, the integration of AI-based risk assessment software into judicial decision-making processes is unsurprising. Nevertheless, sentencing decisions involve broader and more complex considerations.

At the sentencing stage, judicial authorities must determine criminal responsibility, select an appropriate sanction, and establish the severity and duration of punishment, often guided by competing penal theories such as rehabilitation, deterrence, and incapacitation (25). The role of AI technologies in determining guilt and punishment therefore differs substantially from their application in earlier procedural phases, and implementation at this stage requires exceptional caution. Errors in sentencing undermine the legitimacy of the entire criminal justice system and may threaten public security (24). Despite these concerns, some scholars argue that automated decision-making may be faster, more consistent, and in certain respects more transparent than human judicial reasoning.

Critics of traditional adjudication note that no uniform protocol governs judicial decision-making; judges rely on diverse personal and contextual factors—such as criminal history, age, family conditions, employment status, education, and even appearance—yet the manner in which these variables influence outcomes remains largely undocumented. Empirical observations suggest that human judges may demonstrate unconscious bias in sentencing decisions, while institutional mechanisms for controlling such bias remain limited (24).

Supporters of AI-assisted sentencing further argue that systems based on comprehensive legal databases and precisely coded “if–then” rule structures may evaluate mitigating and aggravating circumstances with greater consistency across comparable cases. Following confirmation of guilt, inference engines within AI systems can analyze relevant legal inputs and applicable statutes, producing sentencing outcomes rapidly and systematically. Decisions generated through expert-coded datasets may reduce risks associated with human error, inattentiveness, personal bias, external influence, or inconsistency. Unlike human decision-makers, artificial intelligence systems are not affected by psychological conditions, emotional fluctuations, fatigue, or external pressures, and they are capable of ensuring uniform punishment for similar offenses irrespective of individual judicial preferences. Faster and more consistent sentencing decisions may also reduce delays between arrest and punishment, thereby enhancing the deterrent effect and overall efficiency of criminal sanctions (4).

Conversely, critics maintain that fully automated decision-making within criminal justice systems may be either infeasible or fundamentally unjust for three principal reasons. First, algorithms underlying AI systems are inherently imperfect. Second, machine learning systems depend on datasets that may unintentionally encode existing social discrimination. Third, many AI systems operate as “black boxes,” lacking sufficient transparency and accountability to justify their outcomes within a rule-of-law framework (24).

Issuance of Criminal Judgments through Inferential Algorithms

The use of inferential algorithms in criminal sentencing is closely connected to the defendant’s past circumstances and criminal history. Prior to issuing a judgment, judicial authorities typically request a Pre-Sentence Investigation (PSI) report containing detailed information regarding the defendant’s personal background and life history. This report is generally prepared by a court officer with expertise in social work rather than by a legal practitioner. The resulting document includes information concerning the accused person’s criminal record, interviews with family members, friends, and former employers, as well as broader biographical details. The underlying rationale of such reports is that sentencing should not be limited solely to the legal charge but must also consider the individual characteristics and social context of the defendant (26).

Within the United States, the use of risk-assessment systems does not follow a uniform procedural model. For example, in the State of Kentucky, it is mandatory that pre-sentencing investigation reports include risk assessments tailored to each defendant, and sentencing judges must evaluate the probable impact of a sentence on reducing future criminal behavior. In contrast, the State of Ohio has adopted an approach requiring the Department of Rehabilitation and Correction to employ validated risk-assessment instruments for adult offenders, tools that serve multiple purposes including sentencing decisions (26). Despite differences in implementation, American courts increasingly rely on recidivism prediction models to estimate offender dangerousness and determine punishment severity. These algorithms typically rely on variables such as socioeconomic status, education level, employment situation, gender, age, family conditions, and neighborhood environment, with a common emphasis on past conduct and behavioral history (26).

From an analytical perspective, the incorporation of inferential algorithms into sentencing may be regarded as a justified attempt to structure judicial decision-making. Without algorithmic assistance, the reasoning process occurring within the judge's mind remains largely invisible, and mental evaluations ultimately appear only in the final judicial decision without transparent documentation. Inferential algorithms externalize these previously implicit evaluations by assigning measurable weight to relevant variables and making decision factors observable. Consequently, hidden and subjective reasoning becomes visible and open to scrutiny, potentially reducing discrimination, corruption, and human error. Nevertheless, the risks associated with algorithmic decision-making must not be ignored. Legitimate concerns arise regarding whether inferential algorithms may embed systematic and persistent discrimination against socially vulnerable defendants. Uniform outputs generated by fixed variables and standardized patterns may produce repetitive outcomes that appear consistent but fail to achieve substantive justice. Identical judgments in apparently similar cases may create a deceptive appearance of fairness while neglecting the unique circumstances of individual cases. Therefore, within criminal adjudication, the human judge must remain the ultimate decision-maker, and algorithms should function as supportive instruments rather than substitutes for human reasoning. While structured consideration of relevant variables can enhance consistency, such systems must not constrain the analytical independence of judicial reasoning.

Comparison of the Acceptability of Human Judges and Artificial Intelligence Judges

The judiciary performs not only legal functions but also a public institutional role that must maintain social legitimacy as an impartial and fair authority. Certain legal rules—such as permitting parties to agree to the relationship of an arbitrator while prohibiting agreement regarding judicial impartiality—exist precisely to preserve public confidence in courts. Public acceptance of judicial decisions depends upon reasoned justification and societal trust in judicial neutrality. Society generally rejects decisions perceived as hasty or insufficiently reasoned, and transparent explanation of judicial reasoning plays a decisive role in legitimizing adjudication (4). Judicial independence requires resistance to social pressure; nevertheless, widespread public rejection of judicial decisions may signal systemic deficiencies requiring institutional reform.

Theoretically, the ideal judge is expected to act impartially and rely on objective reasoning, although human decision-makers inevitably remain influenced by personal experiences, values, and emotions. Social resistance toward AI judges partly stems from the prevailing conception of justice as a fundamentally human endeavor grounded in empathy and moral understanding. Public trust in human judges derives from their professional qualifications, ethical obligations, and oath of impartiality, allowing even concise judgments to gain acceptance. By contrast, artificial intelligence lacks such pre-existing trust, and acceptance of its decisions depends almost exclusively on the written reasoning accompanying the outcome (27).

Public Acceptance of Dispute Resolution Conducted by Artificial Intelligence Judges

Public acceptance of dispute resolution processes requires visible evidence that a judge has consciously attempted to discover the truth and deliver a fair decision. This perception constitutes a cornerstone of democratic justice systems, and neglecting the human dimension of adjudication risks undermining public confidence. Despite the susceptibility of human judges to various cognitive influences, their decisions currently enjoy greater social legitimacy than those produced by artificial intelligence systems. Empirical studies indicate that as the role of artificial intelligence in judicial decision-making increases, perceived legitimacy among the public tends to decline

(28). Although AI decisions may be technically accurate or mathematically rational, they often fail to provide explanations understandable or persuasive to ordinary citizens, thereby limiting social acceptance.

The legitimacy of adjudication is closely linked to the human character of judicial proceedings, including interpersonal interaction and empathy toward litigants—qualities largely absent in artificial intelligence systems. Consequently, AI judges may struggle to foster a sense of respect or procedural justice, particularly for losing parties. Public skepticism toward judicial institutions also stems from broader systemic problems such as high litigation costs, unequal access to competent legal representation, and procedural delays, leading some segments of society to perceive courts as serving privileged groups. If artificial intelligence can meaningfully reduce such structural deficiencies, public attitudes toward AI-assisted adjudication may gradually improve. Nevertheless, several scholars argue that even when human and AI decisions produce identical outcomes, judgments issued by human judges remain more socially acceptable (11). Over time, however, as societies become increasingly accustomed to software-based decision systems, this advantage may diminish (9).

Empirical research further suggests that public acceptance of AI judgments remains limited, particularly in the absence of effective human oversight, although experiences in medical diagnostics demonstrate gradually increasing trust in AI systems—a development that may eventually extend to judicial contexts. Despite technological advancement, litigants must feel that they have been heard and afforded a genuine opportunity to present claims and defenses, a perception potentially weakened by extensive reliance on automated adjudication. Some legal theorists therefore warn that excessive commodification of judicial processes may conflict with rule-of-law principles and diminish the institutional dignity and authority of courts (25). The degree of acceptance of AI judges also depends on the structure and legal culture of each judicial system: jurisdictions in which judges play an active and creative role in developing law may encounter greater resistance to AI adjudication, whereas systems characterized by more formalistic or conservative judicial functions may adopt such technologies more readily.

Liability of Artificial Intelligence Acting as a Judge

One of the most significant challenges associated with artificial intelligence adjudication concerns the legal responsibility of AI systems and whether a computer program can independently issue binding judicial decisions while assuming responsibility for their consequences. This issue has already emerged in judicial practice in certain jurisdictions. For example, in *Pintarich v Deputy Commissioner of Taxation (2018)*, the Federal Court of Australia held that a decision generated by a computer could not be regarded as an administrative decision because a legal decision requires a mental process and an intention to express a conclusion—elements absent in computerized systems (16).

The legal status of artificial intelligence responsibility varies across legal systems. Some jurisdictions have experimented with granting limited forms of legal personality to artificial intelligence, thereby opening the possibility of recognizing independent liability. Measures such as granting citizenship to the robot “Sophia” in Saudi Arabia or residence status to an intelligent system in Japan have been interpreted as symbolic steps toward recognizing AI legal personality (19).

Under Iranian law, Article 171 of the Constitution and Article 13 of the Islamic Penal Code (2013) regulate judicial responsibility. According to certain legal scholars, judicial liability consists of four essential elements: the existence of a judicial decision, fault or error, occurrence of damage, and a causal relationship between the decision and the harm. The element of judicial decision-making is fulfilled only where artificial intelligence performs adjudication

independently. Where an AI-generated opinion remains subject to review and approval by a human judge, full responsibility remains attributable to the human judge. Even in hypothetical scenarios involving autonomous AI adjudication, the absence of a clear causal relationship and the difficulty of attributing intention or agency to artificial intelligence cast serious doubt upon the possibility of assigning liability directly to AI systems (29).

Because Iranian law does not recognize artificial intelligence as a legal person, AI systems are treated legally as products or tools and cannot interrupt or replace the liability of natural or legal persons involved in their deployment. In the absence of specific legislation governing AI adjudication, liability arising from error or negligence attributable to artificial intelligence acting in a judicial capacity would ultimately rest with the state. By analogy with Article 11 of the Civil Liability Act, damages caused by AI judicial error may be attributed to deficiencies in governmental instruments or administrative mechanisms, rendering the state responsible as the dominant causal agent (18).

Conflict with Judicial Paradigms in the Iranian Legal System

Replacing human judges with artificial intelligence within the Iranian legal system encounters fundamental challenges rooted in Shi'a jurisprudence and traditional conceptions of adjudication. Islamic jurisprudence and Iranian law prescribe numerous qualifications for judges, including maturity, rationality, Islam, justice, masculinity, *ijtihad* (juristic competence), freedom, legitimate lineage, knowledge of legal and religious principles, and the ability to speak and perceive. Most of these conditions are inherently human attributes, making their realization in relation to an artificial intelligence judge conceptually problematic. Although robots possess capacities for data processing, communication, and rational analysis, applying religiously grounded concepts such as intellect, knowledge, speech, and perception to artificial systems remains highly contested.

From the perspective of Islamic legal theory, differing opinions exist regarding the permissibility of employing artificial intelligence in judicial functions. Some jurists argue that if a person or instrument operates under authorization of a qualified judge and merely assists in applying legal rules to factual situations—while remaining free from error—its use may not be impermissible (30). Other scholars maintain that such use requires explicit authorization by a religious authority, while some reject its permissibility altogether or consider practical realization unlikely. Nevertheless, many accept the use of artificial intelligence as an auxiliary judicial tool rather than an autonomous judge.

Based on interpretations derived from Qur'anic sources, jurisprudential traditions, judicial qualifications, and prevailing legal custom, a stronger tendency appears toward restricting autonomous AI adjudication while permitting broader use of general-purpose artificial intelligence as a supportive instrument. Within this framework, if artificial intelligence operates according to statutory law and, in cases of legislative silence, relies upon recognized juristic opinions while remaining under human judicial supervision, some jurists who accept adjudication by a non-mujtahid judge may also consider AI-assisted adjudication acceptable. Moreover, the significant supportive role of artificial intelligence should not be overlooked. AI systems can assist judges by identifying dominant judicial precedents, organizing case law, and extracting authoritative juristic opinions from extensive doctrinal sources, particularly where statutory guidance is absent, thereby strengthening judicial reasoning without replacing human judicial authority.

Conclusion

The application of artificial intelligence in judicial proceedings creates significant opportunities for judicial institutions and judges; however, the complete replacement of human judges by artificial intelligence faces serious challenges and limitations. One of the most important challenges concerns legal reasoning in hard cases, where competing jurisprudential approaches—such as positivism and formalism on the one hand, and natural law and legal realism on the other—come into conflict. Positivist and formalist perspectives assume that legal rules are definite and determinate, allowing artificial intelligence to apply established norms and determine outcomes logically. In contrast, complex cases and legal gaps often require human judges to rely on moral reasoning, value-based judgment, and rights-oriented interpretation to resolve uncertainty, capacities that current artificial intelligence systems do not adequately possess. Consequently, existing AI capabilities align more closely with formal legal logic and may prove ineffective when confronted with difficult or unprecedented cases.

Another major challenge involves algorithmic bias, which may influence AI-generated outcomes. Although human judges are not free from error or bias, public expectations toward intelligent systems are significantly higher, and society often anticipates fully accurate and impartial results from automated decision-making. Social acceptance of AI-assisted judgments therefore depends on the existence of reasoned and well-justified decisions, and many individuals prefer that AI-generated rulings remain subject to human judicial review.

The specific characteristics of the Iranian legal system introduce additional complexities. Many judicial qualifications—including maturity, justice, moral integrity, and juristic competence—are inherently human attributes that artificial intelligence cannot formally satisfy. Regarding responsibility, some legal systems have considered granting artificial intelligence a form of legal personality and independent liability, which would require allocation of assets or liability insurance mechanisms. In legal systems such as Iran's, however, artificial intelligence cannot be treated as an autonomous causal actor within traditional chains of legal responsibility. In the absence of effective human oversight, ultimate responsibility for erroneous AI decisions would rest with supervising authorities, system developers, and, in practice, the state.

Artificial intelligence nevertheless possesses considerable potential to accelerate proceedings, facilitate judicial processes, and enhance accuracy in both civil and criminal adjudication. Current technological capabilities, however, remain insufficient to justify full substitution of human judicial reasoning at all levels of adjudication. The use of AI in simpler or routine cases may reduce judicial workload, provided that meaningful human supervision over AI-generated decisions is maintained. In complex cases and higher judicial forums, human judges must retain their central role, drawing upon deep understanding of society, culture, ethics, and legal custom while contributing to the evolutionary development of law in response to social needs.

Within criminal justice, artificial intelligence can assist judges and attorneys by analyzing large datasets and generating algorithmic recommendations that support faster and more precise decision-making. Nevertheless, concerns relating to privacy protection, data security, and potential system errors remain significant challenges. Overall, artificial intelligence should be understood as an effective auxiliary tool within judicial processes rather than a replacement for human judgment, requiring careful supervision and an appropriate legal framework to prevent misuse and mitigate potential risks.

Acknowledgments

We would like to express our appreciation and gratitude to all those who helped us carrying out this study.

Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adhered in conducting and writing this article.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

References

1. Kaplina O, Tumanyants A, Krytska I, Verkhoglyad-Gerasymenko O. Application of Artificial Intelligence Systems in Criminal Procedure: Key Areas, Basic Legal Principles and Problems of Correlation with Fundamental Human Rights. *Access to Justice in Eastern Europe*. 2023;3(20):147-66.
2. Moazenzadegan H, Neyestanak A. Feasibility of investigator actions in the electronic trial process. 2023;87(123):267.
3. Hosseini A, Abdekhodaei Z, Sharifkhani M. Application of artificial intelligence in judicial proceedings: The challenge of transparency and its solutions. 2023;28(101):67.
4. Abuzari M, Barzegar M, Naderi Z. Feasibility of criminal responsibility for artificial intelligence-based weapons of war and the issue of impunity in the International Criminal Court. *Journal of Modern Technology Law*. 2023;4(8).
5. Combe G. Issues, Benefits and Risks in the Use of Artificial Intelligence and Its Algorithms in Access to Justice and Law Enforcement. *Ethics, Integrity and Policymaking*2022. p. 175-94.
6. Sheikhvand M, Kord Alivand R, Minaei B, Ashouri M, Mahdavi Sabet M. A comparative study of the facilitating application of artificial intelligence in criminal prosecution: Capacities and challenges. *Quarterly Journal of Comparative Law Research*. 2023;27(1):81-104.
7. Afsari Mardaq N, editor *Analysis of the use of artificial intelligence in the realization of criminal justice and its challenges*2023.
8. Sheikhvand M, Kord Alivand R, Minaei B, Ashouri M, Mahdavi Sabet M. Artificial intelligence and the issuance of criminal sentences: Decision-making or decision-support? *Comparative Law Research*. 2023;27(4):138-67.
9. Laukyte M, editor *AI as a Legal Person*2019.
10. Surden H. *Artificial Intelligence and Law: An Overview*. *Stanford Law Review*. 2019;35(4):105-6.
11. Sourdin T, Zariski A. *The Responsive Judge: International Perspectives*: Springer; 2018. 100-1 p.
12. Mostafavi Ardebili M, Taghizadeh Ansari M, Rahmatifar S. Functions and necessities of artificial intelligence from the perspective of fair trial. *Journal of Modern Technology Law*. 2021;3(6):60.
13. Bahadori Jahromi A, Alipour M. Legal principles and requirements governing legal technologies in judicial proceedings. 2022;86(117):175-200.

14. Jahangiri Darzeh Kanani M, editor *The impact of technology and artificial intelligence on criminal law and the judicial process*2023.
15. Marr B. *Is artificial intelligence (A.I) dangerous and should we regulate it now?* 2021.
16. Brookes T, Bazzana M. *Automated Correspondence not Necessarily a 'Decision' which can be Relied on.* 2018.
17. Bostrom N, Muller VC. *The super intelligent will: motivation and instrumental rationality in advanced artificial agents. Theory and philosophy of AI*2012. p. 71-85.
18. Hekmatnia M. *Civil liability arising from the production of autonomous artificial intelligence-based robots. Islamic Law.* 2019(60):251.
19. Chesterman S. *Artificial Intelligence and Limits of Legal Personality. Journal of International and Comparative Law Quarterly.* 2020;9(4):821.
20. Mirahmadi M, Omidi O. *Application of artificial intelligence in foreign policy decision-making: Capacities and challenges. Strategic Research of Politics.* 2024;13(50):259-300.
21. Mostafavi Ardebili M, Taghizadeh Ansari M, Rahmatifar S. *Functions and requirements of artificial intelligence from the perspective of fair trial. Modern Technology Law.* 2022;3(6):47-60.
22. Omohundro SM, editor *The basic A.I drives-self-aware systems*2008; Amsterdam: IOS Press.
23. Sadeghi S. *Artificial intelligence in the criminal justice system: Future trends and possibilities. Legal Civilization Quarterly.* 2023;6(18):91-102.
24. Bagaric M, Hunter D. *Enhancing the Integrity of the Sentencing Process through the Use of Artificial Intelligence. Sentencing and Artificial Intelligence: Oxford University Press;* 2022. p. 132-55.
25. Posner RA. *How Judges Think.* USA: Harvard University Press; 2008. 5 p.
26. Rasmussen. *Algorithm- Based Sentencing and Discrimination. Sentencing and Artificial Intelligence: Oxford University Press;* 2022. p. 80-102.
27. Crotoof R. *Cyborg Justice and the Risk of Technological-Legal Lock-In. Columbia Law Review.* 2019;119(1):235.
28. Re R, Solow-Niederman A. *Developing Artificially Intelligent Justice. Stanford Technology Law Review.* 2019;22(2):276.
29. Asghari Aghmashadi F. *Civil liability of the judge in Iranian law. Journal of Law and Political Science.* 2007(7):35.
30. Haji Ali F. *Civil liability of the judge from the perspective of Iranian law and the five schools of jurisprudence. Journal of Comparative Jurisprudence.* 2013(1):131.