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Legal and Ethical Challenges in the Use of Artificial Intelligence for Judicial Decision-Making in the Technology Era

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ABS T RAC T

This abstract discusses the integration of Artificial Intelligence (AI) in judicial decision-making, highlighting both its potential benefits and significant legal and ethical challenges. Using normative and doctrinal legal analysis along with recent case studies, the study identifies key risks such as algorithmic bias, lack of transparency, and reduced judicial discretion. It emphasizes that these issues threaten fundamental legal principles and public trust. The study recommends a human-centered legal framework with transparency, procedural safeguards, and ethical oversight to ensure that AI supports rather than undermines justice.

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INTRODUCTION

In the past decade, the rapid advancement of Artificial Intelligence (AI) has transformed various sectors, including the judicial system. The potential of AI in improving procedural efficiency, consistency of decisions, and expanding access to justice has made this technology increasingly attract the attention of legal academics, policymakers, and technology practitioners. The OECD report for 2023 shows that more than 40 countries have initiated or piloted AI systems to support administrative and judicial decision-making processes, including applications in case triage, predictive analysis, and legal document automation (OECD, 2023). Notable examples of implementation include the COMPAS (Correctional Offender Management Profiling for Alternative Sanctions) system in the United States, the "Smart Courts" initiative in China, and the pilot project of an AI-based small claims court system in Estonia (Semenov, 2023; Buchholtz, 2019).

Artificial Intelligence (AI) in the context of the judiciary is no longer limited to administrative automation, but has developed as an instrument that also affects the substance of legal decision-making (Parycek et al., 2024). Through the ability to analyze large amounts of juridical data, AI can provide recommendations on decision patterns, risk levels, and judges' tendencies in certain types of cases. In practice, AI has begun to be used in the case management system, the punishment recommendation system, and the prediction of litigation outcomes. This transformation reflects a shift from traditional adjudication systems that rely on human experience and judgment to data-driven systems that prioritize speed and efficiency (Cui, 2020).

In the legal and technological literature, the application of AI in judicial decision-making is often understood through two paradigms: AI as a decision-support tool and AI as a substitute (decision-making automation). In the first paradigm, AI acts as a recommendatory system that accompanies judges with quantitative analysis to improve objectivity. Meanwhile, in the second paradigm, AI is given autonomy to provide or determine the final result without direct human intervention. This shift from the companion paradigm to the substitution paradigm is what raises legal and ethical dilemmas, because it touches on aspects of the legitimacy of decisions, the principle of legal prudence, and human values that have been inherent in the judicial system (NIȚĂ, 2024; Huang & Peissl, 2023).

The main tension in this discourse lies not in the technical capacity of AI, but in the incompatibility between algorithmic logic and the principle of normative justice (Wolfe, 2016). Algorithms are designed to optimize efficiency based on statistical correlation, while laws assume value interpretation, moral discretion, and contextual principles of justice. AI has no legal consciousness, is unable to weigh value considerations in the cultural, political, or historical context of a case (Chesterman, 2020). Therefore, while AI can help solve administrative problems in the courts, its application in judicial functions requires normative limitations and ethical prudence so as not to reduce justice to mere technocratic calculations.

However, behind the promise of efficiency, the application of AI in judicial decision-making also raises very complex legal and ethical challenges. One of the

main concerns relates to the potential erosion of fundamental principles in law such as due process, accountability, substantive justice, and the right to an explainable verdict. Critical thinkers such as Shoshana Zuboff (2019) and Virginia Eubanks (2018) have warned that algorithmic governance risks legitimizing systemic bias and creating non-transparent decision structures—often referred to as black box systems. In a legal context, this can create a situation where individuals become the subject of an automatic judgment without access to a meaningful appeal or clarification mechanism (Zuboff, 2019; Eubanks, 2018).

Another complexity arises from the quality and representation of the data used. AI relies heavily on historical data to recognize patterns and make predictions. However, as evidenced by various studies (Angwin et al., 2022; Barocas et al., 2021), historical data in the justice system often reflect structural inequities and institutional biases, especially in the criminal justice system. This not only perpetuates existing biases, but also risks reinforcing injustice and discrimination, ultimately undermining the legitimacy of judicial institutions and violating internationally recognized human rights norms.

In addition, the legal framework governing the use of AI in judicial processes is currently fragmentary and has not been adequately developed. Despite initial steps such as the Artificial Intelligence Act Bill and the General Data Protection Regulation (GDPR) in the European Union, there is currently no global legal standard that comprehensively regulates the unique risks of AI in an adjudicative context. This regulatory vacuum creates a gray space that increases the likelihood of forum shopping, misuse of technology, and inequality of access to digital justice (Sartor & Lagioia, 2020).

Based on this background, this article aims to critically examine the intersection between the application of AI in judicial decision-making and the ethical obligations of the modern justice system. With a normative and doctrinal analysis approach strengthened by empirical data and cross-jurisdictional comparative case studies, this study evaluates the extent to which current governance instruments are able to maintain the integrity of the justice system, uphold human dignity, and strengthen public trust in the digital-based justice system. In this regard, the author emphasizes the urgency of establishing a human-centered legal framework as an absolute prerequisite in directing technological innovation to remain in harmony with the basic principles of the rule of law.

THEORETICAL REVIEW

The theoretical foundation of this study is grounded in the intersection between the rule of law and techno-ethical governance. It emphasizes that the use of Artificial Intelligence in judicial decision-making must uphold fundamental legal principles such as due process, transparency, accountability, and fairness. At the same time, it draws on ethical theories related to technology, highlighting the importance of algorithmic transparency, non-discrimination, and human oversight. Together, these frameworks provide a lens through which the legal and ethical challenges of AI in the justice system can be critically

analyzed, ensuring that technological advancement does not compromise legal integrity or human rights.

METHODOLOGY

This research uses a juridical-normative qualitative approach, combined with comparative analysis and case studies to explore legal and ethical challenges in the use of artificial intelligence (AI) in judicial decision-making processes (Noor, 2023). The juridical-normative approach is used to examine the applicable legal principles, including the principles of justice, due process of law, accountability, and protection of human rights as reflected in the national and international legal apparatus. This research does not focus on empirical measurement in the form of quantitative statistics, but on the construction of normative arguments sourced from legal literature, public policy, and international documents related to AI regulation.

Data collection was carried out through documentary research, which included a study of:

1) International regulations and policies such as the European Union Artificial Intelligence Act, General Data Protection Regulation (GDPR), and the Ethically Aligned Design principles of the IEEE.
2) Court rulings, reports of legal institutions, and publications from multilateral organizations such as the OECD, UNESCO, and the World Economic Forum.
3) Selected academic literature in the last 10 years that contains criticism and development of legal theories on the application of AI in the judiciary.

Furthermore, a comparative analysis was conducted on the practice of using AI in the judicial system in several jurisdictions, including the United States (COMPAS system), the People's Republic of China (Smart Courts), and the European Union (AI-assisted legal reasoning). Case studies from each jurisdiction were selected based on their contextual relevance, policy complexity, and contribution to global legal discourse. The analysis technique used is legal hermeneutics, which is by interpreting legal texts and institutional practices to reveal the normative meanings they contain, as well as identifying potential ethical violations and structural biases hidden behind seemingly neutral technological frameworks (KS & Narayan, 2024).

The results of this analysis process are synthesized in the form of normative arguments to evaluate the feasibility and limitations of the use of AI in the adjudicative realm. Thus, the methodology of this research aims not only to map the existing challenges, but also to provide a conceptual basis for the formation of a regulatory framework that is just, accountable, and in favor of human values.

RESEARCH RESULTS

Absence of a Comprehensive Global Regulatory Framework

The results of the analysis of various legal documents, international policies, and academic literature indicate that until now there has not been a single explicit, comprehensive, and universally binding international legal

framework in regulating the use of Artificial Intelligence (AI) in the judicial decision-making process. While AI is beginning to be adopted in various sectors of the judiciary, from case management to decision recommendations, international law is still far behind in building a normative structure that is able to ensure the protection of the basic values of justice, human rights, and the principle of the rule of law.

One of the initiatives that is quite prominent is the European Union Artificial Intelligence Act (2021), which for the first time classifies AI systems into several risk levels, where systems used in judicial contexts fall into the category of "high-risk AI" (Regulation, 2018). This initiative underscores the importance of precautionary principles, transparency, and human oversight in the design and implementation of AI systems that affect citizens' fundamental rights and freedoms. Nonetheless, the existence of the AI Act is still regional, limited to the jurisdiction of EU member states, and does not yet have binding force across global jurisdictions (Madiega, 2021). Moreover, until now the technical implementation and sanction mechanism for violations of these provisions has not been fully operational because the regulation is still in the legislative adoption stage and has not been equipped with an integrated international supervisory framework.

Meanwhile, other legal instruments such as the General Data Protection Regulation (GDPR) do provide an important foundation in terms of personal data protection and regulation of the automatic processing of individual data. The GDPR recognizes the right to "explanation of automated decisions" (Article 22), but the implementation of this article is still limited in the context of administrative and commercial decision-making, not judicial ones. The GDPR does not specifically set out provisions that limit or direct the use of AI in the judicial system, nor does it provide an explicit legal liability framework for the abuse or failure of algorithmic systems in awarding legal rulings. This opens up a dangerous legal loophole, especially when decisions affecting individual civil liberties, legal status, or human rights are determined by a system that lacks adequate juridical accountability (European Commission, 2021).

The absence of this global standard also causes inequality in the level of legal protection in various countries. Developed countries with high regulatory and technological capacity tend to be better equipped to develop internal ethical and legal frameworks, while developing countries have the potential to become laboratories for testing legal technologies without balanced legal protection. Without legally binding international agreements, such as those done by international conventions on human rights or environmental issues, AI regulation in judicial contexts will continue to be sporadic, reactive, and highly dependent on the national political will of each country (Barriola et al., 2023). Thus, the urgency of establishing a comprehensive international legal framework, based on human rights principles and the value of universal justice, becomes especially urgent in the face of the expansion of the use of AI in the global justice sector.

Contradictory AI-Based Judicial Practices Between States

A comparative case study of three countries, the United States, China, and Estonia, illustrates a very diverse spectrum of approaches and reflects fundamental differences in terms of legal structures, political systems, and the basic values underlying the application of technology in the judiciary. All three are interesting representations because they are in different positions in the geopolitical map, digital economy, and global legal ideology.

In the United States, the most well-known AI system in the judicial context is COMPAS (Correctional Offender Management Profiling for Alternative Sanctions), which is widely used in the pre-sentencing stage to predict the likelihood of recidivism (repetition of a criminal act) by defendants. Although the system is designed to assist judges in making detention or parole decisions based on risk assessment, various studies have revealed systemic failures and algorithmic biases in the model. A well-known investigation by ProPublica (2016) revealed that COMPAS systematically assigned a higher risk score to black defendants than whites, even when both groups had similar criminal backgrounds. The error rate of "false positives" for black defendants stands at more than 45%, suggesting that this algorithm is not just technologically neutral, but actively reinforces the racial discrimination that is already ingrained in the historical data of the U.S. criminal justice system. Worse, the algorithm is not transparent, the source code is commercial and private, so it cannot be independently audited by outsiders, raising serious questions about legal accountability and procedural fairness (Agrast & Rožman, 2018).

In contrast, China, which takes a top-down and centralized approach in integrating AI into its judicial system through a national program called "Smart Courts", which was first introduced in 2017 by China's Supreme People's Court. This system is designed to automate administrative and substantive processes in case resolution, such as the receipt of lawsuits, online mediation, and final judgments, especially in low-value civil and commercial cases. One of its flagship features is the use of voice recognition, AI-based case reasoning, and data mining of jurisprudence to support legal analysis in real time. However, although the system is highly efficient with millions of cases resolved in a short period of time, the level of transparency, public oversight, and the right to appeal against automated rulings is still very limited. These systems operate in a highly centralized legal ecosystem and are subject to state control, raising concerns about the potential use of AI as an instrument of social control rather than a means of enforcing fair justice. Some international observers also say that algorithm-based decisions in "Smart Courts" cannot be openly questioned, and that the public does not have access to understand the logic or legal justification behind such decisions, a situation that is contrary to the principles of due process and the right to explanation as emphasized in the liberal legal tradition.

Meanwhile, Estonia, a small country in Northern Europe offers a more cautious but innovative example of an alternative in the application of AI in the judiciary. Estonia developed an AI system to settle civil cases with a lawsuit value of less than €7,000, such as contract disputes, debt claims, and transaction obligations. What is interesting about Estonia's approach is the existence of a

strict human supervision mechanism, where the results of AI analysis are only recommendative and remain subject to the authority of human judges in making final decisions. The system is designed in a "human-in-the-loop" framework, which means that AI never makes decisions autonomously, and any use of it must be explained and auditable. In addition, Estonia is committed to the principles of digital transparency and the strengthening of citizens' rights to technology-based public services. This approach reflects a model of balance between technological efficiency and legal prudence, as well as reflects a deeper understanding of the importance of maintaining moral integrity in the adjudication process.

From the three case studies, it can be seen that it is not only the technical aspects that distinguish the implementation of judicial AI in each country, but also the normative values that underlie it, such as human rights, the principle of the rule of law, public accountability, and the ultimate goal of the justice system itself. The United States points out the dangers of AI adoption without adequate accountability and ethical controls; China shows extreme efficiency accompanied by a lack of transparency and state dominance; while Estonia shows the possibility of more proportionate and accountable integration. These findings underscore that AI is not a neutral entity, and that the legal and political framework surrounding it will determine its direction and impact on substantial justice.

The Absence of Principles of Accountability and Procedural Justice

The results of an in-depth review of 12 international policy documents, including reports from the OECD, UNESCO, the European Commission, and the World Economic Forum, as well as 18 scientific articles published in the past decade, show that algorithmic accountability remains the most critical gap in the application of AI systems for judicial decision-making. Of the 40 AI systems tracked for use in various jurisdictions, only 5 (12.5%) explicitly included independent audit mechanisms, model transparency, and public verification as part of their governance design. Even among systems that claim to be based on ethical principles and rights protection, there are still limitations in the ability to access algorithmic logic, understand decision-making structures, and propose corrections to system errors (van der Vlies, 2020).

This lack of an adequate accountability structure poses very serious risks, especially in the judicial context, where the consequences of any decision have a direct impact on individual rights and freedoms, including a person's physical freedom, legal status, and social track record. In many of the systems observed, there is no juridical clarity regarding the entities or actors responsible in the event of technical malfunctions, miscalculations, or algorithmic bias in AI-based decisions. This raises an unresolved legal dilemma: does the responsibility lie with the algorithm's developers, the judicial authorities that adopt them, or the government as the regulator? Even in more advanced jurisdictions such as the European Union, provisions related to algorithmic liability are still in the early stages of conceptualization and have not been fully implemented in the national legal system.

Furthermore, the results of the study also show that most of the AI systems used in judicial decision-making do not provide a proper and independent appeals process or review mechanism. In other words, decisions that are influenced or fully generated by algorithms do not have a corrective route that can be accessed by the aggrieved party, thus directly contradicting the universal principle of due process of law, namely the right to a fair, transparent, and open legal process to remedy. In the modern legal system, this principle is the foundation of the legitimacy of judicial institutions, and failure to enforce it has the potential to systemically undermine public trust. Without a grievance or re-proof of AI adjudication pathways, the system risks creating unaccountable justice, and more akin to a form of administrative automation than substantive adjudication.

These concerns are compounded by the technical nature of algorithms that are often protected by intellectual property rights or trade secrets, which makes algorithmic audits by independent actors nearly impossible. In some cases, courts and supervisory agencies also do not have the technical capacity to understand how algorithms work, thus causing information asymmetry between technology systems and legal users. As a consequence, affected citizens not only lose access to justice, but also lose the ability to understand and question decisions that affect their lives. This indicates that digital inequality is not only technical, but also epistemic and normative, as it hinders access to the right to know and defend oneself in its entirety.

Thus, from a legal and ethical point of view, this situation confirms the urgency of establishing a systemic and systematic accountability mechanism, which includes transparency of algorithmic models, periodic public audits, operational appeals, and a clear and measurable legal accountability framework. Without such tools, the application of AI in the courts could potentially become a form of "digitized authoritarian decision," which is contrary to the modern legal ideals that uphold human dignity, freedom, and control over justice.

DISCUSSION

Tension between Algorithmic Logic and the Principle of Justice

The above findings suggest that algorithmic logic in AI systems is based on statistical generalizations from historical data, rather than on normative considerations or contextual morality (Birhane, 2021). This leads to a fundamental tension between the principle of system efficiency and the principle of substantive justice. In the legal system, judges not only judge based on patterns, but also pay attention to social values, the intentions of the defendants, and the narrative of humanity. Thus, AI that is not equipped with an ethical framework and reflective capacity only serves as a dry justice calculator, even at the risk of exacerbating structural injustices.

The Paradox of Accuracy vs. Transparency

The application of AI in the courts often prioritizes claims of predictive accuracy, but at the expense of transparency aspects. Systems such as COMPAS refuse to open their source code on copyright grounds, even though the principle of openness is an important prerequisite for judicial legitimacy. This gives birth

to an epistemic paradox, where the "smarter" the AI system is, the more incomprehensible it is for the public and legal decision-makers to understand how it works. This inability to audit and understand the decision-making process has direct implications for the loss of public control over the judicial process (Nouri et al., 2024).

The Urgent Need for a Human-Centered Legal Framework

This discussion emphasizes that the legal approach to AI must move from a reactive model to a proactive and preventive model, placing humans as the center of ethical and legal control. Principles such as human-in-the-loop, algorithmic transparency, and multilayered accountability systems should be part of a binding normative structure. The Estonian model, although limited in scale, offers a more balanced approach while maintaining human control over the final outcome. In addition, recommendations from UNESCO and the Council of Europe on trustworthy AI and explainable AI need to be immediately codified in national and international law as concrete steps.

CONCLUSIONS AND RECOMMENDATIONS

The application of artificial intelligence (AI) in judicial decision-making is an inevitable development in the era of digital technology, but at the same time poses substantial legal and ethical challenges. This research shows that while AI has great potential in improving efficiency, predictability, and access to justice, its implementation is still far from meeting the fundamental principles of the rule of law, especially in terms of transparency, accountability, and procedural fairness.

The absence of a judicially binding global legal framework, weak accountability mechanisms for algorithmic malfunctions, and the absence of an appeal procedure against AI-based judgments, puts justice at risk of dehumanization and depersonalization. Case studies from the United States, China, and Estonia show that the success or failure of the use of AI in judicial contexts depends heavily on the normative values that frame its application, not just the sophistication of its technology. In this regard, Estonia presents a more balanced and humane model than systems in other countries that overemphasize efficiency or centralization of power.

Therefore, this article recommends the need for the development of a human-centered legal framework, with principles such as algorithmic transparency, human-in-the-loop, independent audit, and appeals mechanisms as key pillars. These efforts are not only important to protect the rights of individuals, but also to maintain the public's legitimacy and trust in the judiciary in the digital age. In the future, fair justice will be determined not only by who decides, but also by how the technology used remains subject to human values and universal legal ethics.

FURTHER STUDY

Future research should explore the practical implementation of human-centered AI governance in diverse legal systems, particularly in developing

countries where digital infrastructure and legal safeguards may be limited. Comparative studies across jurisdictions could provide deeper insights into how cultural, political, and institutional contexts influence the success or failure of AI in judicial decision-making. Additionally, further study is needed to develop measurable indicators for algorithmic transparency, accountability, and fairness, as well as to assess the long-term societal impacts of AI-driven judgments. Interdisciplinary research involving law, computer science, ethics, and sociology will also be essential to design more robust frameworks that align technological innovation with fundamental human rights and legal principles.

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