The Role of Artificial Intelligence in the Judicial Process

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Abstract

Artificial intelligence (AI) technology has introduced significant transformations in the field of law and judicial procedures. Intelligent legal systems, utilizing machine learning and natural language processing, can enhance both the speed and accuracy of judicial processes. However, the adoption of this technology presents legal challenges such as the protection of privacy, the risk of bias, and ambiguities in accountability. In recent years, researchers and policymakers have become increasingly aware of the potential disruptive effects of AI on court operations and judicial decision-making. Although AI systems are currently employed to a limited extent in courts, debates persist regarding the future of this technology in judicial decision-making. Designing an automated court or an AI judge requires consideration of societal expectations, as well as the necessary skills and resources. Fundamental principles such as fairness, impartiality, and efficiency must be integrated into the design of new judicial systems in order to maintain public trust. AI has the potential to expand access to justice, render judicial decisions based on logical evidence through data analysis, and prevent discriminatory outcomes. Additionally, this technology may enhance transparency and public trust while increasing the efficiency and accuracy of case adjudication. This article adopts a descriptive-analytical approach, relying on library-based sources, to explore the role of AI in the judicial process. It aims to elucidate the applications of AI within this domain and to identify both its strengths and weaknesses.

Keywords: Artificial Intelligence, Intelligent Legal System, Judicial Process, Judiciary System

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1. Introduction

Artificial intelligence (AI) technology is advancing rapidly and permeating various aspects of human life, one of which is the legal and judicial domain. The utilization of intelligent legal systems in judicial proceedings represents one of the prominent applications of AI. These systems, based on advanced technologies such as machine learning, natural language processing, and big data analytics, are capable of improving legal processes by facilitating, accelerating, and enhancing the accuracy and efficiency of judicial activities, playing a key role in this transformation.

Intelligent legal systems are equipped with capabilities such as automatic summarization of legal documents, analysis and extraction of key topics, identification of relevant precedents and solutions, and detection of similarities between cases. These functionalities can significantly assist judges and lawyers in fulfilling their responsibilities while reducing the complexity and volume of legal documentation. However, the use of AI in the legal and judicial fields raises important challenges and

considerations, including concerns about personal privacy and data protection, risks of bias and unintended discrimination in AI algorithms, security vulnerabilities, and legal ambiguities regarding the distribution of responsibilities and authority between humans and AI systems.

The noble goal of justice and the mechanisms for achieving it, including fair trial rights, have always been core values in both national and international legal systems. A comparison between traditional and modern eras reveals that historical judicial processes often suffered from errors and shortcomings due to the lack of technological infrastructure. These flaws arose from over-reliance on human judgment, the absence of comprehensive legal databases, limited access to legal support services, dependence on oral sources (e.g., witness testimony), and the lack of means to document and archive evidence. The inability to make judicial proceedings publicly accessible further exacerbated the issues. Over time, with the development of infrastructure and the advent of new information processing technologies—particularly AI—this domain has undergone significant transformation to achieve human rights goals, especially fair trials. Various human rights instruments affirm this right, including the European Declaration on Digital Rights and the "Principles for the Digital Decade" adopted by the European Commission in 2022. In this document, under the third pillar titled "Freedom of Choice," it is stated that all individuals should benefit from AI in the digital environment through informed choices while being protected from risks to their health, safety, and fundamental rights. The simultaneous mention of both benefits and risks signifies that technologies like AI carry not only advantages but also inherent challenges. Hence, this study raises two key questions: First, how can AI be applied in judicial systems? Second, what principles and rules must govern the design and training of AI to ensure its outcomes are consistent with overarching principles of justice and fair trial rights?

Today, due to scientific and technical complexity and limited access to emerging AI technologies in many countries, effective utilization of AI in legal and judicial contexts is either unattainable or rarely prioritized, which has affected the quality and scope of related research. Therefore, the objective of this article is to examine the role of AI and intelligent legal systems in judicial proceedings. Initially, it will outline the capacities and potential of AI to enhance and expedite legal processes, followed by an exploration of the key legal and technical challenges.

2. Literature Review

In his study titled *Human Rights in the Age of Artificial Intelligence*, Andersen discusses several issues related to AI and its challenges. He argues that policymaking in the field of AI can reduce the negative impact of this technology on human rights; however, he does not address the goal of fair trial procedures in his research (Shahidi, 2018).

Kelnar, in his research *Governance of Artificial Intelligence*, regards AI-based technologies as highly significant due to their inclusion of human capabilities such as comprehension, reasoning, and planning. He highlights the main advantage of AI as its low cost of use combined with high accuracy, though he does not explore legal dimensions in his study (Mostafavi Ardabili et al., 2022).

Abdi, a researcher at the Islamic Parliament Research Center of Iran, in his study *An Examination of AI Technology in Iran and the World*, defines AI systems as those capable of replicating intelligent human behaviors such as understanding complex conditions and responding appropriately. While he describes applications of AI in identity recognition systems, robotic surgeries, rescue robots, and firefighting robots, he does not address its use in the judicial field or fair trial rights (Ebrahimi, 2023).

Burri, in his study *Artificial Intelligence and International Law*, argues that international humanitarian law can govern AI when used in autonomous weapons. However, regarding AI's application in judicial processes, he defers the matter to regional and international human rights courts, contending that these courts must devise the mechanisms for AI use in legal proceedings, though he offers no practical framework for achieving fair trial outcomes (Engstrom et al., 2020).

3. The Concept and Types of Artificial Intelligence

Understanding the concept of artificial intelligence requires a comprehensive definition of both “intelligence” and “artificial intelligence.” Theorists have proposed various definitions of intelligence. Some define it as the ability to learn from experience, perceive, and adapt appropriately to environmental changes (pasquale, 2019). Others describe intelligence as the capacity to

rapidly find suitable solutions within vast informational spaces that might appear inaccessible to ordinary observers (Jordan & Mitchell, 2015).

Artificial intelligence, accordingly, has also been subject to diverse definitions. The term "AI" was first introduced by Professor John McCarthy of Stanford University, who defined it as the science and engineering of making intelligent machines—specifically, machines capable of learning and acting intelligently (Habibi & Jafari, 2021). In a more comprehensive definition, AI refers to intelligent systems that learn through big data analytics and cloud computing, perform tasks, and empower new types of software and robots to function with high levels of autonomy from human designers and operators (Ebrahimi, 2023).

AI systems are commonly classified into four generations based on their decision-making and problem-solving capabilities: first-generation reactive AI, second-generation limited-memory AI, third-generation theory of mind AI, and fourth-generation self-aware AI (Ebrahimi, 2023).

The significance of this classification lies in the fact that next-generation AI systems proposed for judicial processes must possess not only intelligence but also a human-like understanding grounded in emotional awareness. This trait is deemed essential for ensuring justice in legal proceedings. Notably, intelligent behavior and data analysis in machine systems are ineffective without a practical roadmap, referred to as an "algorithm." An algorithm is a finite set of instructions executed sequentially to solve problems. Simply put, it is a step-by-step process designed to resolve a case or issue.

4. The Concept of Judicial Process

Legal scholars define judicial process as the examination and resolution of disputes between parties through judicial decision-making (Deeks, 2019). They emphasize that the concept of fairness varies across different cultures and legal traditions. In judicial contexts, fairness refers to honesty, impartiality, equality, and conduct in accordance with legal standards. Rather than a singular definition, fairness is reflected in multiple legal principles.

The historical roots of fair trial principles can be traced to the Roman Law of the Twelve Tables, which emphasized principles such as adversarial proceedings, equality, and the prohibition of judicial bribery. Likewise, the Magna Carta enshrined the necessity of jury trials, protection against arbitrary detention, and equality under the law. Fair trial is fundamental to democratic societies, where the rights of the accused hold particular significance. Without fair trial guarantees, rule of law and public trust in the judicial system collapse. This erosion of trust stems from improper conduct and reliance on inappropriate methods for identifying crimes and perpetrators, potentially leading to unjust punishment of innocent individuals.

In modern times, the right to a fair trial is enshrined in numerous international treaties, including Article 14 of the International Covenant on Civil and Political Rights (Habibi & Jafari, 2021).

5. Artificial Intelligence and Judicial Adjudication

Artificial intelligence holds different meanings for different individuals. Some perceive it as a form of artificial life that can render humans more intelligent, while others view it as a data-processing technology (Reiton, 2019, p. 20). AI is an emerging system that seeks to replicate human behavior using computers and big data. It emulates human reasoning through algorithms designed for learning and analyzing vast datasets.

In today's technologically advanced world, many legal system functions can potentially be replaced by AI technologies. Indeed, some courts have already begun incorporating AI into judicial procedures.

AI is a wholly new technology, distinct from digital technologies that courts have used for years, such as case management applications or electronic filing systems. Traditional digital technologies have served various purposes, including case management, electronic filing, integrated justice chains, electronic justice platforms, video technology, legal databases, human resources, and accounting systems (Davey, 2016; Deeks, 2019).

While there are similarities between AI and other digital technologies, the differences are crucial to understanding the implications of AI's integration into the judiciary. The use of AI and machine learning in legal matters faces numerous challenges. One major challenge is retrieving judicial opinions from legal datasets, which often yields narrow or incomplete results. Additionally, the complexity of legal questions can increase the likelihood of inaccuracy.

If AI can effectively perform classification operations and apply logical linking, cross-referencing, and fact-pattern matching in legal cases, it is expected to enhance truth discovery in trials (Habibi & Jafari, 2021). To achieve this, systematic automation methods are employed, which include identifying individuals or objects, modeling relationships between information, detecting relational links, and identifying inconsistencies.

5.1. Law, Technology, and Humanity in the Administration of Justice

Today, information and communication technology has expanded across judicial operations, promising transparency, efficiency, and fundamental changes to work practices. Existing systems (such as case management, electronic filing, and digital exchange of data and documents) automate procedures that are well-regulated by procedural codes. The impact of such "traditional" digital technologies on the performance of the judiciary has been largely positive. They have contributed to improved access, equality, efficiency, and effectiveness in judicial proceedings (pasquale, 2019).

More recently, the development of artificial intelligence heralds a new wave of transformation, not only influencing procedures but also affecting decision-making: legal analyses and recommendations produced by autonomous systems (legal analytics), prediction of judicial decisions based on case law and other criteria (predictive systems), and even the delegation of decision-making capacity to AI judges (Safaei & Azarang, 2019; Shahidi, 2018).

Judiciaries, faced with high caseloads, backlogs, and resource shortages, now confront the modern opportunities offered by AI. AI enables decision-making to be more cost-effective, consistent, and swift. Functionally, digital technologies are considered tools that support the administration of justice. Ministries of justice, through the implementation of case management systems, electronic filing, and inter-agency collaboration platforms between courts and prosecutors, seek to automate processes and improve efficiency, legal compliance, and public access to justice.

These initiatives pave the way for the delivery of electronic justice, which is founded on and benefits from information and communication technologies. Nonetheless, the impact of digital transformation on justice administration is not confined to operational aspects. These changes may also pose challenges to institutional environments, affecting fundamental values such as independence, impartiality, fairness, and accountability. The tension between efficiency and ethical values necessitates a nuanced approach to maintain a balance between innovation and the foundational principles of the judiciary (Rayton, 2019; Safaei & Azarang, 2019).

5.2. Current Status of AI in the Judiciary and Usage Methods

Since ancient times, it has been part of human instinct to maximize benefits and minimize harms. Consequently, people hope to anticipate the emergence of new phenomena and prepare for them through preventive measures (Prevedello, 2017, p. 9).

Utilizing AI in case analysis helps identify applicable laws across numerous historical cases. Judicial staff can use the results of such analyses to predict the time, location, and manner in which a particular case may deviate from precedent. They can then proactively identify emerging cases and allocate appropriate judicial resources for prevention and precautionary action.

The criteria for using AI technology in the judiciary have gradually replaced traditional processing methods, ensuring the protection of citizens' property, personal liberty, social stability, and national security (Mostafavi Ardabili et al., 2022).

Privacy protection laws remain incomplete, and judicial systems lack managerial regulations for safeguarding personal data. This legislative gap makes effective protection of personal information during investigations difficult (Mostafavi Ardabili et al., 2022).

Data retrieval from AI companies plays a critical role in establishing AI-based judicial systems. These companies not only contribute to the implementation of AI in the judiciary but also advance national AI strategy.

5.3. Case Processing in Smart Court Systems

The digitization of judicial systems has been occurring globally in various forms. However, the automation of judiciary operations through AI and machine learning is still under evaluation and remains in its early stages (Alexandre, 2019).

Countries such as Canada, the United Kingdom, Ireland, and even the European Court of Justice have envisioned and implemented electronic filing and conferencing systems. Nonetheless, China leads in judicial automation, currently operating several internet courts in cities such as Hangzhou, Beijing, and Guangzhou. These courts integrate technology with judicial procedures and maximize benefits for all involved parties (Alexandre, 2019).

Internet courts leverage blockchain and AI in big data environments (Alexandre, 2019). They have also successfully implemented advanced technologies such as voice and facial recognition, integrated multi-purpose service platforms for mediation, trial, and enforcement, electronic evidence storage, and electronic summons distribution.

5.4. AI-Based Electronic Case File Generation

When litigating parties submit their complaints, the registry department initially scans the relevant documents and generates preliminary electronic files. Relevant case information is then automatically identified and made accessible through intelligent programs.

This method is nearly twice as fast as the traditional manual data entry process. Once finalized, the AI-generated electronic files are organized in accordance with the case processing workflow and used throughout all stages of litigation, expediting trial proceedings.

5.5. AI Automation in Judicial Affairs

It is frequently reiterated that technology is a tool that simply facilitates the work of judges or arbitrators without altering the nature of their duties (Giuffrida, 2004).

However, the growing prominence of big data in all fields of human endeavor has triggered a surge in demand for new capabilities in machine learning algorithms. This technology not only assumes the acceleration of judicial tasks but also implies a qualitative leap forward.

Automation enables a reduction in response times to legal problems and, as a result, reduces court congestion—particularly in cases involving relatively minor disputes. However, this also raises serious concerns regarding the rule of law (Jordan & Mitchell, 2015).

In legal proceedings, particularly in criminal contexts, extensive information must be collected from a variety of sources. AI's role in this process is to classify, link, and integrate this information without omitting any elements.

With such capabilities, prosecutors and judges can analyze and compare more documents within a comprehensive and complex case file.

It is evident that limitations arise due to concerns over confidentiality, security, or anonymization. However, these data can be combined with other publicly or privately accessible sources to form resource databases for end-users.

These users can then effectively classify, contextualize, and cross-reference the information. This process allows for the presentation of more accurate and better-organized information compared to existing resources.

6. Applications of Artificial Intelligence in Judicial Functioning

Artificial intelligence (AI) technology will profoundly transform legal adjudication processes. AI shows promise in simplifying numerous functions within the judiciary. These include streamlined and accurate case review, assisted sentencing and adjudication, evidence examination and judicial decision-making, integrated courtroom support, case management, judicial and administrative linkage analysis, and automated document generation (Handel et al., 2020).

6.1. Judicial Analytics

The term "judicial analytics" refers to the analysis of data—including judgments and other public records of judges—through AI and machine learning to monitor, understand, or predict judicial behavior. This process enables oversight and predictive modeling of judicial conduct (Mostafavi Ardabili et al., 2022).

6.2. Predictive Justice

Predictive decision-making software, primarily employed before case submission, relies on the analysis of judicial precedents. This AI-based software can review vast volumes of cases, legal documents, and rulings issued by judges over time. It can analyze data related to specific cases along with other relevant public data to inform legal strategies.

6.3. Document Automation

Several law firms are adapting to technologies that use automated software to draft legal documents. Many legal tech companies claim that documents that would typically take several days to produce can now be generated in just a few minutes.

6.4. Predictive Policing Algorithms

Machine learning tools used in judicial functions include predictive policing algorithms that utilize historical crime data to identify trends and forecast potential outcomes. Police departments have used such software to identify individuals potentially involved in firearm-related violence, either as perpetrators or victims. Algorithms assess factors such as occupation, age, and criminal background of family members to assign a numerical risk score, categorizing individuals as low, medium, or high risk for future offenses. Similar models are employed to assess the likelihood of criminal activity or recidivism among defendants (Davey, 2016).

7. Functional Characteristics of AI in Judicial Decision-Making

The digitization of legal information in recent years has introduced technological innovations into courts through the application of electronic data. The emergence of the "smart court" is the result of combining AI with judicial systems. The integration of AI and legal technology transforms judicial decision-making into an electronically informed process. By collecting data and analyzing legal statutes, AI can process judicial data more scientifically and accurately (Mostafavi Ardabili et al., 2022).

This capability allows judges to identify theoretical foundations in real time based on case-specific circumstances. Intelligent statistical data analysis not only saves time spent on research and data retrieval but also prevents the omission of critical information. AI further supports judicial development through smart party identification and retrieval of relevant data, ultimately enabling a more intelligent judiciary while reducing dependency on human labor (Mostafavi Ardabili et al., 2022).

AI can significantly prevent the issuance of duplicate rulings in cases with similar subject matter. Given its capacity to analyze large volumes of cases, AI helps judges identify nuanced differences between complex cases, thereby improving the specificity of legal rulings and avoiding uniform judgments for distinct cases.

Moreover, AI is applicable in monitoring the conduct of judicial personnel. It aids in scrutinizing judicial processes, identifying information gaps, detecting unlawful judicial behavior, and preventing abuses of power. By minimizing the influence of extrajudicial factors, AI can be effective in combating judicial corruption and significantly reducing the risk of unjust or extralegal verdicts (Davey, 2016; Deeks, 2019).

8. Ethical Challenges of AI Implementation in the Judiciary

This section examines the acceptability of AI tools in judicial systems and considers the ethical implications of AI use in legal proceedings. As AI becomes increasingly integrated into legal systems, its application raises more questions and challenges than it resolves regarding the realization of justice.

8.1. Data Bias

Data biases can subtly infiltrate predictive AI models, making them difficult to detect. In AI forecasting techniques, decisions about which datasets to include or exclude may inadvertently lead to favorable or unfavorable outcomes for different social

groups (Mostafavi Ardabili et al., 2022). This suggests that integrating AI into decision-making processes could indirectly impact social and political power dynamics, as automated decisions might advantage certain groups disproportionately.

8.2. Unequal Treatment from AI-Based Decisions

Equal treatment under the law—regardless of status—is a core principle in most legal systems. This norm presupposes that legal decisions should be based on law and facts, not on socioeconomic, political, racial, moral, gender-based, or other inappropriate personal attributes.

When individuals in identical legal circumstances are treated unequally by judges or legal authorities using AI systems, concerns about discriminatory AI-based decision-making arise. Structural inequalities within society may be reflected in the data used by AI systems, reinforcing systemic biases (Safaei & Azarang, 2019).

8.3. Limitations of AI in Judicial Contexts

Delegating value-based judicial decisions to AI remains highly contentious. Moreover, AI's role in evidence assessment contradicts the principle of free evaluation of evidence based on the court's internal conviction. These limitations align with the notion of "predictive justice," which frames AI as a tool for analyzing large datasets rather than as a replacement for human adjudication (Shahidi, 2018).

However, in alternative dispute resolution (ADR), particularly arbitration—which is based on contractual rather than public law—this issue may be addressed differently. In arbitration, parties must be fully informed about the capabilities and limitations of AI tools. Their decision to submit a dispute to AI must be voluntary and mutual. Thus, if both parties knowingly and willingly agree to resolve their dispute through AI-based arbitration, and accept its practical limitations, there is no reason to deny them this opportunity.

9. Forms of Artificial Intelligence Application in Judicial Processes

The manner in which artificial intelligence (AI) is employed in the judiciary of each country and its effects on the judicial process depend on the structure of that country's legal system. According to this study, AI can influence judicial systems in three primary ways: (a) as a crime prevention tool, (b) as a recommendation or decision-support tool, and (c) as a decision-making tool.

9.1. AI as a Crime Prevention Tool

Crime prevention refers to the anticipation, identification, and assessment of the risk of crime occurrence and the adoption of necessary measures to eliminate or reduce it (Law on Crime Prevention, Vol. 1.1, 2015, Art. 1). Preventing crime or its recurrence is a key responsibility of judicial systems globally. In the Islamic Republic of Iran, Article 156 of the Constitution assigns this duty to the Judiciary.

The role of the police as judicial officers—particularly in areas such as fraud detection in traffic incidents, child pornography, or public space crimes—highlights the relevance of AI-based technologies. AI, with its unique capabilities, not only contributes to public safety but also enhances the efficiency of the justice system. Nonetheless, crime prevention begins before a case reaches the courtroom. This aspect is critical because AI-based decisions during crime prevention or detection phases may result in discriminatory outcomes that could influence the judicial process.

AI algorithms involved in prevention work through both individual and collective mechanisms, performing tasks such as risk assessment, threat analysis, and identification of potential offenders.

9.1.1. Individual Prevention Mechanism

In this process, AI is used to assess the risk or threat posed by individuals. It analyzes specific variables—such as age, damage level, violence, police contact, parental data—by connecting to databases like police observation logs and criminal fact repositories. One such example is the ProKid crime risk assessment project developed by Dutch preventive police. ProKid

categorizes children into four risk levels for future criminal behavior: (1) Red: indicating crisis-level danger, (2) Orange: indicating problems, (3) Yellow: signaling growing potential risk, and (4) White: denoting stability and no threat (Ferris et al., 2021).

Despite the promising outcomes, some scholars argue that the data used in these mechanisms are distorted due to implementation errors (Leese, 2020, p. 2) or are biased and incomplete due to over-policing of certain communities, such as Black communities (Gonzalez, 2020, pp. 5 & 14), posing significant challenges to the assessment process.

9.1.2. Collective Prevention Mechanism

Collective prevention employs AI systems for profiling regions and their residents to prevent specific types of crimes. For instance, the integrated and evolving Delia algorithm—formerly known as the crime key—is an AI and machine learning-powered crime analysis and prediction system. It analyzes criminal behavior using geographic crime data and crime sequences committed by individuals or groups (Shahidi, 2018).

This analysis relies on 1.5 million variables, including public data such as eyewitness and victim interviews, date, time, location, age, height, body structure, skin color, hair, eyes, clothing, accent, and ethnicity. These data are combined with police reports, criminal records, and CCTV footage to predict high-crime areas and aid in crime prevention (Azarang, 2020).

9.2. AI as a Recommendation and Decision-Support Tool

Using AI as a judge's assistant or decision-support tool refers to scenarios where a judge consults AI for information gathering and receiving recommendations during case deliberation. The judge may either consider the AI's output or make an independent ruling.

For example, a judge might use AI to concurrently assess various factors—such as the offender's age, criminal record, and attendance at court hearings—to evaluate the risk of reoffending or nonappearance.

Currently, about 10% of courts in the United States, including those in Arizona, Kentucky, and New Jersey, as well as the cities of Charlotte, Chicago, and Phoenix, use such systems, which have contributed to reduced crime and incarceration rates (Azarang, 2020).

9.3. AI as a Decision-Making Tool (Judicial Substitute)

The final and most comprehensive role of AI in the judicial process is its use as a decision-making tool—that is, issuing rulings. Benefits include reducing judicial workload, enhancing evidence analysis, eliminating bias, searching extensive legal and non-legal data, standardizing justice metrics, and promoting legal values.

Achieving these objectives necessitates judicial modeling and the development of specific AI algorithms. Such models should be designed based on foundational legal values—not just legal text—and focus on integrated use of judicial guidelines aligned with system-wide legal norms and applying them rationally to individual cases (Azarang, 2020; Pournajafi & Kazemi, 2023; Safaei & Azarang, 2019).

For example, in models evaluating prisoners' eligibility for parole, assessments are made based on values such as current status, good conduct, uncontrollable variables, and algorithmic interpretations. If a prisoner's parents or close associates have criminal histories, the system may flag the individual as high-risk and unqualified for parole (Pournajafi & Kazemi, 2023).

10. The Role of Artificial Intelligence in Judicial Processes

10.1. Intelligent Capabilities of AI in Judicial Procedures

Intelligent legal systems based on machine learning algorithms, natural language processing, and big data analytics offer numerous applications in judicial processes. These systems assist judges and lawyers in various domains, including:

1. **Automatic Document Summarization**: AI provides concise and accessible summaries of complex case files, enabling quicker understanding and processing by legal professionals.

2. **Content Analysis and Key Topic Extraction**: AI identifies the central themes and legal issues in a case, helping judges focus on essential points and avoid distraction by extraneous details.
3. **Legal Precedent and Solution Identification**: These systems search large legal databases to find relevant precedents and legal provisions, ensuring that rulings are aligned with the most up-to-date legal standards.
4. **Case Similarity Analysis**: By comparing documents across cases, AI systems facilitate knowledge sharing, trend identification, and consistency in judicial decisions.
5. **Outcome Prediction**: By learning from previous cases and judgments, AI predicts possible outcomes, helping judges and lawyers form realistic expectations.

These features help streamline case resolution, reduce court workload, and promote consistency and legal coherence. However, the implementation of such systems brings significant legal and technical challenges that require further examination.

10.2. Challenges of Artificial Intelligence in the Judicial Process

Despite the advantages and vast capabilities of intelligent legal systems in adjudication, the application of such technologies in the judiciary faces significant legal and technical challenges that require careful assessment and resolution.

1. **Privacy and Personal Data Protection**: One of the foremost concerns regarding the use of intelligent systems in judicial proceedings is the protection of privacy and personal data. Given the vast amount of sensitive information contained in legal case files, robust data protection mechanisms must be established, and comprehensive legislation must be developed. The absence of such legal safeguards may lead to misuse by hackers or unauthorized actors.
2. **Risk of Bias and Unintentional Discrimination in Algorithms**: Algorithms used in intelligent systems may inadvertently exhibit bias and discrimination. Judicial decisions must be free from any form of discrimination based on race, gender, ethnicity, or similar factors. Studies have shown that machine learning algorithms can absorb biases from their training datasets, which may contain human prejudices—potentially undermining public trust in the judiciary.
3. **Legal Ambiguities in the Allocation of Responsibility Between Humans and AI Systems**: A major challenge in adopting intelligent systems within the judiciary involves legal uncertainties surrounding the distribution of responsibilities and legal competencies between humans (judges, attorneys) and AI systems. In cases of error or faulty decisions, who bears legal responsibility? Can an intelligent system hold legal or judicial liability? These questions necessitate the establishment of clear and comprehensive legal frameworks, which current laws often lack.
4. **Security Risks and Unanticipated Vulnerabilities**: The extensive use of intelligent systems in adjudication presents concerns regarding the security of sensitive and vital judicial information. Unauthorized access to these systems could have irreversible consequences. Additionally, the possibility of unforeseen vulnerabilities or failures in these systems could lead to serious deviations in judicial decisions.
5. **Accountability and Trust-Building Challenges**: Judicial AI systems often function as complex "black boxes" whose decision-making processes are not easily understandable by humans. This opacity hinders transparency and public trust in the system's outcomes. Users may distrust tools they do not understand or whose operational logic is unclear.
6. **Need for Financial Resources and Robust Infrastructure**: Establishing, maintaining, and expanding intelligent legal systems requires substantial investment in IT infrastructure, high-quality training data, and experienced professionals. These requirements pose serious, costly challenges, especially for developing countries like Iran.

These multifaceted legal and technical challenges demonstrate that while AI has significant potential in adjudication, it necessitates comprehensive evaluation and precise policymaking to mitigate risks and resolve uncertainties.

10.3. Artificial Intelligence in Iran's Judicial Process vs. Leading Countries

Iran remains at an early stage in applying AI technology within its judicial system. However, some preliminary efforts have been made. In contrast, many developed countries are already leading in the deployment of intelligent legal systems within their judiciaries. A comparative review of these experiences can offer valuable insights for Iran.

Although widespread institutional use of intelligent legal systems has not yet occurred in Iran, some initial steps have been taken—such as the development of AI-based platforms like the "Smart Criminal Classification System" and the "Intelligent

Legal Provisions Matching System" in the Judiciary. These platforms use natural language processing and document analysis to identify key issues and legal offenses in cases, offering relevant legal recommendations.

The Judicial Research Institute has also initiated several AI-related research projects in legal and judicial domains in recent years. Nevertheless, full utilization of this technology's potential still demands significant effort in Iran. Key weaknesses include:

- Lack of comprehensive legal frameworks and regulations governing AI use in adjudication
- Shortage of experts with interdisciplinary knowledge in law and AI integration
- Inadequate IT infrastructure and financial resources
- Concerns regarding data security and privacy

Conversely, many developed countries have long adopted AI in judicial practice. In the United States, major tech firms such as Amazon, Microsoft, and Google have launched numerous legal and judicial AI projects. These systems can summarize documents, analyze content, identify legal precedents, and predict case outcomes. Federal courts use AI tools to assist judges in legal research and identifying key information.

In the UK and European Union, significant strides have been made in implementing AI in the judiciary. These include research initiatives and prototype systems for document summarization and judicial decision forecasting. Likewise, courts in countries such as Australia and Canada use AI tools for case management, data integration, and decision support.

These countries benefit from clear legal frameworks for AI use in law, advanced IT infrastructures, access to skilled professionals, and dedicated budgets for developing and implementing such systems. Still, challenges remain, including unresolved questions around accountability, risks of bias and discrimination, and privacy protection concerns.

The contrast between Iran and leading countries shows that although foundational steps have been taken, Iran must enact fundamental reforms to fully integrate AI into its judicial process. Learning from international best practices can greatly expedite this progress.

11. Conclusion

Artificial intelligence holds significant transformative potential for the judicial system and can enhance the efficiency of legal proceedings. Intelligent legal systems can greatly assist judges and attorneys in summarizing documents, extracting key issues, identifying relevant legal sources, and predicting potential outcomes. However, the implementation of AI in adjudication faces serious legal and technical considerations.

Key barriers include concerns about privacy protection, the risk of algorithmic bias and discrimination, security threats, ambiguities in assigning legal responsibility, and difficulties in establishing transparency and accountability. Additionally, the absence of comprehensive legal regulations, lack of qualified human resources, and inadequate technological infrastructure are major challenges confronting Iran.

Success stories from countries like the United States, the UK, and the European Union demonstrate that with proper planning and political will, AI can be effectively integrated to improve judicial systems. Key steps for Iran include enacting comprehensive laws, training specialists, developing infrastructure and securing funding, ensuring transparency and accountability mechanisms, and fostering international collaboration.

Ultimately, AI should serve as a tool to support—rather than replace—judges and the judicial system. Its goal is to enhance human roles by improving accuracy, speed, and effectiveness in decision-making. Thus, legal and ethical considerations must be meticulously addressed to pave the way for better delivery of justice.

Recommendations for Optimizing the Use of Intelligent Legal Systems in Iran's Judiciary:

1. **Develop Clear and Comprehensive Legislation**: Establish legal frameworks governing AI use in the judiciary, addressing privacy, personal data protection, legal responsibility allocation, security standards, and algorithmic bias prevention.
2. **Train Specialized Human Resources**: Implement educational programs to train legal professionals—judges, lawyers, and court staff—in the integration of AI and legal processes.
3. **Build Advanced IT Infrastructure**: Ensure access to modern hardware, high-speed internet, and capable software tools to support AI-driven legal systems.

4. **Allocate Sufficient Financial Resources**: Invest in research and development, infrastructure building, personnel training, and AI legal system design.
5. **Ensure Transparency and Accountability Mechanisms**: Design monitoring and oversight frameworks to ensure AI system transparency, maintain public trust, and prevent algorithmic bias.
6. **Foster International Collaboration**: Establish partnerships with reputable global institutions and leverage the expertise of leading foreign specialists and firms to facilitate knowledge transfer.

Considering the extensive benefits AI can offer to judicial processes, implementing these strategies can enable Iran's judiciary to harness this technology to enhance efficiency, speed, and accuracy—similar to successful models adopted in leading nations.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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References

Alexandre, A. (2019). Chinese Internet Court Employs AI and Blockchain to Render Judgement.

Azarang, M. (2020). The Application of Artificial Intelligence in the Judicial System: Challenges and Opportunities. *Judiciary Legal Journal*(110), 129-154.

Davey, M. (2016). Chicago police try to predict who may shoot or be shot.

Deeks, A. (2019). The judicial demand for explainable artificial Intelligence. *Columbia Law Review*, *119*(1), 1AY9-1A0.

Ebrahimi, A. (2023). The Application of Artificial Intelligence in Legal Affairs: Opportunities and Challenges. *Quarterly Journal of Legal Studies*(35).

Engstrom, D. F., Ho, D. E., Lee, C. M., & Sharkey, C. M. (2020). Government by algorithm: .Artificial intelligence in federal administrative agencies. *Administrative Law Review*.

Giuffrida, I. (2004). Legal, practical and ethical implications of the use of technology in European Courtrooms. *William Mary Bill of Rights Journal*, *12*.

Habibi, M., & Jafari, M. (2021). Legal Challenges of Applying Artificial Intelligence in the Judicial Process: A Comparative Study of Legal Systems in Iran and the United States. *Journal of Comparative Legal Studies*, *7*(2), 345-374.

Handel, L. M., Gaudette, L. W., Fleming, M. R., & Arnold, R. A. (2020). Artificial Intelligence in Higher Education at Worcester Polytechnic Institute.

Jordan, M. I., & Mitchell, T. M. (2015). Machine learning: Trends, Perspectives, and Prospects. *Science*, *349*. https://doi.org/10.1126/science.aaa8415

Mostafavi Ardabili, S. M. M., Taghizadeh Ansari, M., & Rahmati Far, S. (2022). Functions and Necessities of Artificial Intelligence from the Perspective of Fair Trial. *Quarterly Journal of Law and New Technologies*(6).

pasquale, F. A. (2019). a rule of persons, not machines: the limits of legal automation. *geo. wash.*, *87*.

Pournajafi, H., & Kazemi, S. (2023). The Role of Artificial Intelligence in Improving the Efficiency of Iran's Criminal Justice System. *Quarterly Journal of Criminal Law Research*, *7*(26), 143-170.

Rayton. (2019). *The Future of War and Artificial Intelligence: A Visible Path*. Poshtiban Publications.
Safaei, S. H., & Azarang, M. (2019). Legal Requirements for the Use of Artificial Intelligence in Iran's Judicial System. *Quarterly Journal of Public Law Studies*, *49*(1), 177-197.
Shahidi, M. (2018). *Artificial Intelligence and the Judicial System: From Theory to Practice*. Tehran University Press.