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Use of Technology in Criminal Trials: A Comparative Analysis of India and the United States

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Abstract

This study examines the influence of technology on criminal trials in India and the United States, focusing on tools such as artificial intelligence, digital evidence, and virtual courtrooms. It traces the journey from traditional paper-based systems to modern digital platforms that accelerate and improve trial execution and accuracy. New laws in India, such as the Bhartiya Nyaya Sanhita and Bhartiya Sakshya Adhiniyam, reflect this shift by addressing digital evidence and AI use. Similarly, the US has updated its rules to handle electronic data and AI-generated information during trials. Despite these advancements, both countries face challenges, including ensuring the fairness of AI tools, protecting data privacy, and bridging the digital divide so everyone can access these technologies. The study compares legal frameworks, highlighting how India's clear statutes contrast with the US's more flexible case-based approach.

Keywords - Criminal trials, Technology adoption, Digital evidence, Artificial intelligence (AI), Virtual courtroom.

I. INTRODUCTION

The criminal justice systems of India and the United States have undergone significant transformations in recent decades, driven substantially by technological innovation and the integration of digital tools into investigative, prosecutorial, and adjudicatory processes. [1] What was once a predominantly paper-based, manual system has evolved into a complex, technology-enabled ecosystem where artificial intelligence, digital forensics, and real-time communication platforms reshape how evidence is collected, preserved, analysed, and presented before courts.

In India, the transition from the Indian Penal Code (1860) and the Indian Evidence Act (1872) to the Bhartiya Nyaya Sanhita (2023) and the Bhartiya Sakshya Adhiniyam (2023) represents not merely a codification exercise but a fundamental reimagining of criminal procedure in the digital age.[2]. Similarly, in the United States, the Federal Rules of Criminal Procedure and Evidence have been continually refined to accommodate electronic discovery, digital evidence, AI-driven analysis, and virtual courtroom proceedings. [3]Yet despite these legislative advances, both jurisdictions grapple with pressing challenges: How can courts ensure the authenticity of digital evidence? How do we prevent algorithmic bias in predictive analytics? How can technology be

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[1] Ministry of Law & Justice, *Vision Document — e-Courts Phase III* (Government of India 2023).

[2] Ministry of Home Affairs, *Notes on Clauses: Bhartiya Nyaya Sanhita, Bhartiya Nagarik Suraksha Sanhita, and Bhartiya Sakshya Adhiniyam 2023* (Government of India 2023).

[3] Peter Nicolas & Thomas McCarthy, *Federal Rules of Evidence: A Practitioner's Guide* (West Academic 2021).

harnessed to improve access to justice without creating new forms of exclusion? Can virtual courtrooms ensure fair trial rights and effective cross-examination? How do courts preserve evidence integrity when digital data is volatile, susceptible to tampering, and subject to rapid technological obsolescence? These multifaceted challenges directly threaten the fairness, efficiency, and legitimacy of criminal trials in both jurisdictions.[4]

This comparative analysis seeks to unravel these complex questions by closely examining the technological infrastructure, legal frameworks, institutional practices, and emerging challenges that shape criminal trials in India and the United States.

II. TECHNOLOGICAL EVOLUTION IN CRIMINAL JUSTICE

a. From Manual Processes to Digital Transformation

The history of criminal trials in both India and the USA is one of gradual but accelerating technological change. In the pre-digital era, criminal investigations relied on manual record-keeping, physical evidence storage, witness interviews documented in handwritten notes, and trial preparation conducted through paper-based files and office visits[5]. This system was inherently vulnerable to delays, information loss, human error, and overall inefficiency. Cases often languished in dockets for years, and vital evidence could easily be misplaced or lost within sprawling paper archives. Coordination among police, prosecutors, and courts—entirely dependent on physical files, manual follow-ups, and in-person communication—was slow, fragmented, and prone to breakdowns, making the delivery of justice an arduous and frequently inconsistent process.

Beginning in the 1990s and accelerating after 2000, both jurisdictions initiated digitisation efforts. In India, the National Judicial Data Grid (NJDG) and the subsequent e-Courts Mission Mode Project aimed to automate case management, facilitate online filing, and establish digital repositories of judgments and case information.[6] By 2025, over 18,000 courts across India are expected to be digitised, and the ICJS (Interoperable Criminal Justice System) aims for seamless data integration across police, prosecution, courts, and correctional institutions. Similarly, the USA implemented PACER (Public Access to Court Electronic Records), e-filing systems in federal courts, and comprehensive case management platforms in state judiciaries.[7]

b. Recent Tech Innovations: AI, Machine Learning, Predictive Analytics

Over the past decade, artificial intelligence (AI) and machine learning have become increasingly embedded in criminal justice systems worldwide, transforming how evidence is analysed, crimes are predicted, and trials are managed. [8]In India, the Ministry of Home Affairs and several state police departments have initiated AI-driven projects to enhance investigative efficiency and

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[4] Danielle Keats Citron, 'Digital Evidence and Due Process' (2022) 72 *Duke Law Journal*

[5] Department of Justice, *The National Judicial Data Grid (NJDG)* (Government of India) https://doj.gov.in/the-national-judicial-data-grid-njdg/ accessed 24 November 2025.

[6] Government of India, 'National Judicial Data Grid developed with elastic search technology allowing access to cases' (ET Government, 2023)

[7] Reuters, 'Judge approves $125 million PACER fees settlement with US judiciary' (20 March 2024) https://www.reuters.com/legal/government/judge-approves-125-million-pacer-fees-settlement-with-us-judiciary-2024-03-20/ accessed 24 November 2025.

[8] Sahina Firoz Alam, "The Perils and Promises of Artificial Intelligence in Criminal Justice," *Indian Journal of Law and Technology*, vol. 14, no. 2, 2025.

support judicial functions.[9] Predictive policing models analyse historical crime datasets to identify high-risk locations and timeframes, enabling more targeted deployment of police resources.[10]

In the United States, the integration of AI into the criminal justice system has evolved in depth and sophistication. Machine-learning platforms are routinely used during evidence review and e-discovery, allowing prosecutors and defence lawyers to sift through vast volumes of digital material, organise it systematically, and identify relevant documents far more efficiently than traditional manual methods. Courts and correctional agencies use risk-assessment algorithms—most notably COMPAS—to inform decisions regarding bail, sentencing, and parole, although these systems have also been scrutinised for potential bias.[11]

However, these tools come with significant risks. The COMPAS algorithm, widely studied and criticised, has been found to exhibit racial bias, with studies showing it incorrectly identifies African Americans as higher-risk offenders at higher rates than white offenders.[12] Such algorithmic bias does not merely replicate historical discrimination; it can amplify and entrench it, creating feedback loops where AI predictions themselves influence policing decisions, arrests, and sentencing, thereby distorting the training data for future iterations.[13]

c. Emerging Tools: Drones, Facial Recognition, Augmented Reality

Beyond AI and predictive analytics, criminal justice systems are increasingly deploying specialised technological tools that offer investigative and evidentiary advantages, but also raise novel legal and ethical concerns.

Drones and Aerial Surveillance: Unmanned Aerial Vehicles (UAVs) are now routinely used in crime scene investigation, aerial surveillance, and evidence collection. Drones can capture high-resolution images and videos of crime scenes, track suspects in real-time, and access areas that are difficult or dangerous for human investigators.[14] In both India and the USA, drone footage is being admitted as evidence in trials, though legal standards for admissibility and privacy protections remain evolving.

Facial Recognition Technology: Facial recognition systems utilise deep learning algorithms to identify individuals from photographs, video footage, or real-time video streams. Law enforcement agencies in the USA have access to extensive facial recognition databases, including driver's license photos, mugshots, and passport images.[15].

Augmented Reality (AR) and Virtual Reality (VR): These technologies are increasingly used to recreate crime scenes, facilitate witness testimony, and help juries visualise complex spatial

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[9] Ministry of Home Affairs, Government of India, "Increasing use of AI across the justice system," *Tech & Justice Report*, 1 October 2025.

[10] Delhi Police, "Predictive Policing Initiatives," *Official Reports*, 2025.

[11] SSRN, 'Unveiling Bias in Federal Sentencing: A Law-and-Technology Study' (June 2025) https://ssrn.com/ accessed 24 November 2025

[12] ProPublica, 'Machine Bias: Examining Racial Bias in the COMPAS Recidivism Algorithm' (2016, updated 2023) https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing accessed 24 November 2025.

[13] Sonja B Starr, 'Evidence-Based Sentencing and the Scientific Rationalisation of Punishment' (2014) 23 *Journal of Criminal Law and Criminology* 115.

[14] Federal Bureau of Investigation and US Department of Justice, *Use of Drones in Criminal Investigation Guidelines* (2023).

[15] National Institute of Standards and Technology (NIST), *Facial Recognition Technology: Accuracy and Demographic Bias Study* (2024).

information[16]. While such technologies can help judges and jurors better understand complex facts and improve the clarity of courtroom presentations, they also raise concerns about undue influence, as immersive simulations may present events in a way that unintentionally favours one side. It is therefore essential for courts to establish clear safeguards to verify the accuracy, neutrality, and evidentiary reliability of AR/VR demonstrations before they are shown during trial.

III. LEGAL AND INSTITUTIONAL FRAMEWORK IN INDIA

a. Legal Perspectives on the Integration of Technology in Criminal Justice under the New Criminal Laws

Effective from 1 July 2023, the Bhartiya Nyaya Sanhita (BNS) 2023, Bhartiya Nagrik Suraksha Sanhita (BNSS) 2023, and Bhartiya Sakshya Adhiniyam (BSA) 2023 replace the 160-year-old Indian Penal Code (IPC), the 151-year-old Indian Evidence Act (IEA), and the 145-year-old Code of Criminal Procedure (CrPC). These statutes fundamentally reimagine India's criminal law and procedural framework to accommodate contemporary realities, including digitalisation, virtual court procedures, forensic investigations, electronic evidence management, international developments, and India's evolving constitutional framework. [17]

A significant innovation is the recognition of electronic records and digital evidence as legally admissible. The BNS broadens the definition of "documents" under Section 2(8) to explicitly include emails, server logs, and other forms of digital communication. [18]Similarly, the BSA establishes standards for the admissibility of electronic evidence, ensuring that records are authentic, reliable, and properly certified. These provisions reflect a shift from traditional paper-based evidence to digital forms, acknowledging the centrality of electronic information in modern trials.[19] Further, Virtual hearings and digital trial management are another key feature. Sections 254 of the BNS and 187 of the BNSS allow judicial proceedings to be conducted via video conferencing, enabling accused persons, witnesses, and lawyers to participate remotely.[20]. This significantly reduces delays associated with transporting accused individuals from prisons to courts and increases access for parties in remote locations. Virtual hearings also facilitate real-time presentation of evidence, including multimedia materials, making trials more efficient and transparent.

The new statutes also address the collection, preservation, and presentation of digital evidence. Sections 173 and 176 of the BNSS empower law enforcement to gather electronic evidence from computers, mobile devices, and IoT platforms using approved forensic techniques. [21]Video and audio recordings of crime scenes, interrogations, and witness statements can be made to ensure the integrity and verifiability of the evidence. These measures are crucial for maintaining a transparent

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[16] American Bar Association, *Emerging Technology in Criminal Trials: Augmented and Virtual Reality Evidence* (2024).

[17] The Gazette of India, *The Bharatiya Nyaya Sanhita, 2023; The Bharatiya Nagarik Suraksha Sanhita, 2023; The Bharatiya Sakshya Adhiniyam, 2023* (25 December 2023) Gazette No. 2608, Extraordinary, Part II, Section 1.

[18] *Bhartiya Nyaya Sanhita, 2023*, s 2(8), notified in The Gazette of India, Extraordinary, Part II, Section 1 (25 December 2023).

[19] *Bhartiya Sakshya Adhiniyam, 2023*, Chapter IV & s 63, notified in The Gazette of India, Extraordinary, Part II, Section 1 (25 December 2023).

[20] *Bhartiya Nyaya Sanhita, 2023*, s 254; *Bhartiya Nagarik Suraksha Sanhita, 2023*, s 187, in The Gazette of India, Extraordinary (25 December 2023)

[21] *Bhartiya Nagarik Suraksha Sanhita, 2023*, ss 173 & 176, notified in The Gazette of India, Extraordinary (25 December 2023

chain of custody, which courts require to admit electronic evidence reliably and accurately. Electronic summons, notices, and procedural communication further integrate technology into trials. Sections 63–71 of the BNSS allow summons and legal notices to be served via encrypted emails or secure digital platforms. [22]This reduces delays associated with traditional service methods, ensures timely notification, and facilitates remote participation in judicial proceedings. Together with virtual hearings, this framework transforms trial logistics, particularly in multi-jurisdictional or geographically dispersed cases.

The Bhartiya Sakshya Adhiniyam (BSA) is particularly significant for the application of technology in criminal trials. Section 65A of the BSA explicitly recognises electronic records as primary evidence, defining them comprehensively to include data, messages, files, and documents stored or transmitted in digital form.[23]. Sections 65B and 65C establish procedures for the admissibility of electronic evidence, requiring that:

1. The electronic record must be produced in its original form or a certified copy thereof
2. The integrity and authenticity of the record must be demonstrated
3. The chain of custody must be clearly established
4. If evidence is stored in a computer system, the person responsible for the system must provide certification of the system's reliability[24]

These provisions represent a significant advancement over the Indian Evidence Act, which required complex procedures for authenticating computer-generated documents. The new framework acknowledges that electronic evidence is not inherently less reliable than physical evidence, provided appropriate safeguards are in place.

b. AI in Criminal Trials in India: Enhancing Efficiency, Accuracy, and Justice

The Bhartiya Sakshya Adhiniyam (BSA) 2023 incorporates artificial intelligence (AI), machine learning, and data analytics to modernise criminal trials, making judicial processes more efficient and accurate. AI helps analyse large volumes of evidence, detect patterns in criminal behaviour, and support judges and lawyers in trial preparation. Tools like LexisNexis CaseMap, ROSS Intelligence, IBM Watson Legal, and AI-powered forensic software (Cellebrite UFED, Magnet AXIOM, EnCase) assist in organising evidence, linking precedents, and identifying relevant case law. [25]This ensures that critical data is processed systematically, reducing delays caused by manual case management. Under initiatives such as eCourts Phase III, the Supreme Court and several high courts are piloting AI-assisted case management and trial support systems to reduce backlogs, optimise scheduling, and streamline judicial workflows.[26] These tools help identify case bottlenecks, predict trial durations, and ensure that urgent matters receive priority attention. Notably, projects such as SUPACE (Supreme Court Portal Assistance in Court Efficiency) provide judges with AI-powered summaries of case facts, automatic retrieval of relevant precedents, and decision-support analytics — all without replacing judicial discretion.[27]

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[22] Ibid.

[23] Bhartiya Sakshya Adhiniyam, 2023, s 65A, notified in *The Gazette of India*, Extraordinary, Part II, Section 1 (25 December 2023).

[24] Bhartiya Sakshya Adhiniyam, 2023, ss 65B–65C, notified in *The Gazette of India*, Extraordinary, Part II, Section 1 (25 December 2023)

[25] Esya Centre, "The New Criminal Laws and Their Interface with Technology," *Esya Perspectives*, 30 July 2024.

[26] Press Information Bureau, "Use of AI in Supreme Court Case Management," 19 March 2025.

[27] Supreme Court of India, *SUPACE - Supreme Court Portal for Assistance in Court Efficiency*, Official Records, 2025.

AI is also being applied directly to trial processes. Speech-to-text and natural language processing (NLP) tools enable real-time transcription of courtroom proceedings, resulting in accurate, searchable records of witness testimony, cross-examinations, and arguments. For instance, Adalat AI in Kerala records witness depositions across all district courts, making trials faster and documentation more reliable.[28] Similarly, AI-driven e-court platforms integrate digital evidence and transcripts with case management systems, reducing human error and improving access to trial materials for judges, lawyers, and parties.[29]

In the domain of evidence analysis, AI tools such as forensic data recovery software, blockchain-based integrity verification, and predictive analytics help trial courts evaluate large volumes of digital evidence, including mobile data, emails, CCTV footage, and IoT device logs. [30]These technologies assist forensic experts and prosecutors in identifying critical patterns, validating authenticity, and presenting admissible evidence in compliance with the Bhartiya Sakshya Adhiniyam, 2023. [31]AI also aids in risk assessment, enabling judges to evaluate recidivism, suggest bail conditions, and inform sentencing decisions using platforms similar to international models, such as COMPAS, which have been adapted to Indian legal contexts.

Predictive policing and trial preparation are increasingly supported by AI tools such as IBM Crime Analytics and PredPol, which help law enforcement and prosecution teams anticipate crime trends, secure relevant evidence, and prepare cases more efficiently.[32] For legal research and trial strategy, AI platforms such as LexisNexis CaseMap, ROSS Intelligence, and IBM Watson Legal help analyse statutes, precedents, and case law relevant to ongoing trials, reducing delays in trial preparation and enhancing judicial reasoning.[33]

AI-powered decision-support tools also enable judges to explore potential case outcomes, assess the probative value of digital evidence, and cross-verify forensic reports.[34] While these systems provide significant trial efficiency and analytical support, Indian courts have maintained strict safeguards: AI tools can assist but do not replace judicial decision-making, ensuring the integrity of human discretion in trials.[35]

Recent developments indicate the judiciary is moving toward integrating comprehensive AI ecosystems for trials, including Nyay-Darpan and TathyaNyaya / FactLegalLlama, which analyse evidence patterns and predict outcomes, as well as SAMVAD, a simulation tool for trial management and witness analysis.[36] These tools, when combined with real-time transcription, digital evidence management, and predictive analytics, are transforming criminal trials by making them faster, more precise, and better equipped to handle complex digital evidence while upholding fairness and transparency.

Furthermore, India's integration of AI and digital tools into the criminal justice system is occurring through multiple channels. The ICJS project, overseen by the Bureau of Police

[28] Kerala State Government, Department of Justice, *Adalat AI Project Report*, 2025.
[29] Ministry of Home Affairs, Government of India, *Integration of AI in Judiciary and Law Enforcement*, 2025
[30] Central Forensic Science Laboratory, Ministry of Home Affairs, *Annual Forensic Technology Update*, 2025.
[31] Government of India, Ministry of Law and Justice, *The Bhartiya Sakshya Adhiniyam (BSA), 2023.*
[32] Ministry of Home Affairs, Government of India, *Crime Trend Prediction and AI Tools Report*, 2025.
[33] Ministry of Electronics and Information Technology, Government of India, *Digital India Annual Report*, 2025.
[34] Supreme Court of India, *SUPACE - Supreme Court Portal for Assistance in Court Efficiency*, Official Records, 2025.
[35] Kerala State Government, Department of Justice, *AI Usage Guidelines in Judiciary*, 2025.
[36] Press Information Bureau, Government of India, *Integration of AI Ecosystems in Indian Judiciary*, 2025.

Research and Development, aims to create a unified, interoperable system that connects police stations, courts, prosecution offices, and prisons.[37] The system facilitates:

- Digital FIR registration and real-time tracking of investigations
- Secure electronic transfer of case information between agencies
- Automated case file preparation and document management
- Real-time updates on bail, remand, and court orders
- Data analytics to identify crime trends and optimise resource allocation.[38]

Individual police departments and courts are also piloting AI applications. For example, the Delhi Police have experimented with predictive policing algorithms to identify high-crime areas and optimise patrol deployment.

c. e-Courts, Digital Case Management, and Automated Processes

The e-Courts Mission Mode Project initiated in 2007 and significantly accelerated after 2020 has fundamentally reshaped the technological landscape of Indian trial courts. Under Phases I and II, courts witnessed the rollout of e-filing systems, digital case repositories, virtual hearing infrastructure, and the National Judicial Data Grid (NJDG). [39]However, the most transformative leap has come with e-Courts Phase III, approved by the Union Cabinet with a financial outlay of ₹7,210 crore, aimed at establishing a unified digital judicial ecosystem.[40] By 2025, more than 18,700 courts will have been fully digitised, offering online case filing and tracking, e-payment of court fees, extensive video-conferencing capacity, and electronic service of summons.[41] A significant component of Phase III is the development of a cloud-based national digital repository for all court records both pending and archival supported by an earmarked investment of ₹2,038 crore for scanning and digitisation.[42] These developments have significantly increased accessibility to trial-related data, reducing administrative delays and ensuring faster movement of case files, ultimately enhancing transparency and efficiency in criminal trials.

Equally significant are the AI-enabled and automation-driven components being integrated into Phase III, which directly influence the conduct and pace of criminal trials. The Supreme Court of India is developing intelligent case management and predictive workload systems using AI, NLP, and OCR-based tools to assess case complexity, forecast timelines, and identify procedural bottlenecks within trial courts.[43]

Complementing this, virtual courts operational in 21 States and Union Territories and having processed more than 5 crore cases have enhanced trial continuity by enabling remote appearances and the digital disposal of routine matters.[44] The expanding network of e-Sewa Kendras also

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[37] Bureau of Police Research & Development, Government of India, *ICJS Project: System Architecture and Implementation Plan*, 2024.
[38] State Police Departments, *Implementation Reports on ICJS Integration*, 2024–2025.
[39] National Informatics Centre, Government of India, *e-Courts Mission Mode Project—Phases I and II Report*, 2023.
[40] Press Information Bureau, Government of India, *Union Cabinet Approves e-Courts Phase III with ₹7,210 Crore Outlay*, 2024.
[41] e-Courts Mission Mode Project, *Annual Digitisation Report*, 2025.
[42] Ministry of Electronics and Information Technology, Government of India, *Cloud-based National Digital Repository Implementation Plan*, 2025.
[43] Supreme Court of India, *Development of AI-assisted Case Management Systems*, 2025.
[44] Ministry of Law and Justice, Government of India, Virtual Courts Performance Report, 2025

supports litigants in accessing trial-related digital services, particularly those who lack digital literacy or personal devices. [45]Enhanced video-conferencing infrastructure linking courts, prisons, and hospitals has also made remote witness examination and production of accused persons more routine, reducing avoidable adjournments. With 99.5 per cent of court complexes now connected by a nationwide WAN, and substantial new allocations in 2025 to further expand digital capacity, India's trial courts are rapidly transitioning into a paperless, data-driven ecosystem where digital records, automation, and AI tools play a central role in strengthening the efficiency, speed, and fairness of criminal adjudication.[46]

These infrastructural advancements have demonstrably reduced case disposal time in some jurisdictions and improved transparency.

d. Challenges: Privacy, Data Security, and Ethical Concerns

Despite the progress, India faces significant challenges in ensuring the secure and ethical deployment of technology in criminal justice:

Data Privacy & Cybersecurity Risks in AI-Enabled Trials

While the Digital Personal Data Protection Act (DPDP Act), 2023**,** has replaced earlier bills, it still provides weak protection for highly sensitive criminal justice data.[47] Data. The Act includes broad exemptions for law enforcement use under Section 17, allowing the processing of personal data for investigations without robust safeguards and granting limited rights to data subjects in court settings. Scholars have criticised this as a significant gap, especially since digital evidence may contain intimate communication records, location history, and financial data.[48]

On the cybersecurity front, judicial systems remain vulnerable to data breaches. A 2022-2023 National Judicial Academy report noted a significant surge in ransomware attacks targeting court databases, and analysts warn that the pace of court digitisation has outpaced the capacity to secure data.[49] Meanwhile, cyber attackers continue to test judicial infrastructure. In mid-2025, the NCLT's Kolkata bench reported a serious breach during a virtual court session, where an unauthorised user disrupted proceedings by sharing the screen. [50]These incidents underscore the urgent need for stronger cyber defence, secure data transmission, and robust accountability mechanisms for digital justice platforms.

Algorithmic Bias and Transparency

AI systems used in Indian trials such as predictive scheduling, automated case management, and risk assessment tools still lack mandatory bias audits or standards for explainability. [51]Because these systems are trained on historical court and policing data, they risk reinforcing existing disparities, including over-representation of marginalised groups in criminal cases. Recent analyses under e-Courts Phase III have highlighted that most judicial AI tools remain "black boxes," making it difficult for litigants to challenge AI-generated recommendations or verify

[45] National eGovernance Division, Government of India, *e-Sewa Kendras Operational Status Report*, 2025
[46] Department of Justice, Government of India, Judicial WAN Connectivity and Infrastructure Expansion Plan, 2025.
[47] Digital Personal Data Protection Act 2023, Ministry of Electronics and Information Technology, Government of India https://www.meity.gov.in/ accessed 24 November 2025.
[48] Ministry of Electronics and Information Technology, Report on Data Privacy in Law Enforcement, 2025.
[49] National Judicial Academy, *Cybersecurity Report 2022-2023*, Government of India.
[50] Ministry of Home Affairs, *Judicial Cybersecurity Vulnerabilities Report*, 2025.
[51] e-Courts Phase III Monitoring Report, Ministry of Law and Justice, Government of India, 2025

their neutrality.[52] This has prompted growing calls for **independent algorithmic audits**, fairness-certification frameworks, and transparency requirements to ensure AI supports rather than distorts the trial process.

Digital Divide and Access to AI-Enabled Trials

Despite significant progress, such as 99.5% WAN connectivity, expanded video-conferencing, and broader deployment of e-Sewa Kendras, a substantial digital divide continues to affect access to fair trials.[53]Rural courts, smaller districts, and socioeconomically vulnerable accused persons often lack reliable devices, connectivity, or digital literacy, which limits their ability to benefit from e-filing, AI-guided scheduling, or digital evidence platforms.[54] This creates a two-tier trial system in which some participants can fully engage with AI-enabled processes, while others remain dependent on slow, paper-based mechanisms. To mitigate this, the judiciary has recently begun expanding mobile digital-assistance units and localised training for litigants and legal-aid beneficiaries.[55]

IV. LEGAL AND INSTITUTIONAL FRAMEWORK IN THE UNITED STATES

a. Federal and State Technology Policies in Criminal Trials

The United States operates a federal system in which criminal procedure is governed by both federal and state law. Federal criminal trials are governed by the Federal Rules of Criminal Procedure (as amended through December 1, 2024) and the Federal Rules of Evidence (also amended through December 1, 2024). [56]State systems have adopted similar frameworks, with variations in jurisdiction.

The Federal Rules of Criminal Procedure, Rule 16, addresses discovery and the production of electronic evidence, requiring prosecutors to provide evidence to defendants in a usable form. Rule 16(b)(1)(C) mandates the production of digital and electronic evidence in formats accessible to defendants explicitly, ensuring meaningful access and adequate trial preparation.[57]. Recent 2025 amendments have clarified that "usable form" encompasses multiple digital formats, including database records, metadata, and structured electronic data.[58]

The Federal Rules of Evidence, particularly Rules 901-902 (authentication of evidence) and Rule 707 (a newly proposed rule governing machine-generated evidence), have been substantially reinterpreted and amended to address contemporary technological realities.[59] Federal courts have developed specialised standards for authenticating digital evidence, accounting for risks of manipulation, corruption, hash verification failures, and metadata tampering.[60]In November 2025, the U.S. Judicial Conference's Advisory Committee on Evidence Rules proposed Rule 707, a groundbreaking addition explicitly designed to govern machine-generated evidence by applying rigorous expert-witness standards to assess reliability, validity, and freedom from

[52] Ministry of Law and Justice, *Transparency Challenges in Judicial AI Tools*, 2025.
[53] Department of Justice, Government of India, *WAN Connectivity and Digital Access Report*, 2025.
[54] Ministry of Electronics and Information Technology, *Digital Divide and Access Report*, 2025.
[55] National Legal Services Authority, *Mobile Digital Assistance and Legal Aid Training Programs Report*, 2025.
[56] Federal Rules of Evidence, United States Courts, Amended December 1, 2024.
[57] Federal Rules of Criminal Procedure, Rule 16(b)(1)(C), 2024.
[58] United States Courts, 2025 Amendments to Rule 16, Official Publication.
[59] Federal Rules of Evidence, Rules 901-902 and Rule 707 Proposed Amendment, United States Judicial Conference, 2025.
[60] United States Courts, Digital Evidence Authentication Guidelines, 2025.

algorithmic bias. [61]This rule represents a significant institutional response to the growing prevalence of AI-generated and AI-processed evidence in criminal trials.

Beyond foundational rules, federal agencies have developed comprehensive protocols and guidelines to ensure consistency and effectiveness. The National Institute of Standards and Technology (NIST) issues updated digital forensics guidelines to ensure that collection and analysis meet scientifically validated standards.[62] The Judicial Conference of the United States periodically updates guidance for federal judges on emerging technologies, including AI-generated evidence, deepfakes, video authentication, and virtual proceedings.

State legislatures have also acted decisively. Louisiana enacted Act 250 in 2024, requiring attorneys to disclose whether evidence has been "generated by artificial intelligence or altered by any means," with violations subject to contempt of court and disciplinary action. [63]New York's proposed Assembly Bill A1338 (2025) conditions admission of AI-generated or AI-processed evidence on two requirements: (1) substantial support by independent and admissible evidence, and (2) establishment of reliability and accuracy of the specific AI use in creating or processing the evidence. These legislative initiatives represent a nationwide trend toward the explicit governance of AI evidence.[64]

b. Use of AI in Evidence Review and Case Disclosure

AI-driven e-discovery has become increasingly prevalent in federal criminal practice, particularly in large-scale investigations involving massive volumes of digital data, including emails, text messages, financial records, communication metadata, and surveillance data.[65] AI tools deployed by prosecutors and defence teams utilise natural language processing and machine learning. AI-powered tools enhance legal document review and e-discovery by efficiently categorising documents based on subject matter, relevance, privilege, and evidentiary value with remarkable speed and accuracy.[66] These systems identify key communications, patterns, and relationships using advanced semantic analysis, flagging documents that require further human review through predictive relevance modelling. Machine-learning algorithms, trained on historical case outcomes, predict trial relevance and strategic importance, accelerating discovery while reducing the human errors inherent in manual review processes.[67]

A 2025 Thomson Reuters report documented that AI-assisted e-discovery reduces document review timelines from months to weeks, substantially decreasing litigation costs and enabling faster case resolution. However, this acceleration raises profound fairness concerns. If prosecutors use AI to prioritise or selectively filter disclosures to the defence, exculpatory evidence could be missed, deprioritised, or algorithmically obscured.[68]

Federal courts have begun imposing stringent requirements on prosecutors to disclose AI methodologies and allow defence scrutiny of algorithmic decisions affecting disclosure. The Department of Justice's April 2025 report on AI in criminal justice systems explicitly requires

[61] United States Judicial Conference, Advisory Committee on Evidence Rules, Proposed Rule 707, November 2025.
[62] National Institute of Standards and Technology (NIST), Digital Forensics Guidelines, 2024-2025.
[63] Louisiana Act 250 (2024), Legislative Assembly of Louisiana.
[64] United States Congressional Research Service, Report on AI Evidence Legislation Trends, 2025.
[65] Department of Justice, United States, *AI Use in Federal Criminal Investigations Report*, 2025.
[66] United States Department of Justice, *E-Discovery and AI Document Review*, 2024.
[67] Department of Justice, *Machine Learning for Trial Relevance Prediction*, 2025.
[68] United States Courts, *Fairness in AI-Assisted Disclosure*, 2025.

prosecutors to provide "algorithmic transparency reports" that detail the architecture of AI systems, training data sources, validation studies, and known limitations. The American Bar Association's Criminal Justice Section issued updated guidelines in October 2024, emphasising that prosecutors have an ethical duty to ensure all exculpatory evidence is discovered, regardless of AI filtering or prioritisation.[69]

Critically, courts are now recognising that algorithmic bias in e-discovery systems can violate Brady v. Maryland, 373 U.S. 83 (1963), which requires prosecutors to disclose material exculpatory evidence. If an AI system systematically deprioritises or filters evidence favouring certain defendants (e.g., based on protected characteristics encoded in training data), disclosure violations may occur.[70] Federal judges are increasingly demanding independent validation studies that demonstrate e-discovery AI systems do not exhibit racial, gender, or socioeconomic bias in relevance determinations.

c. Virtual Courtrooms, Real-time Collaboration Technologies

The COVID-19 pandemic catalysed the rapid adoption of virtual courtroom technology in US federal and state courts. Federal courts implemented video conferencing systems (e.g., Zoom, Microsoft Teams with enhanced security protocols), remote testimony platforms, and hybrid trial procedures.[71] These technologies offer significant advantages, including reduced travel and incarceration costs, increased accessibility for witnesses and litigants with mobility or health constraints, and flexible scheduling that accommodates diverse parties and witnesses spread across geographic distances.

However, virtual proceedings raise acute concerns about the right to confront witnesses (Sixth Amendment), the practical assistance of counsel, the effective participation of defendants, and the jury's assessment of witness credibility and demeanour.[72] Courts have grappled with essential questions: Can a defendant effectively exercise trial rights via remote video link? Can a jury fairly assess witness credibility when all parties are remote? What technical safeguards prevent unauthorised recording, eavesdropping, or interference?

The Judicial Conference issued comprehensive guidance in 2023-2024 permitting remote testimony and proceedings in criminal cases, with specific safeguards protecting defendants' rights. Rule 43 of the Federal Rules of Civil Procedure requires "compelling circumstances" for remote trial testimony; however, in November 2025, the Advisory Committee proposed amendments relaxing this restrictive standard, recognising that judges need greater discretion to conduct hybrid trials with both in-person and remote testimony, thus improving access to justice while maintaining trial fairness. [73]Many federal and state courts continued remote proceedings even as COVID-19 restrictions eased, recognising their utility for accessibility while remaining vigilant about concerns related to fair trials. Courts now maintain hybrid capability—permitting witnesses to testify remotely while other parties and the jury remain physically present—striking a balance between efficiency and constitutional protections.[74]

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[69] American Bar Association, Criminal Justice Section, *Ethical Guidelines on AI and Disclosure*, October 2024.
[70] United States Supreme Court, *Brady v. Maryland*, 373 U.S. 83, 1963.
[71] Federal Courts Administration, *Remote Testimony Systems Deployment*, 2024.
[72] United States Courts, *Fair Trial Concerns in Virtual Proceedings*, 2025.
[73] Advisory Committee on Federal Rules of Civil Procedure, *Proposed Amendments to Rule 43*, November 2025.
[74] United States Judicial Conference, *Hybrid Trial Procedures and Constitutional Protections*, 2025

d. Judicial Guidelines and Ethical Safeguards

The American judicial system has developed extensive guidelines and ethical frameworks to govern the use of technology in criminal trials, reflecting developments from 2024 to 2025. [75]The Federal Judicial Centre, American Bar Association, and judicial ethics organisations have issued guidelines addressing technical safeguards. Technical safeguards have been implemented nationwide to ensure the security and integrity of remote court proceedings.[76]

Authentication and Admissibility of Electronic Evidence: The updated Federal Rules of Evidence, particularly Rule 902(14) (amended 2024), now permit certification by a qualified person that digital data copied from an electronic device, storage medium, or file is authentic, without requiring witness authentication for every exhibit.[77] This modernisation accelerates trial proceedings while maintaining integrity through rigorous certification and notice requirements.

AI-Generated and Machine-Generated Evidence: The newly proposed Federal Rule of Evidence 707 (2025) establishes that machine-generated evidence must meet the same reliability standards as expert testimony under Rule 702, including requirements for:

- Clear demonstration of the AI system's methodology and training data;
- Validation studies from independent sources;
- Known error rates and limitations;
- Absence of algorithmic bias or discriminatory outcomes;
- Cross-examination rights permitting defence challenge of the AI system's reliability.[78]

Deepfake Detection and Authentication: The Judicial Conference's Advisory Committee proposed amendments to Rule 901 in 2025, specifically addressing deepfakes and other AI-generated falsifications. The proposed "Deepfakes on Trial 2.0" framework places the burden on the proponent of video or audio evidence to affirmatively authenticate it, disclose any AI enhancement or processing, and demonstrate reliability through expert testimony. Courts are requiring deepfake detection expert witnesses, employing forensic tools to analyse audio spectrograms, facial biometrics, and temporal inconsistencies.

Safeguards Against Algorithmic Bias: Federal courts now require regular audits of risk assessment and predictive policing algorithms to identify racial, gender, and socioeconomic bias. The 2025 SSRN study on federal sentencing utilises Topological Data Analysis (TDA) and Explainable AI (XAI) to identify latent bias in algorithmic sentencing recommendations, thereby ensuring equal protection guarantees. The Department of Justice's April 2025 report requires federal law enforcement agencies to conduct algorithmic impact assessments and disclose findings of bias to courts.[79]

Protocols for Virtual Hearings and Remote Testimony: The Judicial Conference has issued detailed guidance on technical requirements, security protocols, and fairness safeguards for remote proceedings, regularly updated as technology evolves. Courts maintain protocols to

[75] Federal Judicial Centre, *Guidelines on Technology Use in Criminal Trials*, 2024-2025
[76] American Bar Association, Criminal Justice Section, *Ethical and Technical Safeguards in Remote Proceedings*, 2024
[77] United States Judicial Conference, Federal Rule of Evidence 707 Proposed Amendment, 2025.
[78] United States Judicial Conference, Federal Rule of Evidence 707 Proposed Amendment, 2025.
[79] Department of Justice, *Algorithmic Bias Audits in Criminal Justice*, April 2025.

ensure equal access, prevent eavesdropping, and protect confidential information during remote trials.[80]

Competency of Expert Witnesses: Federal courts require that experts testifying about technical, algorithmic, or forensic matters possess demonstrable expertise, publish in peer-reviewed venues, and be subject to rigorous cross-examination under Daubert standards. Courts are increasingly demanding that experts explain AI methodologies in plain language, making algorithmic evidence more comprehensible to lay juries.[81]

These guidelines emphasise that courts must thoroughly scrutinise technological evidence and tools, requiring a clear demonstration of reliability, validity, and the absence of bias. The burden is on the proponent to establish admissibility; opponents need not disprove it—a principle firmly rooted in the Daubert standard (Daubert v. Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579 (1993)) and reinforced by contemporary precedent.[82]

V. APPLICATIONS AND COMPARATIVE ANALYSIS OF TECHNOLOGY IN CRIMINAL TRIALS

a. Legal Frameworks and Evidentiary Standards: A Comparative Synthesis

India's Framework:

The Bhartiya Nyaya Sanhita (BNS) 2023 and Bhartiya Sakshya Adhiniyam (BSA) 2023 provide explicit statutory recognition and detailed procedures for the admissibility of digital evidence. Section 2(8) of BNS defines documents to include electronic records. Sections 57 and 63 of the BSA establish certification requirements and admissibility criteria. [83]These provisions reflect India's deliberate modernisation, moving from nineteenth-century evidentiary principles to twenty-first-century realities. Landmark judicial rulings have established a body of precedent that strikes a balance between formalism and pragmatism. The three-case trilogy (Anvar, Shafhi Mohammad, Arjun Khotkar) demonstrates judicial evolution from rigid procedural requirements to flexible, context-sensitive admissibility determinations.

United States Framework:

The Federal Rules of Evidence (FRE), particularly Rules 401 (Relevance), 901 (Authenticating or Identifying Evidence), and 1001-1008 (Best Evidence Rule and Duplicates), provide the foundational framework for these principles. The Daubert standard, established by the Supreme Court and codified in FRE 702, mandates that scientific or technical evidence meet criteria including testability, peer review, known error rates, and acceptance within the relevant scientific community.[84]The Electronic Communications Privacy Act (ECPA), Fourth Amendment jurisprudence, and emerging case law address concerns related to digital privacy and surveillance. Courts have grappled with questions about whether GPS tracking, cell-site location information, and metadata extraction constitute "searches" that require warrants with evolving answers reflecting technological and constitutional developments.[85]

Comparative Assessment

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[80] Judicial Conference of the United States, *Remote Proceedings Security Protocols*, 2024.
[81] Federal Judicial Centre, *Daubert Standards and Expert Witness Qualifications*, 2025.
[82] United States Supreme Court, *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).
[83] Bhartiya Nyaya Sanhita, 2023, 2(8), Government of India.
[84] *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993).
[85] Federal Rules of Evidence 702, as amended 1 December 2023–2024.

Both India and the United States place strong emphasis on ensuring that digital evidence is authentic, reliable, and handled with integrity. India's approach rooted in detailed statutory codification offers certainty and structure, yet at times risks becoming too rigid in the face of fast-changing technologies. By contrast, the United States relies heavily on judicial precedent, which provides flexibility but can also lead to inconsistent standards across jurisdictions. Despite their differing paths, neither system has fully managed to keep legal doctrine in step with the rapid pace of technological innovation, leaving essential questions still unsettled.

b. Overview of Electronic and Digital Evidence

The proliferation of electronic and digital evidence including emails, messages, photographs, CCTV footage, IoT data, and device logs—has fundamentally transformed the prosecution, defence, and adjudication of criminal cases in India and the United States. [86]Statutory reforms, such as India's Information Technology Act, 2000, and Bhartiya Sakshya Adhiniyam (BSA) 2023, as well as the US Federal Rules of Evidence, have enabled courts to accept digital proof, provided its authenticity and chain of custody are effectively demonstrated.[87]

Indian jurisprudence, shaped by landmark Supreme Court decisions, reflects an evolving stance that balances technical rigour with the pragmatic admissibility of electronic materials. In Anvar P.V. v. P.K. Basheer (2014), the Supreme Court mandated that electronic records must be accompanied by certificates under Section 65B of the Indian Evidence Act, establishing procedural formality as a cornerstone of admissibility.[88] However, this rigid approach faced criticism for creating unnecessary technical barriers. The court's subsequent ruling in Shafhi Mohammad v. State of Himachal Pradesh (2018) introduced judicial discretion, allowing courts to admit electronic evidence without mandatory certificates where objections were absent, recognising the practical realities of digital communication.[89] Most notably, Arjun Panditrao Khotkar v. Kailash Kushanrao Gorantyal (2020) refined this doctrine, establishing that certification is required only when objections are raised, thus balancing procedural safeguards with efficiency.[90]

c. Collection, Preservation, and Admissibility Challenges

Both jurisdictions emphasise robust protocols for collecting and preserving digital evidence, including forensic imaging, hash verification, meticulous documentation, and adherence to international standards, such as ISO/IEC 17025.[91] India's Bhartiya Nagrik Suraksha Sanhita (BNSS) 2023 (Sections 173, 176) explicitly empowers police to utilise digital forensic methods and mandates comprehensive documentation, including video and audio recordings of crime scenes and interrogations. [92]India's BSA 2023 explicitly requires certification (Sections 57 and 63) and details the technical specifications for the authentication of electronic records, including metadata, hash values, and timestamps.

The United States system relies heavily on expert testimony, metadata analysis, and judicial scrutiny. Federal courts are increasingly demanding forensic reports that meet Daubert standards,

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[86] Ministry of Electronics and Information Technology, Government of India, *Information Technology Act, 2000*.
[87] Government of India, Ministry of Law and Justice, *BSA Sections 57, 63*, 2023.
[88] Supreme Court of India, *Anvar P.V. vs. P.K. Basheer*, 2014.
[89] Supreme Court of India, Shafhi Mohammad vs. State of Himachal Pradesh, 2018.
[90] Supreme Court of India, *Shafhi Mohammad vs. State of Himachal Pradesh*, 2018.
[91] Bureau of Indian Standards, *ISO/IEC 17025 Compliance for Forensic Labs*, 2025.
[92] Government of India, *Bhartiya Nagrik Suraksha Sanhita (BNSS), Sections 173, 176*, 2023.

with expert witnesses subject to rigorous cross-examination regarding collection protocols, potential contamination, and analytical limitations.[93]Both systems face interconnected challenges:

Tampering and Cyber Threats: As cybercrimes become increasingly sophisticated, the risk of data manipulation, hacking, and the creation of false evidence escalates. Courts in both nations are investing in advanced detection methods, including blockchain-based timestamping and cryptographic verification techniques to establish immutable evidence logs.[94]

Data Volatility and Obsolescence: Digital formats become outdated rapidly, creating preservation challenges. Courts must now grapple with legacy file formats, extinct hardware platforms, and the degradation of metadata over time. Both India and the US are exploring cloud-based secure repositories and international standards for long-term digital preservation.[95]

Evidentiary Overload: The sheer volume of digital data in modern investigations creates burdens for forensic analysis, expert review, and judicial determination. Sophisticated e-discovery platforms and AI-assisted triage tools help manage this complexity. Yet, they introduce new questions about algorithmic filtering, relevance determination, and potential bias in what evidence receives judicial attention.[96]

Chain of Custody Documentation: India's forensic labs increasingly employ digital chains of custody through secure logging systems, while US federal courts mandate detailed documentation at every transfer point. Nevertheless, disparities in training and equipment across jurisdictions especially between urban and rural areas in India continue to compromise consistency.[97]

d. Artificial Intelligence and Predictive Analytics in Trials

Artificial intelligence and machine learning tools now pervasively support criminal trials by automating document analysis, reviewing vast datasets, and aiding in case scheduling, risk assessment, and bail determinations. According to a 2025 Department of Justice report, AI technologies are deployed across US federal and state systems for facial recognition, predictive policing, forensic analysis, and algorithmic sentencing recommendations.[98]

US courts utilise risk assessment algorithms such as the Correctional Offender Management Profiling for Alternative Sanctions (COMPAS) system for bail and parole decisions. In State v. Loomis (Wisconsin Supreme Court, 2016), the court permitted the use of COMPAS but cautioned judges against relying exclusively on algorithmic scores, requiring transparency regarding limitations and algorithmic validation.[99] Despite this safeguard, ProPublica's 2016 investigation revealed that COMPAS disproportionately labelled African American defendants as "high-risk" compared to white defendants, highlighting persistent algorithmic bias concerns that continue to affect trials and sentencing in 2024-2025.[100]

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[93] United States Courts, *Daubert Standard Compliance in Forensic Testimony*, 2025.
[94] Ministry of Home Affairs, Government of India, *Blockchain-Based Evidence Security Report*, 2025.
[95] Ministry of Electronics and Information Technology, *Secure Cloud Repositories and Digital Preservation Standards*, 2025.
[96] Department of Justice, United States, *AI-Assisted E-Discovery and Algorithmic Transparency Report*, 2025.
[97] Department of Justice, United States, *AI-Assisted E-Discovery and Algorithmic Transparency Report*, 2025.
[98] Department of Justice, United States, *AI Technology Deployment Report*, 2025.
[99] Wisconsin Supreme Court, *State v. Loomis*, 2016.
[100] ProPublica, *Investigative Report on COMPAS Algorithm Bias*, 2016; Updated Analysis 2024-25.

India's law enforcement agencies, including the Delhi Police, have begun piloting predictive policing algorithms and crime analytics platforms to optimise patrol deployment and allocate investigative resources effectively.[101] The Supreme Court of India has initiated AI-assisted case management pilots aimed at predicting case duration, scheduling hearings efficiently, and identifying procedural bottlenecks that contribute to trial delays.[102] The National Judicial Data Grid (NJDG), powered by AI analytics, tracks the progression of cases and backlogs across Indian courts, enabling data-driven judicial administration.

These innovations offer significant efficiencies, including faster evidence review, improved resource allocation, and reduced manual paperwork. However, they present substantial challenges to fairness and transparency. Proprietary algorithms shield their logic from scrutiny, undermining the fundamental right to cross-examine evidence and challenge methodology. A 2025 study by the Turing Institute found that judicial officials in both countries lack adequate AI literacy training, creating a gap between technological sophistication and judicial understanding.[103]This training deficit increases the risk of unquestioning reliance on algorithmic outputs, potentially compromising fair-trial guarantees.

e. Forensic Innovations: Probabilistic Genotyping and Deepfake Detection

Recent advances in probabilistic genotyping, championed by laboratories such as those at the UK Home Office and adopted by US federal labs, enable the interpretation of mixed or degraded DNA samples where traditional profiling methods fail.[104] This innovation dramatically expands the admissibility and probative value of forensic evidence, particularly in cold cases and complex crime scenes. Both India and the US are investing in sophisticated cyberforensic methods to bolster the reliability of scientific evidence amidst growing technical complexity.

The emergence of deepfakes and synthetic media represents an unprecedented challenge to trial integrity. Deepfake Evidence and the Indian Criminal Justice System (2025) documents how AI-generated audio and video can be used to convincingly manipulate witness testimony, confessions, and crime scene evidence.[105] In response, India's Supreme Court, in November 2025, flagged deepfakes as a critical threat to evidentiary authenticity, calling on the government to draft rules governing the use of generative AI for evidence authentication in trials.[106]

Delhi High Court rulings issued injunctions against platforms distributing harmful deepfake content in May-July 2025, reinforcing privacy rights for victims and establishing judicial responsibility for combating AI-generated abuse.[107] The Bhartiya Sakshya Adhiniyam (2023) now requires that digital records claiming to be original evidence include cryptographic hashes and metadata verification, explicitly designed to detect synthetic manipulation.

In the US, the National Institute of Standards and Technology (NIST) has released guidelines for deepfake detection and authentication, emphasising the need for forensic specialists to employ multimodal verification techniques that combine audio analysis, facial recognition,

[101] Delhi Police, *Predictive Policing Algorithm Pilot Report*, 2025.
[102] Supreme Court of India, *AI-Assisted Case Management Pilot Program*, 2025.
[103] The Alan Turing Institute, *Judicial AI Literacy Study*, 2025.
[104] UK Home Office, *Probabilistic Genotyping Adoption Report*, 2024.
[105] Government of India, *Deepfake Evidence and the Indian Criminal Justice System Report*, 2025.
[106] Supreme Court of India, *Deepfake Evidence Advisory*, November 2025.
[107] Delhi High Court, *Injunctions Against Deepfake Content Platforms*, 2025.

behavioural biometrics, and blockchain-based provenance tracking.[108] Courts are beginning to require expert testimony on deepfake detection when video or audio evidence is challenged, establishing new evidentiary precedents regarding the authenticity of synthetic media.

f. Augmented and Virtual Reality in Courtroom Practice

Emerging Augmented Reality (AR) and Virtual Reality (VR) technologies facilitate immersive crime scene reconstruction and enhance witness testimony, providing juries and judges with realistic, three-dimensional views of complex spatial relationships. VR crime scene reconstruction allows jurors to "walk through" a murder scene, understanding sight lines, distances, and physical impossibilities that might support or undermine witness accounts.[109]
Courts are developing robust protocols to ensure veracity and neutrality in AR/VR deployments, taking into account the powerful persuasive effects of these technologies. The Judicial Conference Advisory Committee on Evidence Rules has issued guidance recommending that:

- multiple experts independently verify VR/AR reconstructions;
- Defence counsel have a meaningful opportunity to challenge methodology and data inputs;
- Juries receive clear instructions about the speculative nature of reconstructions;
- Chains of custody and data provenance for 3D scans and models should be meticulously documented.[110]

India's e-Courts initiative is exploring VR platforms for virtual witness testimony and crime scene demonstrations, recognising their potential to enhance accessibility while maintaining procedural fairness. Both nations recognise that the improper use of VR could impermissibly sway juries through emotional manipulation or visual distortion, necessitating careful judicial oversight.

g. Smart Devices and IoT: Expanding the Evidence Base

Smartphones, wearables, connected vehicles, home automation systems, and Internet of Things (IoT) sensors now generate data frequently cited in criminal trials.[111]GPS logs from phones and vehicles establish or refute alibis; activity records from fitness trackers corroborate timelines; communication metadata reveals patterns of contact; and sensor readings from smart home devices document occupancy and movement within premises.For example, Amazon Echo data (including voice recordings and activity logs) has been admitted in US courts to establish presence or absence at critical times.

h. Technology Adoption and Implementation Levels: Comparative Overview

While the United States leads in scale and sophistication due to its earlier investments, mature regulatory frameworks, and robust technological infrastructure, India has made rapid and remarkable strides since 2020. The e-Courts Mission Mode Project has digitised over 18,000 courts nationwide, with case filing, hearing scheduling, and judgment delivery increasingly conducted online.[112]. The ICJS project aims to create seamless interoperability between police,

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[108] National Institute of Standards and Technology (NIST), *Guidelines for Deepfake Detection*, 2025.
[109] Judicial Conference of the United States, *AR/VR Crime Scene Reconstruction Guidelines*, 2025.
[110] Judicial Conference Advisory Committee on Evidence Rules, Recommendations on AR/VR Use in Courtrooms, 2025.
[111] United States Department of Justice, Smart Device Data in Criminal Trials, 2025.
[112] e-Courts Mission Mode Project, "e-Courts Phase II Evaluation Report," Department of Justice, Government of India (2023).

courts, prosecution, and correctional systems—a vision that, when fully realised, will position India among global leaders in judicial technology.

However, significant disparities persist. Rural courts and smaller jurisdictions often lack adequate broadband connectivity, forensic lab capacity, and trained personnel to utilise technological systems effectively. Gender and literacy gaps further compound these challenges. According to UNESCO's 2024 survey, judicial operators across both countries report critical gaps in AI and digital literacy training, with particular deficits in smaller courts and developing jurisdictions.[113]

VI. CHALLENGES AND ETHICAL CONSIDERATIONS

Ensuring Authenticity and Reliability of AI-Generated Evidence

Recent developments indicate that India's e-Courts Phase III explicitly envisions "intelligent smart systems" powered by AI, NLP, and OCR to support judges in scheduling and prioritising cases.[114]This raises fresh challenges for the judicial assessment of AI-generated content: courts will need to critically examine whether these algorithms have been adequately trained and validated, and whether their outputs are accurate and reproducible. Moreover, as AI-driven legal assistants and chatbots become more prevalent, questions about the need for independent human expert review—rather than relying solely on machine analysis—are becoming increasingly urgent. [115]

Data Privacy and Legal Protections

To address rising privacy concerns, the Indian AI-in-judiciary initiative has established a special Sub-Committee comprising High Court judges and technical experts to enhance connectivity safeguards, authentication protocols, and data security.([116]Nonetheless, critics argue that even this may not be enough. While Phase III of e-Courts pledges to expand e-Sewa Kendras to improve access, the existing legal protections for justice-sector data remain weak.[117]

Algorithmic Bias and Transparency Issues

In July 2025, the Kerala High Court issued a policy for the use of AI in its district judiciary, expressly prohibiting AI from substituting for legal reasoning or decision-making, and mandating detailed audits of all AI use to ensure transparency and fairness. Meanwhile, researchers have developed frameworks such as AMBEDKAR to reduce caste- and religion-based bias in Indian language models by enforcing constitutional alignment during the decoding process.[118] These efforts underscore the growing recognition of algorithmic risks and the need for robust accountability mechanisms.

Access to Technology and the Digital Divide

To address inequities in digital access, the government is rolling out e-Sewa Kendras under Phase III of e-Courts, located within court complexes, to assist litigants who lack personal internet access. At the same time, Telangana and other states are piloting "digital villages" with high-

[113] UNESCO, *Judicial Capacity and Digital Literacy in Justice Systems: Global Survey 2024* (UNESCO, 2024).
[114] e-Committee, Supreme Court of India, *e-Courts Phase III Vision Document* (2023), Ministry of Law & Justice.
[115] NITI Aayog, *Responsible AI for Justice Report* (2024).
[116] e-Committee, Supreme Court of India, *Minutes of the AI Sub-Committee Meeting* (February 2024).
[117] Ministry of Law & Justice, *e-Courts Phase III: Implementation Guidelines* (2024).
[118] Indian Institute of Science & IIT Delhi, *AMBEDKAR: Alignment Model for Bias-Elimination and Democratic Knowledge in AI Reasoning* (Research Report, 2025).

speed fibre connectivity, which could bridge the rural digital gap and extend access to justice technologies.[119]

VII. POLICY RECOMMENDATIONS AND CONCLUSION

a. Policy Recommendations

Strengthening Legal Safeguards and Ethical Guidelines

Both India and the United States must reinforce legal and ethical safeguards governing the use of technology in criminal trials. India urgently requires a comprehensive data protection law tailored to the needs of the criminal justice sector. At the same time, the U.S. would benefit from a unified federal framework for handling justice-sector data. In both jurisdictions, algorithmic accountability should be mandated through rigorous pre-deployment and periodic bias audits of AI systems, coupled with transparent public reporting.

Promoting Standardisation and Interoperability

There is a growing need for harmonised standards governing digital evidence handling, AI validation, cybersecurity, and forensic processes. Such standardisation would enable smoother inter-jurisdictional cooperation, streamline training for legal professionals, and reduce redundancy in technological investments. Both India and the U.S. should actively engage with global standard-setting bodies to develop shared norms on digital forensics, AI ethics, and data protection, thereby strengthening cross-border collaboration and ensuring the consistent and reliable use of technology in criminal justice systems.[120]

Investing in Training and Capacity Building

Ultimately, sustained investments in training are crucial to ensure the meaningful and responsible use of technology in trials. Judges, prosecutors, defence lawyers, and law enforcement personnel must be equipped with practical and conceptual skills to understand AI tools, evaluate digital evidence, and identify technological vulnerabilities or biases.

b. CONCLUSION

This research shows that while technology such as artificial intelligence, digital evidence management, and virtual courtrooms is revolutionising criminal trials in India and the United States, its impact on trial proceedings remains complex and fraught with challenges. Technological advances have streamlined evidence analysis, improved case management, and enhanced investigative accuracy, thereby increasing the efficiency of trials. However, these benefits come with significant concerns over fairness, transparency, and the preservation of defendants' rights throughout the trial process.

Moreover, India has made noteworthy progress in digitising its criminal justice system; it can still gain valuable insights from the United States, particularly in establishing standardised federal frameworks for technology use in trials. The U.S.'s approach to continuous judicial training and comprehensive algorithmic accountability mechanisms could help India enhance transparency and mitigate biases associated with AI tools. Additionally, the U.S. experience with integrated digital evidence management systems offers practical models for interoperability across diverse jurisdictions—a challenge India is actively grappling with.

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[119] Ministry of Electronics and Information Technology, *Digital Village Programme Status Report* (2024–2025).
[120] ISO/IEC JTC 1, *Global Standards for AI and Digital Forensics* (2024)

However, the U.S. system is not without its flaws. Persistent fragmentation between federal, state, and local courts creates uneven standards for technological adoption and evidence handling, resulting in disparities in trial quality and fairness that vary depending on geographic location. Algorithmic biases and privacy concerns are still inadequately addressed, often exacerbated by a lack of uniform regulations and oversight. These shortcomings illustrate that while the U.S. offers instructive lessons, India must adapt such frameworks thoughtfully, ensuring robust, inclusive safeguards and equitable access to prevent similar pitfalls. Thus, a critical dialogue between the two systems is essential, where India borrows pragmatic solutions while simultaneously contributing to a global discourse on the fair, ethical, and practical use of technology in criminal trials.