Data Science and Artificial Intelligence for Justice Delivery in India: Overview and Research Issues

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Abstract. Data science and artificial intelligence (DSAI) based methods can process massive amounts of data to extract useful knowledge and can be employed to build decision support systems in various domains. Like other domains, the legal systems in several countries are being digitized and there is a scope to build DSAI-based frameworks to improve the performance of legal systems. In the literature, research efforts are being made to investigate DSAI-based methods to improve justice delivery. The Indian legal system is currently experiencing a major problem with a substantial backlog of cases. This paper provides an overview of DSAI-based efforts in the legal domain related to India. We also listed potential research issues to be explored. We hope the issues will encourage further research to improve justice delivery performance in India and other countries.

Keywords: AI and Law · Legal Data Analytics · IT for Law

1 Introduction

In today's world, a vast amount of data is generated due to the digitization of various systems. Over the last three decades, data science and artificial intelligence (DSAI) based concepts such as database systems, data warehouse, data cube, pattern mining, clustering, classification, regression, and machine learning/artificial intelligence [12] have been developed to organize and process different types of data for building decision support systems (DSSs) and search systems in various domains. Like other domains, legal systems in several countries are being digitized. Efforts are being made to improve the performance of legal systems by employing the latest advancements in DSAI.

Globally, around 5.1 billion individuals have been estimated to face unresolved issues related to justice [24]. In particular, the Indian judicial system is under tremendous pressure due to the huge number of pending cases. As of January 2024, more than 50 million civil and criminal cases were awaiting resolution in India [2,45].

Judges, lawyers, students/interns, investigators, and the common public are the key stakeholders and users of the legal system. Globally, efforts are being

made to extend developments in DSAI to improve justice delivery. The size and complex domain-specific formats are significant issues in developing DSAI methods to build DSSs to improve the performance of stakeholders. Like other domains, the judiciary system in India has transformed from manual to digitization. As a result, judiciary related data is being generated at various levels in digital formats. In India, research efforts are also being made to extend DSAI approaches to improve justice delivery. Several DSAI-based tools are being developed in the public and private domain [10].

In this paper, we first provide an overview of the Indian judicial system and explain the processing of a legal case. We will review the DSAI-based efforts in the legal domain related to India. We also discuss the DSAI-based efforts abroad briefly. Finally, we list the potential research issues to be explored.

Even though this paper is written by considering the Indian legal system, we hope that the contents of this paper will help the DSAI researchers, who do not have a legal background, understand the terminologies of a typical legal system with the corresponding stakeholders and the processing of a legal case. It will also help the researchers of DSAI to visualize the frameworks of stakeholders-specific DSAI-based DSS. We also hope that the research problems will encourage DSAI researchers to collaborate with legal practitioners to conduct further research to improve the performance of justice delivery in India and other countries.

The organization of the paper is as follows. In the next section, we will explain the Indian justice delivery system. In Section 3, we explain the steps involved in processing the case. In Section 4, we review the related research in India and abroad. In Section 5, we list the potential research problems. The last section provides a summary and conclusion.

2 Overview of the Indian Justice Delivery System

In this section, we first briefly explain the court system in India. Next, we explain the types of cases and stakeholders/users.

2.1 Details of Court System

The Indian judiciary system is a hierarchical structure that operates according to the constitution of India and the rule of law at various levels of courts. Fig. 1(a) shows the hierarchical relationship among the courts. India is geographically divided into states, with each state further subdivided into districts. The Supreme Court is the highest court, also called the apex court. Each state contains a High Court, and each district contains civil and criminal courts (sessions) where trials are held. The important legal terms used in this paper are described in Table 1. We now briefly explain the different types of courts in India.

- **Lower Court**: Lower courts such as judicial magistrate and junior civil judge courts serve as the first point of legal redress, handling civil cases like property disputes and family matters, as well as criminal offenses under the *Bharatiya Nyaya Sanhita* (BNS).

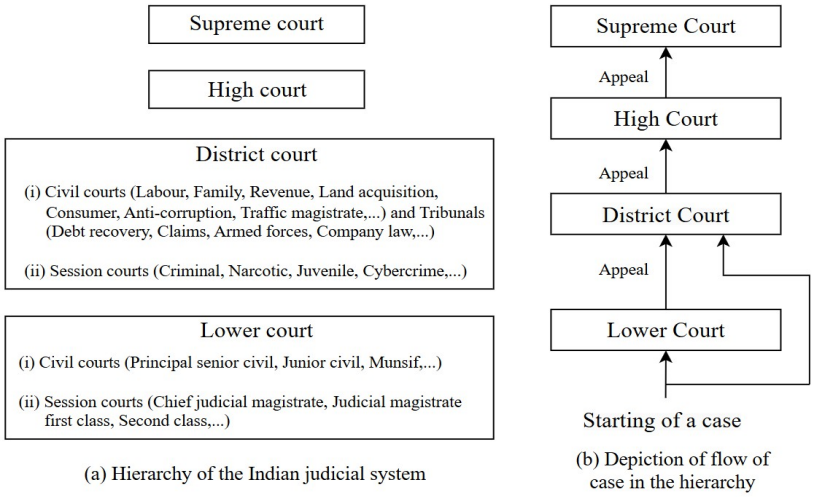

Fig. 1. The Structure and Case Flow in the Indian Judicial System

- **District Court**: The District and Sessions Courts handle various types of cases. Civil matters are addressed by District Courts, Sub-Courts, Principal Junior Civil Courts, and Munsif Courts. Criminal cases fall under Session Courts, led by the Sessions Judge under whom the Chief Judicial Magistrate, and first and second Class Judicial magistrates would be functioning. Special courts and tribunals, such as Family, Consumer, Labor, Tax Tribunals, and Administrative Tribunals, etc., focus on specific domains.
- **High Court**: A High Court is a judicial body that typically exercises jurisdiction over a state or a union territory. The appeals from district courts are handled by the High Court.
- **Supreme Court:** The Supreme Court is the apex court in India and typically hears appeals from the High courts across India.

2.2 Types of Cases

There are broadly two types of cases, as described below:

- **Civil Case**: A civil legal case is a legal dispute between two or more parties regarding a civil wrong. The disputes include issues relating to contracts, properties, family law, employment, consumer protection, etc.
- **Criminal Case**: A criminal case is a case that involves a person accused of committing a crime where one party to the crime is the State, and the ultimate goal is to punish the criminal or accused. The crimes include murder, rape, robbery, accidents, kidnapping, arson, other anti-social activities, etc.

Fig. 1(b) depicts the flow of a legal case. A plaintiff has to approach the lower court or district court in case of a dispute. The trial of the case happens at the

Table 1. Description of key legal terms

Term	Description
Affidavit	A statement written as an oath of truthfulness.
Appeal	A request for a court to review and overturn a decision made by a court or administrative body.
Arrest	A document issued by judicial authority to arrest someone over an offence.
Bail	Temporary release of an accused person with special conditions.
BNS	"Bharatiya Nyaya Sanhita" is the official criminal code in India, comprises of various chapters and sections related to Indian Law.
Charge-sheet	A document detailing the charges against a person accused of committing an offense by the Investigating officer.
Civil case	A legal case involving disputes between individuals or organizations over civil wrongs.
Criminal case	A legal case involving charges against a person accused of committing a criminal offense.
FIR	First Information Report (FIR) is a document created by police to record the details of a crime.
Hearing	A hearing is a formal proceeding in a court or other decision-making body where evidence and arguments are presented to decide a case. Hearings can be civil or criminal, and can take place before a judge, magistrate, or other decision-maker.
Lawsuit	A lawsuit is a civil legal action by one person or entity (the plaintiff) against another person or entity (the defendant), to be decided in a court.
Legal case	It is a dispute between two parties that is brought before a court to be resolved through a legal process
Order	A written directive issued by a court.
Summons	A legal document issued by a court requiring a person to appear in court.
Trial	A trial is a legal process where parties present evidence in a court to resolve a dispute. The trial is conducted by a judge or jury, who weigh the evidence and the law to reach a decision.

lower court or district court. Appeals from lower courts at the district level are dealt with by the higher courts at the district level. High courts only deal with appeals from the district courts. The Supreme Court only deals with appeals from the high courts.

2.3 Key Stakeholders

This section explains the stakeholders or users of a legal decision support system.

– **Lawyer**: We first explain the plaintiff and defendant and then explain about the lawyer. In a civil case, a plaintiff is a person or entity that files a lawsuit against another person or entity, the defendant. In a criminal case, the state or people prosecute the defendant for a crime against society. A defendant is a person or entity against whom a criminal or civil action is brought.

Lawyers represent their clients (plaintiff or defendant) in court and other legal forums and work to protect their rights and interests. Lawyers often help their clients resolve disputes through negotiation and settlement rather than going to court. A prosecutor is a lawyer appointed by the court to fight for the victim in a criminal case on behalf of the State (since the State is mandatorily one party to a criminal case).

- **Judge**: A judge is a person who presides over court proceedings, either alone or as a part of a panel of judges. India follows the adversarial system of justice delivery system where the judge hears all the witnesses and any other evidence presented by the lawyers of the case, assesses the credibility and arguments of the parties, and then issues a ruling in the case based on their interpretation of the law and their judgment. A judge is expected to conduct the trial impartially in an open Court.
- **Police (Investigating Officer)**: Police are primarily responsible for conducting investigations apart from other special investigating agencies such as the Narcotic Bureau, Food Inspectors, the Enforcement Directorate, etc. They gather evidence, examine witnesses, arrest suspects, and collect necessary evidence to assist the court in conducting trials.
- **Forensic experts**: Forensic experts analyze evidence associated with a case using scientific methods to aid investigations and court cases.
- **Law students and interns**: LLB (Bachelor of Legislative Law) students are often called law students or aspiring lawyers. The LLB is the first professional degree in law. Upon completion of LLB, graduates can pursue a legal career as lawyers, judges, legal advisors, and other legal professionals. A law intern is a law student or recent law graduate who participates in an internship program to gain practical experience. The skills they gain include researching, drafting documents, collecting evidence, and preparing for cases.
- **Law researchers**: Law researchers analyze legal documents, case laws, and other legal matters to help answer legal questions. They work in law firms, government agencies, non-profit organizations, and corporate legal departments. It is an essential skill for working on any case. It helps lawyers provide well-informed advice to clients and ensure sound decision-making.
- **Common Public**: The common public typically expects a law system to be accessible, fair, impartial, efficient, transparent, and timely in resolving disputes, meaning everyone should be able to access justice, receive without bias, have cases resolved promptly, and understand the reasoning behind legal decisions, all while being free from corruption or undue influence.

3 Processing of the Legal Case

In this section, we explain the typical flow of the case and then explain the important steps in the proceedings of the civil and criminal cases. Next, we present the details of dispatch latency in a civil and criminal case.

Fig. 2 illustrates how the arguments take place between the defendant and the appellant with the help of lawyers defending their statements in the court

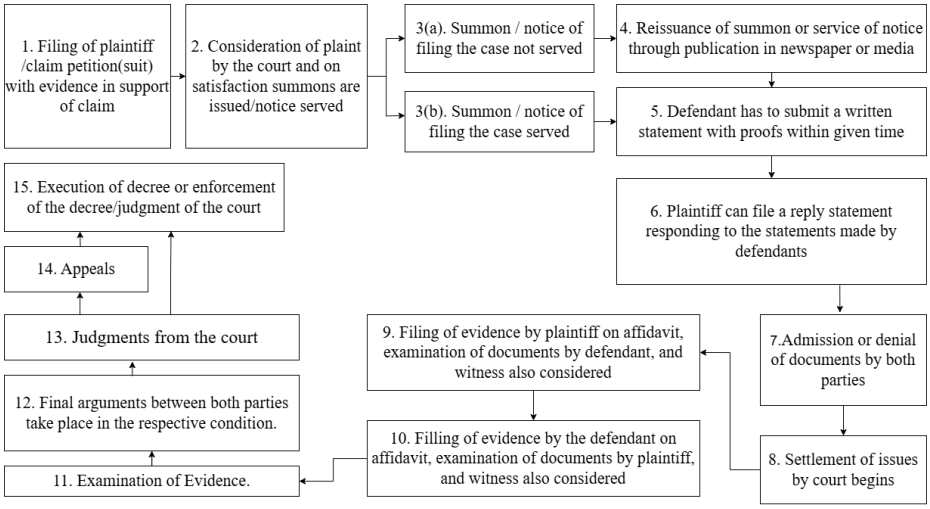

Fig. 2. Detailed steps of a legal case

with multiple arguments before final judgment in the presence of judge [1]. It starts with the plaintiff filing the lawsuit. The exchange of notices and replies occurs between the plaintiff and the defendant (Steps 1 to 7). Next, the court examines the evidence (Steps 8 to 11). Subsequently, the arguments in the court take place (Step 12), and the judgment is delivered (Step 13). If any party (plaintiff or defendant) appeals, the arguments happen at the higher court (Step 14). Otherwise, the court order/decree enforcement occurs (Step 15).

Fig. 3 depicts the case flow by identifying important phases. Both civil and criminal case proceedings are divided into two phases: the pre-trial phase and the trial phase. The pre-trial phase of a civil case (Fig. 3(a)) starts with the plaintiff's complaint to the court through a lawyer. Next, the court sends the notice to the defendant. Subsequently, the defendant, through a lawyer, responds to the notice. The pre-trial phase (Fig. 3(b)) of a criminal case starts with the complaint to the police by the plaintiff (or victim). Next, the police file an FIR and submit it to the court. The subsequent action takes place based on the court's direction.

For both civil and criminal cases, the trial phase (Fig. 3(c)) consists of several hearings. In each hearing, both lawyers (plaintiff, defendant, witnesses) participate in the arguments before the judge, and the judge may pass an interim order. The final judgment is delivered after completing the trial phase.

Based on the preceding explanation, the dispatch latency details of civil and criminal case proceedings are depicted in Fig 4. The total case time of civil and criminal case proceedings is divided into pre-trial and trial phases. The trial phase is divided into the discovery phase (exchange of documents, statements, and evidence) and hearings phase in civil case proceedings. In the case of a

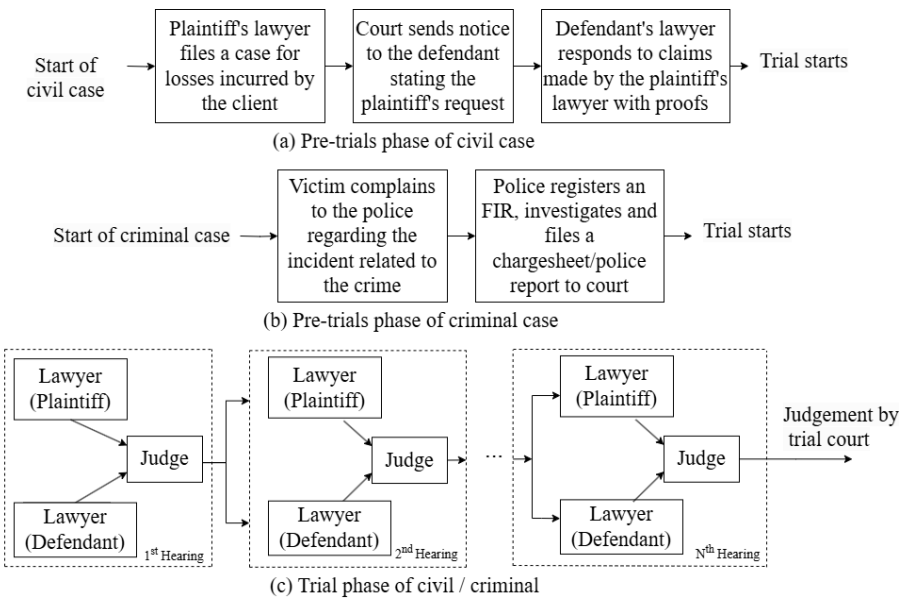

Fig. 3. Depiction of process at the trial court

criminal case, the pre-trial phase consists of arrest and case investigation. The trial phase consists of multiple hearings.

Discussion on delays: In case of a dispute, a plaintiff/victim approaches the lower court/district court, i.e., the justice system, to receive justice. An ideal justice system should deliver justice to the plaintiff at the earliest possible. However, especially in the Indian scenario, justice delivery is delayed due to several types of delays [20] for processing the case. Examples of delays include postal delays, investigation delays during the pretrial phase, and scheduling delays during the trial phase due to overburdened courts. In case of appeal, the delay is further prolonged.

4 Related Research

In this section, we first present the related DSAI research to improve Indian law. Next, we briefly summarize the DSAI research trends abroad. We provide concrete observations about DSAI research in India.

4.1 About DSAI-based law research in India

Some of the early works in the legal domain included, for example, tasks like summarization of legal documents [37,38,39] and finding similarity between legal documents [21]. A graphical model for legal document summarization was

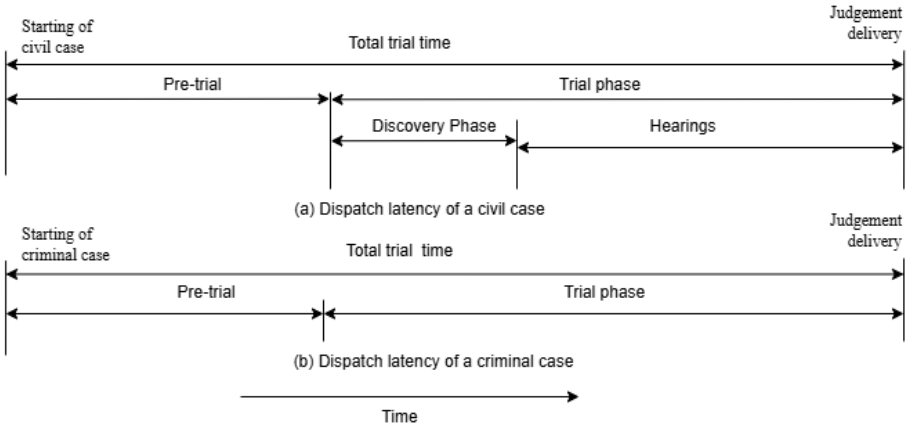

Fig. 4. Dispatch latency of a civil and criminal case: starting of the case to judgment delivery

proposed in [39]. In [37], authors leveraged conditional random fields to identify rhetorical roles for the summarization task. Authors in [21] showed that citation networks could be leveraged for estimating similarity between legal documents and found bibliographic coupling effective.

Over the years, with significant advancements in NLP, Information Retrieval and Deep Learning, the focus has broadened and now focuses on developing AI-based solutions for more challenging and sophisticated tasks. In recent years, the Indian research community has made efforts to apply advanced AI-based techniques in the domain of justice delivery and law and has also established some benchmarks for the Indian legal domain [13,17]. The authors in [13] have developed the IL-TUR benchmark for facilitating NLP research in the Indian legal domain. They have also set several LLM-based baselines for legal NLP research. We provide brief explanations for the tasks below.

- **Legal Information Retrieval:** One of the important problems in legal information retrieval is precedent retrieval. Legal practitioners are often required to cite precedents while formulating arguments in court and while drafting judgments. Manually retrieving relevant precedents is a very tedious task. Several approaches to automate the task have been proposed. Event-based representations have been proven effective for retrieval [14]. A number of possible document representations have also been experimented with [30,42]. Citation networks have been utilized extensively for finding similar cases [6,31]. Approaches leveraging both the citation network and text-based similarity have also proven effective [7,26,34].
- **Summarization of Legal Documents:** Summarizing legal documents is challenging due to their length and the intricate nature of legal cases. Summarizing legal documents aids legal practitioners. Efforts have been made to create benchmark datasets for extractive and abstractive summarization of

Indian court judgments [27,41]. It has been found that fine-tuning Legal-LED for abstractive summarization of Indian judgments is effective [13].

- **Named Entity Recognition (NER):** Legal NER involves the identification of legal entities in legal documents. Sample legal entities include the appellant, defendant, dates, statute, case number, etc. Developing models for NER is an important problem, and efforts have been made to create datasets and to develop transformer-based models for NER [16].
- **Rhetorical Role Labeling:** Rhetorical Role Labeling involves identifying rhetorical roles for each sentence in a given legal document. Examples of rhetorical roles include - facts, arguments, ruling by the court, the ratio of decision, etc. [8]. Identifying the rhetorical roles of sentences can help improve legal search [33] and summarization of judgments [37]. Authors in [8,9] developed deep learning models for identifying seven rhetorical roles. Authors in [28] focused on developing models for fine-grained rhetorical role labelling involving 13 class labels.
- **Judgment Prediction and Explanation:** This judgment prediction task typically involves a binary classification task where- given the facts and arguments associated with a case, the model predicts if the appeal from the petitioner is to be accepted or dismissed, along with generating an explanation for the same [29]. In [44], the authors evaluate the performance of various LLMs in the judgment prediction and explanation task and found that LLMs are good at generating explanations. In [19], the authors explored the applicability of GNNs for the prediction task.
- **Legal Statute Identification:** Legal statute identification involves identifying the statutes applicable to the case at hand. Earlier, the statutes for criminal law were described in the form of the IPC (Indian Penal Code), which has now been replaced by the *Bharatiya Nyaya Sanhita*. Such tools can help legal practitioners quickly identify relevant parts of the law that apply to a given case. In [35], a GNN-based approach was proposed for legal statute identification. Efforts have also been made to create datasets for explainable legal statute identification [44]. In [44], the authors find that LLMs are good at statute identification tasks while being moderately good at generating explanations for the same.
- **Bail Prediction:** Bail prediction is a task mainly designed for district courts in India and has been framed as a binary classification task, where, given a bail application, the model decides whether the bail should be granted or dismissed [18]. In [18], the authors release a dataset comprising legal documents written in Hindi and propose a Multi-Task Learning-based model for the bail prediction task. In [4], authors leveraged CNN for the same task.
- **Translation of legal documents:** Several Indians are more comfortable reading in regional languages, and there have been efforts to create datasets for the translation of judgments from English to the local languages [25]. In [25], authors released benchmark datasets for the translation of the legal text to Indic languages and carried out extensive experiments using various models (including LLMs) for the translation task.

Apart from the preceding tasks, there have been efforts to build a fine-tuned LLM for the Indian legal domain, called Aalap, with the primary focus being training the model for legal reasoning [43].

4.2 About DSAI and Law Research Abroad

International conferences and journals focusing on advancements at the intersection of AI and law include, for example, JURIX (International Conference on Legal Knowledge and Information Systems), ICAIL (International Conference on Artificial Intelligence and Law) and Journal of Artificial Intelligence and Law. Some of the trending research areas among researchers in foreign countries include legal reasoning and argumentation [23,32], knowledge representation [3,40] and applications of LLMs in the legal domain [5,36]. In particular, leveraging AI for legal reasoning has been a topic of interest for decades [11]. In [22], authors have surveyed applications of legal LLMs, elaborating on possible use cases, challenges, and future research directions. It can be observed that the applications of legal LLMs are a topic of great interest among researchers.

4.3 Observation

Overall, it can be observed that most of the existing literature in the Indian legal domain focuses on creating benchmark datasets and developing and improving models for various NLP and IR-related tasks. However, certain issues arising at different stages of the case flow, which contribute to delays in the delivery of justice, have not received sufficient attention from the research community. A lack of comprehensive research on stakeholder-specific problems can also be observed.

Researchers from foreign countries have focused on problems such as legal reasoning, argumentation, and the application of large language models (LLMs) in the legal domain, owing to the differing nature of challenges faced by their respective countries. More stakeholder-specific research leveraging DSAI is needed to enhance the performance of the Indian judicial system.

5 List of Research Issues

As observed in the preceding section, there are some past and ongoing efforts (not many) to extend DSAI approaches to improve the performance of the Indian judicial system. Earlier, the research mainly leveraged data sets comprising legal documents and focused on information retrieval, precedent retrieval, and summarization. Recently, there have been efforts to leverage LLMs for various tasks. With this background, we provide the research issues identified in the workshop[1] by brainstorming between DSAI researchers and experts from the legal domain.

[1] A workshop entitled "Data Science for Justice Delivery in India (DSJDI2022)" was held on December 10, 2022, at IIIT Hyderabad in conjunction with 10th International Conference on Big Data Analytics, 2022 (BDA2022)

1. **Autonomous judicial system:** The pre-trial and trial phase of a case is often prolonged due to numerous reasons. Although some repetitive tasks can be easily automated, complex tasks require extensive research. The goal of building an autonomous judicial system is very challenging. Creating a goal for building an autonomous judicial system will result in many valuable tools that may not replace the existing judicial system but assist in many ways that can help deal with certain tasks autonomously.
2. **Judicial precedents for legal reference:** Legal practitioners often need to cite precedents to support their arguments. Manually retrieving relevant cases is time-consuming and inefficient. Building precedent retrieval systems to help reduce the workload of lawyers and judges is currently an active research area.
3. **Language translation:** India is a multilingual country, and several courts operate in regional languages. Translation between different languages is necessary to make the justice system accessible to stakeholders across the country. Advancements in the domain of NLP have made the problem tractable. The "SUVAS" system adopted by the Supreme Court of India involves the translation of judgments into some Indian regional languages[15]. This can be improvised and scaled to accommodate other languages and can be made available at other courts in the judicial hierarchy.
4. **Analysis of judgments:** Court judgments need to be analyzed at the macro level, which may, for example, include the study of crimes committed and how they are growing or the study of cases related to divorces, suicides, atrocities, etc. Such an analysis not only gives us a way to evaluate and understand our judicial system but also helps us understand society and its problems. Such a system may be relied upon to develop policies based on the emerging trends in society that strive to improve thinking and provide adaptability for the common public in India.
5. **Digitization of trial court data:** Several trial courts in the country may not be fully digitized. Argument and judgment data can potentially be a valuable resource for researchers and can provide valuable insights. A major effort must be made to digitize the historical argument data and the judgment data of all trial courts in India while preserving privacy. Such data can also be utilized by other courts.
6. **Summarization of documents:** Trials involve a lot of paperwork, and stakeholders are often required to read very long documents. Reading such documents and extracting the most relevant information from the document is often cumbersome. Summarization of legal documents can help legal practitioners understand the document in brief and its automation can decrease their workload.
7. **Legal document drafting:** Legal practitioners are often required to draft case documents, agreements, contracts, etc. Leveraging DSAI-enabled systems to assist in drafting the document can reduce the workload of lawyers, judges, and other stakeholders. Additionally, such tools can be used for verification and to find possible flaws in documents. Possible flaws may include

spelling or grammatical errors and logical errors that can be difficult to identify.

8. **Simplification of legal documents:** Understanding and interpreting legal documents can be very challenging for the common public. Simplification of legal documents is very crucial for the law to be more accessible. NLP techniques for simplifying legal documents need to be explored.
9. **The platform of case management and tracking:** A case management platform should be built to connect all of the stakeholders in the justice delivery system; such systems can increase efficiency as the information can be exchanged faster and in a secure manner. Such a system can also help maintain the chain of events and evidence, thus providing a better case overview and fast-track justice delivery.
10. **Organizing court proceedings and scheduling hearings:** In order to make legal case management smoother, the AI system can be equipped with details about court hierarchies and judge benches. This would help to efficiently schedule hearings, reduce delays, and minimize errors. The system can also help build trust in the legal process by verifying the authenticity of evidence and cross-checking documents and transcripts in lower courts and other official records.
11. **Virtual hearing:** Virtual hearings are present in the Supreme Court and High Courts but not in the lower courts. Virtual hearings in lower courts can help to fast-track justice delivery. Implementing virtual hearings in lower courts in India can significantly reduce case backlogs by expediting routine matters, bail hearings, and preliminary arguments without unnecessary delays. This enhances access to justice, especially for individuals in remote areas, by minimizing travel costs and logistical challenges faced by litigants, lawyers, and witnesses
12. **Lack of standardization:** Judicial documents often lack standardization that can help fast-track legal procedures. Implementing standardized templates for orders, judgments, and filings can streamline case processing, reduce clerical errors, and improve inter-court coordination. Judicial documents should be required to follow a standardized structure to ensure consistency across states and languages.
13. **Practical training for law interns and students:** Innovative DSAI-based tutoring systems can be leveraged to impart practical skills to law interns and students to produce more competent legal practitioners. It can provide hands-on legal training to Indian law students, bridging the gap between theory and practice. This can enhance courtroom readiness and improve the efficiency of legal research.
14. **Human resource management:** Lack of coordination among stakeholders is a significant issue in the judicial system. Building databases to keep all stakeholders updated with the necessary documents and information can fast-track the delivery of justice. AI can also play a crucial role in resource management.
15. **Disparity in judgments:** Decisions taken by courts in similar cases may have disparities. Among the many reasons for the stated disparity, gender

bias is predominant. Inconsistent court rulings in similar cases can create uncertainty in the legal system. Gender bias, particularly in cases related to marital disputes, workplace harassment, and inheritance rights, often leads to varying interpretations.

16. **Judicial values and societal morality:** While AI often provides accurate and comprehensive analytics, it is crucial to understand the limitations that must be imposed on its usage to ensure that judicial values, constitutional principles, and societal morality are not compromised.
17. **Corruption-free, robust systems:** Systems designed for the judiciary need to be resistant to external influences, such as corruption and political pressure. Cryptography offers various methods to make systems more secure, trustworthy, and reliable. A transparent and digitally secure legal system that can reduce bribery, case manipulation, and delays and ensure trustworthy and corruption-free justice delivery should be implemented.

6 Conclusion

The Indian judicial system is overburdened with a huge number of pending cases. There is an opportunity to exploit recent developments in DSAI to improve the situation. In this paper, we provided potential research issues after an overview of the DSAI-based efforts in the legal domain related to India. Notably, more research is required to investigate decision support systems by considering users' requirements, such as judges, lawyers, law interns, students, and investigators. Most importantly, an effort has to be made to digitize the historical argument data along with the judgment data of all trial courts in India while preserving privacy. Such an effort will enable the building of tools to provide stakeholder-specific services to improve the Indian justice system.

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