

ARTIFICIAL INTELLIGENCE AND VIRTUAL COURTS: ENHANCING EFFICIENCY OR COMPROMISING JUSTICE?

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ABSTRACT

Background

Artificial Intelligence (AI) is progressively transforming judicial systems through automation, predictive analytics, and online dispute resolution (ODR). Virtual courts, supported by AI technologies, aim to reduce case backlogs, enhance operational efficiency, and improve access to justice. However, concerns persist regarding due process violations, algorithmic bias, and the erosion of judicial discretion.

Objective

This paper critically examines whether AI enhances judicial efficiency or compromises fundamental legal principles.

Methods

Employing doctrinal legal research, comparative analysis across India, the USA, the UK, and the EU, and empirical review of case studies (e-Courts India, COMPAS, China's smart courts, EU AI tools), the study evaluates AI's role in case management, decision making, and procedural fairness.

Discussion

AI reduces case disposal time by 30-50% in pilot projects, lowers administrative costs, and improves access. However, algorithmic bias (e.g., COMPAS showing racial disparities), lack of transparency ("black box" problem), accountability gaps, and data privacy risks remain substantial. A hybrid human-AI model, mandatory transparency audits, and regulatory safeguards under the Digital Personal Data Protection Act, 2023, and the EU AI Act are necessary.

Conclusion

AI should assist, not replace, judicial discretion. The paper proposes six regulatory recommendations for balanced AI integration.

Keywords: Artificial Intelligence, Virtual Courts, Online Dispute Resolution, Judicial Efficiency, Due Process, Algorithmic Bias, Access to Justice, Digital Transformation, Legal Technology, E-Governance.

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1. INTRODUCTION

Artificial Intelligence is revolutionising multiple sectors, including the legal domain. Within the judiciary, AI assists in case management, legal research, and decision-support systems¹⁻². The integration of AI aims to streamline court proceedings, reduce human error, and enhance access to justice³. Virtual courts have emerged as a direct response to mounting caseloads, particularly after the COVID-19 pandemic, enabling remote hearings and digital case processing⁴. AI-driven legal technologies such as natural language processing and machine learning now assist in drafting judgments, predicting case outcomes, and automating administrative tasks⁵. Globally, judicial systems face persistent challenges of high caseloads, procedural delays, and inefficiencies⁶. AI addresses these issues by enhancing legal research, automating routine functions, and supporting judicial decision-making⁷. AI-powered predictive analytics assist in case prioritisation, thereby reducing judicial burden. However, a comparative analysis of

traditional and AI-powered justice systems reveals that while AI expedites proceedings, it may lack the human discretion essential for fair adjudication⁸.

The central question posed by AI and virtual courts is whether they enhance judicial efficiency or compromise justice. While AI facilitates faster adjudication, concerns regarding algorithmic bias, lack of accountability, and potential erosion of judicial independence remain⁹. Automated decision-making may lead to procedural unfairness, particularly when AI lacks contextual understanding of complex legal principles¹⁰. This research examines whether AI-driven virtual courts align with constitutional guarantees of due process, fair trial, and judicial impartiality. The study focuses on AI's role in the Indian judicial system, with comparative insights from the USA, UK, and EU. It analyses AI applications in case management, predictive analytics, virtual court proceedings, and ODR, considering statutory provisions, case law, and international legal instruments regulating AI in the judiciary.

2. MATERIALS AND METHODS

2.1 Research Design

This study adopts a mixed-method doctrinal legal research design, integrating qualitative doctrinal analysis with comparative and normative methodologies. The design is specifically tailored to examine the multi-dimensional interplay between AI technologies and judicial processes, recognising that legal phenomena involving technology cannot be adequately understood through a single methodological lens¹¹. The research is primarily exploratory and evaluative, seeking not only to describe the current state of AI integration in virtual courts but also to assess its implications for fundamental legal principles and to formulate evidence-based policy recommendations.

2.2 Doctrinal Legal Research

Doctrinal legal research constitutes the core methodology. It involves systematic analysis of primary legal sources (statutes, case law, constitutional provisions) and secondary sources (legal commentaries, scholarly articles, law reform reports) to identify, interpret, and critique legal rules and principles governing AI in virtual courts¹². The doctrinal method is particularly suited to this research because it allows the determination of existing law *de lege lata* and identification of gaps requiring reform *de lege ferenda*¹³.

Specifically, the doctrinal analysis included:

- I. **Examination of Indian constitutional provisions**, particularly Articles 14 (right to equality), 19 (freedom of speech and expression), and 21 (right to life and personal liberty, including due process and fair trial)¹⁴.
- II. **Analysis of statutes** such as the Information Technology Act, 2000 (electronic evidence and cyber regulation), the Indian Evidence Act, 1872 (section 65B on admissibility of electronic records), and the Digital Personal Data Protection Act, 2023¹⁵⁻¹⁶.
- III. **Review of judicial pronouncements** from the Supreme Court of India (e.g., *Justice K.S. Puttaswamy v. Union of India* on privacy), US courts (*State v. Loomis* on AI sentencing), and international courts (European Court of Human Rights, CJEU)¹⁷⁻¹⁸.
- IV. **Examination of international legal instruments**, including the European Convention on Human Rights, the International Covenant on Civil and Political Rights (ICCPR), the Universal Declaration of Human Rights, the EU AI Act (2023), and the Council of Europe's Ethical Charter on AI in Judiciary¹⁹⁻²¹.

The doctrinal research was conducted iteratively: initial broad searches identified key legal sources, which were then analysed to extract relevant

principles, followed by targeted searches for case law applying those principles to AI contexts.

2.3 Comparative Legal Analysis

A comparative legal analysis was undertaken to identify best practices, common challenges, and divergent regulatory approaches across four jurisdictions: India, the United States, the United Kingdom, and the European Union. These jurisdictions were selected based on their varying stages of AI judicial integration and regulatory maturity²².

The comparative method followed a functionalist approach, in which the researcher identifies a common legal problem (e.g., the regulation of algorithmic bias in sentencing) and compares how different legal systems address it²³. The analysis focused on four dimensions: (i) institutional framework – which courts or agencies oversee AI deployment; (ii) regulatory instruments AI-specific laws or general principles; (iii) judicial practice specific AI tools deployed (e.g., SUPACE in India, COMPAS in the US, smart courts in China); and (iv) legal challenges – lawsuits, ethical controversies, or legislative reforms²⁴⁻²⁵.

2.4 Empirical Review of Case Studies and Secondary Data

Although the study does not involve primary data collection (e.g., surveys or experiments), it incorporates a systematic empirical review of existing quantitative and qualitative studies on AI in courts. This review followed a structured approach:

- I. **Identification of relevant empirical studies** through searches in legal databases (Westlaw, HeinOnline, SCC Online), social science databases (Google Scholar, JSTOR), and grey literature (government reports, think-tank publications). Search terms included “AI court efficiency,” “algorithmic bias sentencing,” “virtual court case disposal,” “COMPAS recidivism prediction,” and “e-courts India pendency reduction.”
- II. **Inclusion criteria:** Studies published between 2015 and 2024 that reported empirical data (quantitative metrics or qualitative case observations) on AI performance in judicial settings, focusing on efficiency (case disposal time, cost reduction, backlog clearance) or fairness (bias detection, error rates, litigant satisfaction).
- III. **Synthesis of findings:** Data were extracted on key outcomes, including percentage reduction in case pendency, time saved in legal research (e.g., SUPACE reportedly saving 40-50% of judge time), accuracy rates of AI predictive tools (e.g., COMPAS recidivism predictions), and documented instances of algorithmic bias (e.g., ProPublica's 2016 investigation).

Specific case studies examined in detail include: the Indian e-Courts Project phases I-III, tracking digitisation of records, e-filing adoption rates, and virtual hearing statistics from Supreme Court annual reports²⁶; the COMPAS system in the US, including the ProPublica study (2016) and the *Loomis* litigation¹⁷⁻¹⁸; China’s “Smart Court” initiative, reviewing published performance metrics from the Supreme People’s Court²⁷; and the EU’s AI-assisted legal research tools at the CJEU, evaluating time savings in preliminary ruling procedures²⁸.

2.5 Normative and Ethical Analysis

Normative analysis examines legal principles and values that should guide AI integration in courts beyond current law. This method involves identifying relevant legal norms from constitutional law, human rights instruments, and legal philosophy (e.g., due process, natural justice, judicial independence, transparency, accountability) ²⁹. For each AI application (e.g., predictive sentencing, automated case triage, AI-generated legal recommendations), the study assesses compliance with normative standards. For example, does AI-based case prioritisation violate the principle of *audi alteram partem* (right to be heard) by silently deprioritising certain cases without party input? ³⁰ The normative analysis also draws on ethical frameworks from the Council of Europe, OECD AI Principles, and UNESCO’s recommendations on AI ethics²¹⁻³¹.

2.6 Hypotheses

Based on the literature review and identified gaps, the study addresses five research questions: (RQ1) How does AI improve efficiency in virtual courts? (RQ2) Does AI in legal adjudication compromise judicial fairness and procedural justice? (RQ3) What ethical and legal challenges arise from AI’s role in courts? (RQ4) How can algorithmic bias be mitigated in AI-driven judicial processes? (RQ5) What are global best practices for AI governance in courts? Corresponding hypotheses were formulated: H1 – AI-driven virtual courts enhance judicial efficiency by reducing backlog; H2 – AI-assisted decision-making risks procedural fairness and due process; H3 – Algorithmic bias in AI-driven legal decisions compromises judicial impartiality; H4 – A hybrid AI-human judicial model can mitigate AI’s risks while maximising efficiency.

2.7 Limitations

The study acknowledges several limitations: rapidly evolving technology may outdate findings; limited empirical data from India (granular AI-specific performance metrics not publicly available) ³³; lack of uniform definitions of “virtual court” and “AI adjudication” across jurisdictions; and exclusion of private ODR platforms (e.g., eBay resolution centre) except where directly relevant to state-run judicial processes.

3. Results

3.1 Efficiency Gains from AI in Virtual Courts

The analysis confirms that AI significantly improves judicial efficiency across multiple dimensions, supporting H1.

3.1.1 Reduction in Case Pendency

In India, the e-Courts project has digitised over 18 crore case records and facilitated e-filing in all district courts²⁶. Pilot virtual courts in Delhi and Maharashtra reported a 30-35% reduction in average case disposal time for traffic and petty offence matters⁶. AI-powered scheduling tools reduced unnecessary adjournments by approximately 25% in participating courts³³.

Internationally, China’s smart courts resolve minor civil disputes in under 10 minutes using AI-powered judgment drafting systems²⁷. In the US, AI-based case triage in federal district courts reduced civil case backlogs by 22% over 18 months²⁴. The EU’s AI-assisted legal research tool at the CJEU decreased preliminary ruling preparation time by an average of 40%²⁸. These findings are summarised in Table 1.

Table 1: Efficiency Gains Reported in Select AI-Integrated Court Systems

Jurisdiction / Tool	Efficiency Metric	Reported Improvement	Source
India – e-Courts (pilot)	Case disposal time (traffic)	30-35% reduction	Indian Judiciary Annual Report 2022-2023 ⁶
India – SUPAC E (legal research)	Judge research time	40-50% saving	Supreme Court of India report ²⁶
China – Smart Courts (minor disputes)	Resolution time	~10 minutes per case	Supreme People’s Court 2023 ²⁷
USA – COMPAS (case triage)	Civil backlog reduction	22% over 18 months	USA Judiciary Review 2023 ²⁴

Jurisdiction / Tool	Efficiency Metric	Reported Improvement	Source
EU – CJEU AI research tool	Preliminary ruling prep time	40% decrease	CJEU AI Strategy 2024 ²⁸

3.1.2 Cost Reduction and Accessibility

Virtual courts powered by AI reduce logistical costs for litigants and the state. In India, the average cost per hearing (travel, lost wages, legal fees) decreased by an **estimated ₹1,500-2,000 per appearance** in e-Courts locations⁴. E-filing and AI-based document verification cut administrative processing costs by nearly 30%³³. Accessibility improved for rural and remote populations: virtual hearings allowed litigants from distant districts to participate without physical travel, increasing overall court access by approximately 18% in pilot phases²⁶.

3.1.3 Automation of Administrative Tasks

AI-powered transcription services (speech-to-text) and automated translation tools (SUVAS in India) reduced court reporter workloads by up to 50%³⁴. AI-based case categorisation and legal research (SUPACE) enabled judges to spend more time on complex legal reasoning rather than routine document review²⁶. These efficiency gains, however, come with trade-offs examined in the following sections.

3.2 Algorithmic Bias and Lack of Transparency

Substantial evidence supports H2 and H3: AI risks procedural fairness and judicial impartiality due to bias and opacity.

3.2.1 Bias in Predictive Sentencing – The COMPAS Example

The Correctional Offender Management Profiling for Alternative Sanctions (COMPAS) system, used in several US states, predicts recidivism risk to inform bail and sentencing decisions. A landmark investigation by ProPublica (2016) found that COMPAS was twice as likely to falsely label Black defendants as high-risk compared to White defendants (45% vs. 23% false positive rate)¹⁸. Conversely, White defendants were more frequently misclassified as low-risk when they later reoffended. In *State v. Loomis* (2016), the Wisconsin Supreme Court upheld the use of COMPAS but warned that sole reliance on AI risk scores violates due process¹⁷. Similar concerns arise in India. While India has not deployed predictive sentencing AI at scale, the AI tools under consideration (e.g., SUPACE for case outcome prediction) rely on historical court data that may embed caste, gender, or religious biases present in past judgments²⁹. Under Article 14 of the Constitution, any AI-driven disparity that

disproportionately affects protected groups would violate equality guarantees¹⁴.

3.2.2 The “Black Box” Problem

Many AI models, particularly deep learning systems, do not provide transparent reasoning for their outputs. This “black box” problem conflicts with the fundamental legal principle that judicial decisions must be reasoned and contestable³⁰. In the EU, the General Data Protection Regulation (GDPR) Article 22 grants individuals the right to an explanation for automated decisions²¹. However, current AI tools used in courts (including COMPAS) often fail to meet this standard. In India, no equivalent statutory right to explanation exists; the Digital Personal Data Protection Act, 2023, does not explicitly address AI explainability¹⁶.

3.2.3 Accountability Gaps

When an AI-assisted decision leads to an unjust outcome, assigning legal responsibility is problematic. Human judges enjoy judicial immunity for decisions made within their jurisdiction. But if a judge relies on an erroneous AI recommendation, is the judge, the AI developer, or the court administration liable?¹¹ International instruments such as the Council of Europe’s Ethical Charter require human oversight, but specific liability frameworks remain absent in most jurisdictions²⁰.

3.3 Data Privacy and Cybersecurity Risks

AI-driven virtual courts process vast amounts of sensitive personal data, making them vulnerable to breaches. The Indian Supreme Court in *Justice K.S. Puttaswamy v. Union of India* (2017) recognised privacy as a fundamental right under Article 21¹⁵. Yet, AI judicial platforms have faced security challenges: a 2023 audit of India’s e-Courts infrastructure identified vulnerabilities in data encryption and access controls³³. The Digital Personal Data Protection Act, 2023, provides a framework (data minimisation, purpose limitation, consent), but compliance in AI judicial applications remains incomplete¹⁶. Table 2 summarises key risks identified across jurisdictions.

Table 2: Key Risks and Challenges in AI-Driven Virtual Courts

Risk Category	Specific Challenge	Jurisdiction Example	Legal/Constitutional Implication
Algorithmic bias	Racial disparity in recidivism prediction	USA – COMPAS	Violation of equal protection (14th Amendment); Article 14 India

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Risk Category	Specific Challenge	Jurisdiction Example	Legal/Constitutional Implication
Lack of transparency	“Black box” decisions without reasoning	Global – many AI tools	Right to fair trial (Article 21 India; Article 6 ECHR)
Accountability gaps	No clear liability for AI errors	All jurisdictions	Erosion of judicial review (Articles 32, 226 India)
Data privacy	Unauthorized access to court records	India – e-Courts vulnerability	Violation of fundamental privacy right (Puttaswamy)
Cybersecurity	Hacking of virtual court platforms	Potential in all systems	Compromised integrity of judicial process

3.4 Comparative Regulatory Approaches

The study found significant divergence in how jurisdictions regulate AI in courts, offering lessons for India.

India: No AI-specific judicial regulation. The IT Act, 2000, and the Evidence Act, 1872, provide limited guidance. The Supreme Court’s AI Committee oversees SUPACE and SUVAS, but these are voluntary tools, not mandatory systems²⁶. The Digital Personal Data Protection Act, 2023, addresses privacy but not algorithmic fairness or explainability¹⁶.

European Union: The EU AI Act (2023) classifies judicial AI as “high-risk” and mandates conformity assessments, human oversight, transparency, and accuracy standards¹⁹. The CJEU’s AI Strategy (2024) requires that AI-generated legal recommendations remain subject to judicial validation²⁸.

United States: No federal AI-specific law for courts. State-level approaches vary. Wisconsin (post-*Loomis*) requires judges to provide “written explanation” when relying on COMPAS¹⁷. Some states prohibit AI-only sentencing. Federal courts use AI for administrative tasks but not for adjudication.

China: Supreme People’s Court has deployed AI judges for small claims, but the system lacks adversarial safeguards and independent appellate review²⁷. Transparency is minimal, and litigants cannot contest AI logic.

4. DISCUSSION

4.1 Synthesis of Findings in Light of Previous Literature

The present study confirms and extends previous research on AI in judicial systems. Zeleznikow (2017) argued that AI and ODR can enhance court efficiency but cannot replace human judicial discretion⁷. Our findings align: efficiency gains (30-50% time reduction) are real, but risks of bias and opacity persist. Ejjami (2024) cautioned that “AI-driven justice may prioritise quantitative metrics over qualitative legal values”⁵; we observed this tension in COMPAS, where predictive accuracy was traded against racial fairness. Reiling (2024) emphasised the importance of procedural fairness in AI-augmented courts³. Our comparative analysis reveals that jurisdictions with stronger procedural safeguards (EU, post-*Loomis* Wisconsin) retain more public trust than those with opaque systems (China’s smart courts). Waseem et al. (2024) documented the transformative potential of e-Courts in India⁴; we add that without explicit bias-audit requirements, efficiency could mask systemic discrimination.

Kaur and Kaur (2024) noted that Indian courts are cautiously adopting AI². Our study provides empirical grounding: while SUPACE and SUVAS are assistive, the absence of a statutory framework comparable to the EU AI Act leaves Indian judges and litigants vulnerable. Chakravarthy (2023) called for “technological innovations grounded in constitutional morality”¹; we operationalise this through proposed hybrid models and transparency mandates. The “black box” problem identified in computer science literature (e.g., lack of explainability in deep learning) has direct legal consequences, as articulated by the European Court of Human Rights in cases concerning automated decisions¹¹. Our discussion integrates these technical and legal dimensions, arguing that explainable AI (XAI) should become a legal requirement, not merely a technical preference.

4.2 The Efficiency vs. Justice Trade-off: A Reappraisal

Superficially, AI appears to offer a straightforward trade-off: faster, cheaper justice at the cost of some accuracy or fairness. However, our findings suggest

a more nuanced picture. **First**, efficiency gains are not uniformly distributed. Marginalised litigants may face higher rates of algorithmic error (as with COMPAS), meaning they experience both slower justice (if they appeal) and more erroneous outcomes. **Second**, some efficiency gains arise from automating tasks that should not be automated – e.g., AI-based case triage that deprioritises certain claims without notice violates *audi alteram partem*³⁰. **Third**, the lack of transparency in AI decisions undermines the deterrent and educative functions of judicial reasoning, potentially reducing long-term compliance with court orders. Thus, the question is not “efficiency or justice?” but “how can we design AI systems that enhance efficiency without eroding justice?” This reframing leads to the hybrid model.

4.3 The Hybrid AI-Human Model as a Solution (H4)

H4 proposed that a hybrid model can mitigate risks while maximising efficiency. The evidence supports this. In the EU, the AI Act’s “human-in-the-loop” requirement for high-risk systems ensures judicial oversight¹⁹. In India, SUPACE is explicitly designed as an assistive tool, leaving final decision-making to judges²⁶. Hybrid models preserve the qualitative strengths of human judges – empathy, contextual understanding, moral reasoning – while leveraging AI for quantitative tasks (document review, legal research, transcription, translation).

However, hybrid models are not self-executing. They require:

- I. **Mandatory human review** of any AI-generated recommendation that could affect substantive rights.
- II. **Training for judges** to identify and correct potential algorithmic biases.
- III. **Audit trails** recording how AI outputs were used and overridden.
- IV. **Redress mechanisms** allowing litigants to challenge AI-influenced decisions.

Without these safeguards, “hybrid” can become a fig leaf for automation in disguise.

4.4 Regulatory Recommendations

Based on the synthesis of results and discussion, the following six regulatory recommendations are proposed for India, adaptable to other jurisdictions:

- I. **Enact AI-specific judicial regulation** – A separate chapter in the Digital Personal Data Protection Act or a new “Judicial AI Act” should mandate transparency, fairness, human oversight, and accountability for any AI tool used in court proceedings.
- II. **Mandatory algorithmic bias audits** – Independent audits (annual or semi-annual) of AI tools deployed in courts, with results publicly disclosed (subject to security redactions). Audits should examine

disparate impact by caste, gender, religion, socioeconomic status, and geography.

- III. **Explainability requirements** – AI systems used in judicial settings must provide human-readable, contestable reasoning. Where explainability is technically infeasible, the AI tool should not be used for adjudicative purposes.
- IV. **Data protection compliance** – The Digital Personal Data Protection Act, 2023, must be amended to include explicit provisions on AI in judicial contexts, including the right to explanation and the right to human review of automated decisions¹⁶.
- V. **Judicial AI literacy programmes** – Mandatory training for all judges and court staff on AI capabilities, limitations, biases, and ethical use. The Supreme Court’s AI Committee should develop a certification curriculum.
- VI. **International harmonisation** – India should adopt best practices from the EU AI Act (risk categorisation, conformity assessments) and Council of Europe’s Ethical Charter (human rights impact assessments), adapting them to Indian constitutional jurisprudence^{20–21}.

4.5 Future Research Directions

Several avenues for future research emerge: (i) longitudinal studies tracking AI’s impact on sentencing disparities in India once predictive tools are deployed; (ii) development and testing of explainable AI (XAI) models specifically designed for legal reasoning; (iii) comparative empirical studies on litigant trust in AI-assisted vs. traditional courts; (iv) legal engineering research on designing appellate review mechanisms for AI-influenced decisions; and (v) interdisciplinary work on algorithmic fairness metrics tailored to Indian legal contexts (e.g., caste-sensitive bias detection).

5. CONCLUSION

Artificial Intelligence and virtual courts offer transformative potential for judicial efficiency, reducing backlogs, lowering costs, and improving access to justice. However, this paper demonstrates that such benefits are accompanied by serious risks: algorithmic bias, opacity, accountability gaps, and potential violations of due process and fair trial rights. The Indian judiciary, like its global counterparts, stands at a crossroads. Unchecked AI adoption could compromise the very foundations of justice; complete rejection would perpetuate chronic inefficiencies.

The optimal path forward is a balanced, human-centric hybrid model. AI should serve as a powerful assistant – handling routine tasks, providing data-driven insights, and enhancing productivity – while human judges retain ultimate authority, discretion, and responsibility. Robust

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regulatory frameworks, including transparency mandates, bias audits, and data protection compliance, are essential to safeguard fundamental rights. As AI continues to evolve, the legal community must remain vigilant, ensuring that technology serves justice – not the reverse.

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