



Natural Language Processing (NLP)-Powered Legal A(t)Ms (LAMs) in India: Possibilities and Challenges

Charalampos Alexopoulos¹ · Stuti Saxena² · Shalini Saxena³

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Abstract

With the infusion of information and communications technology (ICT) in legal domain, of late, the attempts of reforming the judicial landscape have been forthcoming. In this vein, the paper seeks to present the possibility of harnessing natural language processing (NLP) for instituting legal automated (teller) machines (LAMs) in India as an innovative application of legal informatics in a developing country. Literature on legal informatics with a focus on NLP is scanned to drive home the key argument in the paper. Institutionalization of LAMs in a developing country like India would go a long way in expediting the automated judicial arbitration system apart from providing easier and accessible alternatives to the aggrieved parties. However, it is important that the required political will and sustained leadership is there to provide the required wherewithal for the institutionalization of LA(t)Ms in the country. As an innovation in the field of legal informatics, LAM is the first of its kind both in terms of its ideation and in terms of the academic output till date. It is anticipated that academia would be interested to conceive of improvising LAMs in different contexts post-screening of the ecosystemic determinants therein.

Keywords Legal informatics · Natural language processing · NLP · India · Legal automated (teller) machines · LAMs · Judicial innovation · Legal technologies

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✉ Stuti Saxena
stutisaxenaogd.vishnu@gmail.com

Charalampos Alexopoulos
alexop@aegean.gr

Shalini Saxena
toshalinisaxena@gmail.com

¹ Department of Information and Communications Systems Engineering, University of the Aegean, Mytilene, Greece

² Department of Humanities and Social Sciences, Graphic Era University, Dehradun, India

³ School of Law, IMS Unison University, Dehradun, India

Introduction

With the giant strides in the domain of information and communications technologies (ICT) in terms of the advanced processes, tools and technologies like cyber-physical-systems, Big Data, Internet of Things, artificial intelligence, cloud computing, robotics and cyber security, of late, the legal environment has witnessed a churn across the globe (Owoeye, 2011), and this calls for innovations in the judicial system (Buseti & Vecchi, 2018). Given the need to address the needs of Society 5.0, the current defining trait of the knowledge society, it becomes pertinent to provide the desired legal landscape for bringing about expediency, efficiency, transparency and justice in the grievance redressal mechanism. The consequent datafication, i.e. the availability of the information across online data formats, in the digitally transformed society, has led to the refurbishment of a range of ecosystemic sectors, including the legal one (Dewitz, 1995). Thus, the need for ushering innovations in the e-justice, i.e. justice delivered electronically (electronic justice), ecosystem becomes the sine qua non for any country to meet the challenges of the multitudinous heterogeneity of crimes and their ramifications. Putting things into perspective, the need for invoking ICT in the legal domain—referred to as “legal tech” (Mania, 2022a, b)—is being felt by leaders and jurists, and steps are being taken to push forward in this direction (Skorzewska-Amberg, 2017). It is anticipated that with the infusion of ICT in judicial system, i.e. the synergy of “rules and tools”, the applications including judicial information systems, litigation support systems etc., the citizenry shall be more informed besides receiving justice from a more unbiased and expeditious mode (Seipel, 2004). This synergy has best developed in the form of an independent domain of legal informatics.

Legal informatics is an emerging area (Dolin, 2021) and may be defined in its crudest terms as the utilization of ICT in law—an implication of the interdisciplinarity between legal and ICT domains (Hinson, 2005; Seipel, 2004). ICT, in itself, encompasses different technologies with the advanced ones being artificial intelligence (AI) including machine learning and deep learning apart from Big Data, blockchain and natural language processing (NLP). Whereas AI facilitates human–machine interaction via algorithmic inputs (IBM, 2020a), Big Data relates to the complex, heterogeneous and voluminous data arising from diverse sources (Oracle, 2022), Blockchain is defined in terms of the “shared immutable ledger for recording transactions, tracking assets and building trust” (IBM, 2022), and NLP involves the exchange of text and voice in the human–machine dyad with the algorithmic governance procedures (IBM, 2020b). Thus, with the help of novel ICT tools like deep learning, machine learning and natural language processing, the data-driven innovative legal models are developed for providing expeditious judicial solutions (Sharma et al., 2022)—case in point being the application of Big Data analytics in legal domain by deducing inferences from the voluminous and heterogeneous real-time case laws (Antoniou et al., 2018). This process of automation of legal-institutional procedures leads to the “rationalization of the information flows” (Aguilo-Regla, 2005, pp. 19). It is important for the prerequisites

like the availability of the ICT infrastructure coupled with the advanced stage of digital advancement in a country alongside the working of the environmental forces (i.e. political will, regulatory framework, institutional culture, motivation of the personnel concerned etc.) for ensuring the proliferation of legal informatics (Greenstein, 2021). Furthermore, it has been attested that legal information needs of the society shall be better met with the efficacious governance of legal informatics given the recurrent interface of citizens with law (Virkar et al., 2022). Legal informatics is yet to percolate deeper in developing countries like India in the contrast with the west where legal informatics has succeeded to entrench itself to some extent—case in point being the European Legal Semantic Web, for instance (van Opijnen, 2017; Seth, 2019). For instance, whereas India has initiated the online dispute resolution mechanisms, of late, the fool proof running of such measures needs to be ascertained (Chandra, 2016)—case in point being the cybercrimes or the infringement of the privacy of the individuals (Prasad & Sharan, 2019).

To effect cataclysmic changes in the hitherto-mundane, snail-paced, nepotism-drenched, corruption-ridden and biased judicial ecosystem, especially in the case of developing countries like India (Chandan, 2016; Mishra, 2021), it becomes pertinent to invoke state-of-the-art ICT tools in the legal domain for easing the grievance redressal system and ensuring justice in the true sense of its term, and in this vein, the present study projects the institutionalization of legal automated (teller) machines (LAMs) in India that are backed by NLP. To the best of the authors' knowledge, this legal innovation is the first of its kind, especially in a developing country like India. LAMs are the NLP-backed machines, much like the ATMs, stationed in select societal areas for easy accessibility by the people in order to address their immediate legal grievance/s. Immediate redressal of grievances is facilitated by the ready and customized automated responses of the LAMs, thereby obviating the procedural delays entailed in the grievance handling mechanisms.

The present study subscribes the belief that knowledge production, in the form of human, organisational, intellectual capital or activities like R&D, ICT innovations etc., is pertinent for bringing about economic growth and social change (Powell & Snellman, 2004). Given the impetus of products'/services' innovation for knowledge generation for furthering economic development (Svarc & Dabic, 2017), the introduction of LAMs in a developing country is more likely to bolster the knowledge economy indices underscored by the World Bank (World Bank, 2007): education, innovation, economic incentives and institutional regime and ICT (Tchamyou, 2007). Thus, it is hoped that the legal innovation advanced in this paper would kindle the interest of the other countries for conceiving of more legal innovations via ICT going forward.

The rest of the paper is structured as follows: followed by a brief on the extant literature on legal informatics with a focus on NLP, the motivation behind setting up LAMs is provided; thereafter, the possibilities arising from the institutionalization of LAMs in India are provided along with the possible challenges for effecting this innovation in the country, and a rounding up of the paper is done with the concluding remarks, study limitations and further research pointers apart from the insights for the practitioners.

Related Research

Legal Informatics

Despite the hype behind legal informatics, sustained efforts are required to institute a legal information system that may support the legislation of countries across the globe, thereby bringing about more uniformity and interoperability of the legal environment (Loutsaris & Charalabidis, 2020). Legal informatics has been conceptualized in terms of the computer-assisted legal framework that results in automation and digitization of the entire legal system's value-chain (Erdelez & O'Hare, 1997). Retrieval and analysis of legal information from the voluminous legal texts and documents is the backbone of legal informatics (Sanson & Sperli, 2022). Thus, legal informatics harnesses state-of-the-art technologies like Big Data analytics, artificial intelligence, machine learning, blockchain, virtual environments, cyber-physical systems, cloud computing and Internet of Things such that the decision systems are aligned to respond to the customized queries requested by the stakeholder concerned, i.e. jurists, clients, lawyers and legislators (Agrawal, Sahu and Kumar, 2022; Virkar et al., 2020). Therefore, this infusion of technologies has impact on judicial mechanisms and the stakeholders involved in the dispensation and management of justice, thereby impacting the legal ecological landscape in the ICT-backed support systems (Aguilo-Regla, 2005). Legal informatics has utilitarian value in document review, due diligence, compliance, case prediction, billing, negotiation and online dispute resolution (Katz et al., 2021). For instance, legal documents are being updated by the ICT tools that come in handy for analysis and further deliberation (Sartor, 2008). Legal informatics tools and techniques are useful for the conduct of legislative proceedings with regard to contextual policy making (Fitsilis et al., 2022) or even for the automatic processing of legal documents and dossiers via specialized software (Ren et al., 2022). However, not all the legal informatics' aids are accessible to all, and this increases the cost dimension incurred by the providers and clients alike.

XAI and NLP in the Legal Context

Of late, the intersection of artificial intelligence (AI) and law is being witnessed in terms of the automation of legal argumentation as well as the autonomous legal reasoning and argumentation to facilitate drawing inferences for the legal professionals and practitioners (Prakken & Sartor, 2015). This intersection progresses across the usage of advanced automation technologies like NLP, machine learning (ML), knowledge-based systems for case management and facilitating legal reasoning and eventually emerging as superhuman autonomous legal entities in the future (Eliot, 2020). Furthermore, as an advanced field of AI, explainable artificial intelligence (XAI), i.e. design systems explaining how the predictions have been arrived at (Bei et al., 2022), is a potent support in legal informatics wherein the human-system and system-system interactions are facilitated in decision-making (Deeks, 2019; Vassiliades et al., 2021). For instance, XAI has been deployed in understanding the algorithmic decision-making via European (non-discrimination) law (Vale et al., 2022). XAI and interpretable artificial

intelligence (IAI) are being used as well in the legal informatics ecosystem for drawing inferences via knowledge graphs (Rodriguez-Oconitrillo et al., 2021). XAI applications in legal domain are useful for deriving inferences from argumentation and logical decision-making in line with the software designed for the purpose wherein the facts and progression of the cases are taken into account for sense-making (Al-Abdulkarim et al., 2016; Vassiliades, Bassiliades and Patkos, 2021). However, there are caveats against the applications of XAI in legal landscape given the security concerns in the absence of clear-cut regulatory standards and norms (Ebers, 2021).

NLP “is an area of research and application that explores how computers can be used to understand and manipulate natural language text or speech to do useful things” (Chowdhury, 2003, pp. 51). NLP has been traced to develop across four phases, viz. the period of emphasis on machine translation (late 1940s to late 1960s), the phase when artificial intelligence became dominant (late 1960s to late 1970s), the period when logico-grammatical style came to be adopted with the use of logic for knowledge representation and reasoning in the AI (late 1970s to late 1980s) and the final phase when there was an attack on massive language data and there was an emphasis upon general formalisms of expressing lexical information (late 1980s and onwards) (Jones, 1994). Application of NLP entails assignments like machine summarization, pre-processing, classification, information retrieval, information extraction, text generation and resource management in terms of taxonomies, ontologies, datasets and code libraries (Katz et al., 2023). NLP works at low level including sentence boundary detection, tokenization, part-of-speech assignment to individual words, morphological decomposition of compound words, shallow parsing (chunking), problem-specific segmentation and high-level tasks like spelling/grammatical error identification recovery and named entity recognition, word sense disambiguation, negation and uncertainty identification and relationship extraction (Nadkarni et al., 2011). NLP facilitates speech synthesis besides helping in the identification of sentiments and emotions (Hirschberg & Manning, 2015; Liu, 2010). However, there are challenges pertaining to documents’ analysis given the multiple levels of judicial decisions by different jurists and the non-standardized pose challenges for NLP-based applications (Kalamkar et al., 2021).

Users of Legal Information and Patterns of Use

The legal informatics ecosystem includes several entities including policy makers, legal experts and professionals, administrators, police, parliamentary staff, professionals, citizens and the like (Virkar et al., 2022). The proper management of the voluminous legal data with adequate provisions for search and filter along with the computational analysis of textual databases facilitates automated decision-making (Virkar et al., 2020). Lawyers, for instance, seek information just-in-time and with accuracy amidst the plethora of information available via the electronic database (Kuhlthau & Tama, 2001). Likewise, the process of legal information retrieval involves the usage of AI algorithmic modelling given the volume, document size, structure, heterogeneity, self-contained documentation, role of legal hierarchy, temporality, significance of citations, legal terminology, audience/stakeholders, personal

data, multilingualism and multi-jurisdictionality and scatteredness of legal resources (van Opijnen & Santos, 2017; Weidong, 2022). Legal informatics rests its edifice on the state-of-the-art ICT architectural platform, and it is important that the legal data be amenable to text mining and sophisticated processing and semantic analysis for drawing more nuanced deductions (Charalabidis et al., 2019). Apart from bringing about homogeneity and uniformity in the recognition and processing of different languages in which the legal data is available, visualization and representation of the disparate legal data is also a key feature of legal informatics which facilitates in meeting the expectations of the stakeholders concerned in terms of providing access to legal information (Cyras, 2009; Francesconi & Peruginelli, 2010; Lettieri et al, 2017; Virkar & Novak, 2019; Virkar et al., 2019). Argumentation mining is also an important facet of legal informatics wherein sophisticated machine learning algorithms are deployed to text (Mochales & Moens, 2011). XAI is used for legal predictive analytics (Waltl & Vogl, 2018), and blockchain technologies are useful for transaction records—case in point being the maintenance of smart contracts for the land record management (Ante, 2021; Goldenfein & Leiter, 2018). Likewise, robot judges are helpful in pronouncing judgements and so are the robot lawyers to render legal advice (Markou, 2017; Markovic, 2019; Fitch, 2020).

Legal Informatics in Developing Countries

All these innovations backed by legal informatics are conducive for developing countries too—case in point being the utility of Big and Open-Linked Data (BOLD) analytics for drawing inferences from China Judgements Online (Wang, 2020; Zuo & Wang, 2020), the conduct of virtual trial proceedings in Indonesia to expedite dispensation of justice in the period of COVID-19 pandemic (Jamila et al., 2020). Similarly, legal decision support system (DSS) is emerging in Cuba with a focus on improvising jurists' notes and developing algorithms specialized in representation of legal knowledge (Rodriguez et al., 2021). For instance, in India, the ICT-enabled judicial services are encapsulated in Table 1 (Supreme Court of India, 2023). It may be deduced from the table that the infusion of ICT in the judicial services is still evolving and the differences across the proliferation of such services is a factor of the ICT infrastructure, societal makeup, political stability and support etc.

Research Methodology

For the present study, a heterogeneous set of experts were approached for soliciting their perspectives regarding the efficacy, opportunities and challenges pertaining to LAMs in India (Table 2). Experts hailed from the judicial background in the capacity of academic researchers or practitioners. Experts were approached via email and directly in the months of February–March 2023, and their perspectives were filtered and summarized (Miles & Huberman, 1994). As a potent research methodology for understanding an under-researched or completely

Table 1 ICT-enabled judicial services in Indian High Courts*Indian State High Courts ICT-backed judicial services offered*

Bombay	<ul style="list-style-type: none"> ✓ Peripheral software developed at High Court of Bombay ✓ Hybrid video conferencing solution ✓ eFiling
Gujarat	<ul style="list-style-type: none"> ✓ Justice Clocks (displaying information regarding cases' progression) ✓ Court Management Console (CMS) ✓ eWrits (Writ petitioning via electronic mode)
Karnataka	<ul style="list-style-type: none"> ✓ Virtual justice clock (provides details regarding cases' progression) ✓ Telegram channel (provides daily notifications and details regarding the cases) ✓ E-payment (monetary transactions by litigants and advocates for following up with the cases) ✓ ICJS (Interoperable Criminal Justice System) (providing interoperability of datasets pertaining to dispensation of criminal justice)
Delhi	<ul style="list-style-type: none"> ✓ e-Courts (paperless digital dispensation of justice) ✓ Telepresence system (physical presence of the stakeholders is not required) ✓ QR-code based entry pass system (allowing the entry of stakeholders via digital passes) ✓ LAYERS (Linked Applications and Extended Report System) for all personnel concerned with the judicial services
Allahabad	<ul style="list-style-type: none"> ✓ Court wise Case Running Information System ✓ Computerized Case Information Counter ✓ Digitization of court records ✓ Video Conferencing Facility for Counsels
Calcutta	<ul style="list-style-type: none"> ✓ Inventory Management System ✓ Virtual Courts
Manipur	<ul style="list-style-type: none"> ✓ Scanning and digitizing of case records ✓ File tracking system using bar code reader
Punjab and Haryana	<ul style="list-style-type: none"> ✓ Touchscreens ✓ Digitization of judicial records ✓ CIS (Case Information System) ✓ e-Inspection (inspection of files and records by advocates and other stakeholders)
Rajasthan	<ul style="list-style-type: none"> ✓ Justice clock ✓ Automated emails of judgement/orders to trial courts ✓ E-filing ✓ Calendar (computer programme for court management)
Orissa	<ul style="list-style-type: none"> ✓ Record Room Digitization Centre ✓ District Court Digitization Centres ✓ Order Communication Portal (OCP) (secure and expeditious communication of orders to Subordinate Courts) ✓ Virtual Courts ✓ Justice Clock (providing information about the case disposal and management)
Tripura	<ul style="list-style-type: none"> ✓ Justice Clock (providing information regarding the nature and scope of judicial services; case progression) ✓ Record Room Management Software (maintenance of records and databases)
Patna	<ul style="list-style-type: none"> ✓ National Judicial Data Grid (NJDG) (integrating the case records) ✓ District Information, Report & Communication Tracker (Direct) (data/reports related with the judgements/orders)

Table 1 (continued)

<i>Indian State High Courts ICT-backed judicial services offered</i>	
Kerala	<ul style="list-style-type: none"> ✓ Case Management System (CMS) ✓ Smart/digital courts
Madras	<ul style="list-style-type: none"> ✓ E-filing (of cases) ✓ Video conferencing judicial proceedings ✓ Online portal for Gender Sensitization and Internal Complaints Committee (GSICC)
Sikkim	<ul style="list-style-type: none"> ✓ Virtual courts ✓ Scanning and digitization of records ✓ Mobile apps for providing judicial services

negligent research theme, seasoned experts were solicited to share their perspectives after explaining the research objectives (Doring, 2021; Snizek & Henry, 1989). Interviews were conducted by the authors themselves, and the interviewees were approached based on purposive sampling. Interviewees were apprised of the research frame and a typical interview lasted for about an hour. All the interviews were conducted in-person or via video conferencing depending upon the accessibility of the interviewee locally or nationally. Typically, the eleven experts were posed semi-structured questions across four themes: ideation and implementation of LAMs in India; possibilities unleashed by LAMs from a developing country's perspective; challenges in the rolling out and implementation of LAMs and the overall absorption and acceptance of LAMs in the country.

Given that an engineering innovation has been forwarded in the study, goal-modelling approach was referred for driving home the nuances of LAMs. As such, goal-modelling approach is applicable in cases wherein the match of means and ends is investigated vis-à-vis the design and conceptualization of an information system (Liu & Yu, 2004). Furthermore, in line with the goal modelling approach to understand the objectives and efficacy of a novel engineering artefact (Duran & Mussbacher, 2019; Hassine & Amyot, 2017), LAMs in the present case, stakeholders' perspectives across the aforementioned four themes are robust inferential aids to understand the expectations, possibilities and caveats vis-à-vis their actual feasibility, implementation and institutionalization in a developing country like India. Furthermore, being a value creation initiative encompassing a collaborative platform involving a range of stakeholders (Fragidis, 2021), i.e. jurists, ICT professionals, citizens, legal luminaries and the like, the application of goal modelling approach for understanding the intricacies of LAMs falls in place. A key advantage of goal-modelling approach lies in securing perspectives regarding the contextualization of the said application apart from the possible issues of legal and regulatory compliance (Akhigbe et al., 2019). Therefore, this approach was considered valuable for drawing inductive insights from the key stakeholders regarding operationalization of LAMs (Alrajeh et al., 2009) in India.

Table 2 Experts’ opinions regarding LAMs in India

<i>Expert</i>	<i>Main perspective/s</i>
Lawyer, Allahabad High Court (20-year experience)	➤ “... Technology is always subject to manipulation... (therefore) the veracity of these LAMs needs to be checked time and against so as to maintain and enforce justice”
Lawyer, Uttarakhand High Court (4-year experience)	➤ “Legal ATMs might have access to all the statutes and other sources of law”
Additional District Judge, Chhattisgarh High Court (16-year experience)	➤ “... Providing legal advice through LAMs can prove to be an effective tool for providing equal justice... We can feed the basic information related to all the laws in the LAMs by classifying them according to the subjects and according to the beneficiaries, such as in relation to consumer matters, family matters, property, in relation to the effective method of providing legal aid and legal advice. You can categorize legal information and advice on topics like criminal matters, matrimonial matters, motor vehicle claim cases, insurance cases, income tax related, property tax, electricity, sexual harassment, economic crime, cybercrime etc.” ➤ “...It is often seen that whenever an aggrieved person goes to a legal practitioner to seek legal advice in a matter and he does not have any information related to the subject, he acts according to the advice given by the legal practitioner... Whatever legal advice will be provided by the ATM, it will be legal and authentic. It will not be easy for citizens to be misled by any legal practitioner after they get basic information about the related subject through ATM” ➤ “... (However) There is a lack of educated class in India, especially there may be difficulty in understanding legal terminologies, for which simple words should be used in ATMs and the legal experts who Information about the provisions should be given, illustrations should also be included in it, so that citizens can understand the provisions better through illustrations” ➤ “...For the less educated class or those who are not able to operate the legal ATM, there should be Para-legal Volunteers to run the legal ATM and guide them in accessing the appropriate and accurate information, for which the help of NGO can be taken. Legal ATMs should be linked to the National Judicial Data Grid (NJDG), so that the parties to the case can be aware of the status, date, progress, and order/decision made in the case”

Table 2 (continued)

<i>Expert</i>	<i>Main perspective/s</i>
Additional District Judge, Allahabad High Court (16-year experience)	<ul style="list-style-type: none"> ➤ “The biggest advantage of providing legal advice by LAM is that the person on whom information is desired, he can get comprehensive information on that subject through LAM, and he can get legal advice as per his convenience whenever and wherever he wants... (The aggrieved) will be able to get on getting legal help from LAM, the privacy of the person will be maintained, and the party can get legal advice without hesitation on any subject like sexual abuse, family matters like maintenance, bigamy, dowry cruelty, domestic violence etc.” ➤ “There should also be a system to get the print of the legal advice/information given through ATM or to get it in pen drive/CD” ➤ “The person on whom information is desired, he can get comprehensive information on that subject through ATM, and he can get legal advice as per his convenience whenever and wherever he wants”
Professor, Law (22-year experience)	<ul style="list-style-type: none"> ➤ “Certain elements of subjectivity in decisions/ opinions will affect the efficiency of the legal ATM” ➤ “Proper classification and coverage of legal issues, domain-wise, may reduce the burden in courts, but advocates may see it as a challenge to their income opportunities”
Assistant Professor, Law (11-year experience)	<ul style="list-style-type: none"> ➤ “It should be voice enabled guiding system as well as able to accept the grievances in written as well as in verbal format. Where it is accepting verbal grievances a transcript of the verbal grievances and solution should be made available to the complainant”
Assistant Professor, Law (9-year experience)	<ul style="list-style-type: none"> ➤ “Legal ATM has the potential to provide legal aid to a large number of people across India, especially those who do not have easy access to legal professionals” ➤ “One of the major challenges of Legal ATM is ensuring the accuracy and reliability of legal information provided through the system”
Assistant Professor, Law (3-year experience)	<ul style="list-style-type: none"> ➤ “... Establishment of legal ATM in the present scenario will be fruitful. The one who is aggrieved can get the legal advice for no or nominal cost”
Research scholar (Law, 3rd year)	<ul style="list-style-type: none"> ➤ “...A challenge with regard to LAM is that people find it more convenient and comfortable to have face-to-face talk with their advisor instead of talking to a machine”
Student (4th year of the Integrated Bachelor of Law degree programme)	<ul style="list-style-type: none"> ➤ “... Aggrieved party can get legal information from the Legal ATM by selecting well-lit, camera-equipped ATMs, for example avoid using vandalized or abandoned terminals and ATMs, and always inspect a machine before using it”

Table 2 (continued)

<i>Expert</i>	<i>Main perspective/s</i>
Student (4th year of the Integrated Bachelor of Law degree programme)	<ul style="list-style-type: none"> ➤ “...(LAMs would provide) versatile functioning and accessibility to individuals 24/7 and would provide an interactive interface with video capabilities for quick lodging of one’s complaint or grievance” ➤ “...This would be productive when such ATMs are positioned in remote areas with professional legal counsel interested in offering pro bono services” ➤ “...The price of providing legal services via ATMs may be considerable because they rely on energy and a network for accessibility”
Student (4th year of the Integrated Bachelor of Law degree programme)	<ul style="list-style-type: none"> ➤ ... An aggrieved individual without wasting time can easily put his complaint and grievance through and does not make the same to the authority by standing in long queues”

The Need for LAMs

The association of NLP and law is bolstered by its applications in terms of computational analyses via automatically analysing, indexing and enriching the legal data and the support by the governments—case in point being the EU wherein it supports MIREL (MIning and REasoning with Legal texts) (Robaldo et al., 2019). Three applications of NLP have been outlined in law: question answering (wherein the system responds to a user’s question after searching from the plethora of textual data), document review (wherein the system seeks to engage itself in the process of e-discovery of documentary evidence, i.e. storage, retrieval and analysis of documents) and legal writing (using algorithms in legal writing) (Haney, 2020). Special software packages like LexNLP—an open source package based on Python—are in place for information retrieval from legal and regulatory texts (Bommarito et al., 2021). NLP is also useful for the legal engineering domain that invokes computers and inter alia its associated technologies inclusive of software engineering and AI for supporting and implementing laws (Shimazu & Le Nguyen, 2014). Empirical research shows the application of NLP for making predictions for the Turkish Constitutional Court and Courts of Appeal, and the algorithmic results show that higher levels of accuracy may be achieved with the NLP deployment (Mumcuoglu et al., 2021). Likewise, in another empirical research based on the Philippine Supreme Court case decisions, NLP came in handy to predict the outcomes based on text analysis via NLP (Virtucio et al., 2018). Similarly, in the context of Russia, NLP was used for analysing the court decisions with the help of a case study, and it was concluded that the usage of NLP might result in the automated mapping of court decisions, thereby facilitating in the decision support systems (Metsker et al., 2020). From the foregoing, it is apparent that NLP’s utility in the legal domain is well-attested.

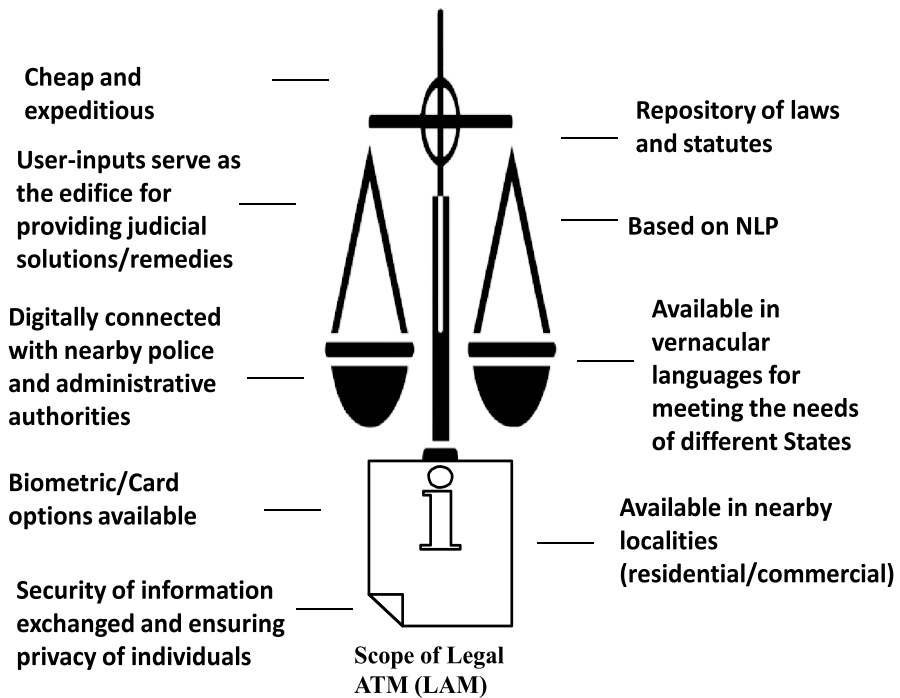


Fig. 1 Features and scope of LAMs in India

LAMs: Nature and Features

Given the utility of NLP for the legal domain, the present study proposes the institutionalization of LAMs in a developing country's context. As mentioned earlier, LAMs look similar to ATMs in design. The operationalization of LAMs is simple wherein justice rests on the pedestal of ICT (Fig. 1; Table 3): an aggrieved party approaches the LAM which resembles any common ATM that we approach for availing banking services. Implicitly, LAM serves as an advisor for the grievant.

Table 3 Services provisioned via LAMs in India

Services	Functions
Query handling	Voice-recognition and secure mechanisms in place for comprehending the issue at hand vis-à-vis the client concerned
Legal documents' repository	Legal documents and judicial decisions' documentation shall be readily available along with the interpretation and exactitude of the relevant clauses
Police-Administration-LAMs nexus	Police and administrative authorities shall be promptly apprised of the LAMs complaints and grievances for expeditious action
Important contacts' repository	Contact details of important personnel and functionaries shall be provided to the client

LAM is a more sophisticated entity that “responds”, “understands” and “responds” to a client’s grievance immediately by providing legal guidance and probable solutions. LAM has an in-built system for biometric analysis of the client for being registered with itself so that the case history of the client is automatically retrieved by LAM during the next visit of the client. For authentication purpose, LAM shall ask for the identity evidence to be registered with the case history, and every time, the case history recovery process shall be undertaken by LAM, post-verification of the identity of the client. Identity verification shall, needless to say, be run across multiple options—mobile phone authentication, biometric verification and/or identity evidence authentication—and the client would have the option to have any two registered with the LAM during her visit. For LAMs, as a component of NLP, Hidden Markov model (HMM) shall be deployed for speech recognition which would facilitate the speech-to-text and text-to-speech recognition. Likewise, N-grams shall be invoked for facilitating suggested auto-completion of words and phrases, speech recognition, spelling correction and word disambiguation (Sulis et al., 2022). Thus, LAMs shall be programmed with algorithms for providing legal advice on an impromptu basis after listening to the client’s grievance and provide just-in-time solutions. Depending on the algorithms, LAMs would provide advice to the aggrieved parties for undertaking further course of action which shall be linked with the e-judicial ecosystem such that the complaint received by the client concerned along with the suggestion tendered by LAMs shall be communicated to the court of law where the judge in person or the robot judge shall pronounce the final judgement in a nick of time. Besides ensuring access to legal information to the citizens, LAMs would come in handy for providing legal advice. It goes without saying that LAMs shall be situated in the major geographic divisions in tandem with the availability of the police stations so that the aggrieved party might get buffer support from the cops as well, should the need arise. The number of LAMs shall be situated in locales as per the population of the area. LAMs shall be supported with state-of-the-art technologies for facilitating client verification procedures, and surveillance mechanisms shall be in place to obviate any untoward incidents. Finally, LAMs shall be safeguarded with the position of CCTVs and other security requirements.

Possibilities from Instituting LAMs in India

Following pointers are suggestive of the possibilities unleashed via LAMs:

LAMs would go a long way in supporting another judicial reform proposed as eLegalls for Indian landscape where the filing of citizens’ complaints with the police may be done without any physical visit as long as the geographical jurisdiction is the same as the address of the aggrieved (Sharma & AL, 2021). LAM would serve to expedite judicial settlement at a much quicker pace than the conventional one.

Besides, the instances of nefarious activities like bribery and red-tapism would be easily tackled. LAMs would result in cost effectiveness for the aggrieved parties

because the e-judgement pipeline would obviate the need for repeated visits of the clients to the lawyers or the courts of law, for that matter.

LAMs would go a long way in ensuring that the rule of law is upheld in all cases and this would ensure equity and justice.

It is possible that with LAMs in place, the crime rate of the country would slide down because of the robust surveillance and security measures adopted while hearing the client's grievance.

There are many accouterments that might further act as props for the efficacious running of LAMs—for instance, the availability of SMS communication or email or any other popular social media source like WhatsApp that might quicken the dissemination of any course of action or legal suggestion to the client.

Challenges to be Tackled for Instituting LAMs in India

A significant challenges with regard to the infusion of legal informatics in general, and, implicitly, for LAMs, relate to the fact that the lawyers have not been able to adapt themselves in terms of required skills-set to ensure the smooth transition from non-automated legal systems to the automated ones (Susskind, 2010). Thus, in the case of LAMs, while it is important that the lawyers' involvement in the institutionalization of LAMs cannot be ignored, it also remains to be underlined that without the transpiring of knowledge reservoirs from the lawyers to the machine, LAMs would not be a success. Extending the argument further, there is a need for a "change in the mentality of jurists" (Aguilo-Regla, 2205, pp. 18) to ensure that the LAMs innovation is successful, thereby furthering the case of legal knowledge management. Public policy makers need to be involved in the legal information requirements (Alexopoulos et al., 2020) to ensure that LAMs are sustainable. Implicitly, the motivation and leadership of the personnel concerned with the innovation needs to be a sustained one (Thogersen, 2022). Furthermore, it is important that the requisite technological infrastructure be in place for the LAMs to operate properly. Likewise, given the heterogeneity of languages in the country, it behooves upon the NLP experts to programme the LAMs to understand the languages of one and all. In addition, the challenges of making the LAMs comprehend the language of the illiterates in the country are also a bottleneck that needs to be addressed, and this challenge may be countered with the support of the cops available in the nearest geographic division associated with the LAM. A major challenge that needs to be factored into account relates to the privacy of the client, and it must be ensured that the client's personal details are not leaked, misused or misappropriated by any third party, in particular; thus, laws need to be in place to safeguard the privacy of the citizens (Malmir & Malmir, 2015). Academic courses on legal informatics need to be strengthened in the Indian varsities for understanding the optimum utilization of ICT via AI, blockchain, Internet of Things etc. in Indian judicial system to ensure expeditious disposal of cases. Finally, and, above all, there is a need for having a legal policy framework for the LAM institutionalization wherein the specifics regarding the roll out and implementation shall be spelt out in detail. In addition, the legal framework for LAMs should incorporate dimensions linked with user

etiquette, algorithmic governance, privacy, surveillance, geographical distribution, the role of the government body along with the police administration that shall be responsible for identifying the need of LAM in a particular place and the challenges for tackling the same besides underlining the penalties for tampering or destroying the LAM by the user or any stakeholder in the eventuality of programming it with false, manipulated or incomplete data, thereby resulting in erroneous judgements by the LAM. In the Indian context, the impact of AI on the human rights issue has been investigated with the conclusion that the Indian legal system needs to chalk out a suitable regulatory framework for AI to prevent its negative impact on the citizens (Chatterjee et al., 2022)—this caveat needs to be taken into consideration when conceiving of LAMs in the country, though.

Conclusion

The Venn diagram of law and technology encapsulates several strands that impinge upon the judicial system of any country (Portela & Cruz-Cunha, 2010), including India. Modernization of the judicial system can be done by understanding the impact of reforms across seven areas such as judicial independence, quality of service, cost-effectiveness, democracy, efficiency, speed and government (Raine, 2000). To bring about e-justice reforms, it is important that legal informatics be deployed for realizing an efficacious public service delivery system (Contini & Cordella, 2015). The present study addresses the call made by Nay (Nay, 2021) that “the intersection of NLP and law is poised for innovation because there are ... the potential to improve the effectiveness of legal services due to inefficiencies in its current practice” (pp. 99). Thus, the purport of this study was to suggest a judicial reform in the field of legal informatics—specifically, the roll out and institutionalization of LAMs in a developing country like India. Following a goal-modelling approach to understand the preliminary inputs of the stakeholders vis-a-vis a new software engineering application (Hassine & Amyot, 2017), eleven experts hailing from academia and practice were solicited to share their inputs vis-a-vis the conceptualization, possibilities and caveats associated with LAMs. Drawing lessons from the legal informatics’ applications in the developed countries, LAMs might be further refurbished with the requisite regulatory and technology infrastructures in place (Andres et al., 2015; Agrawal et al., 2022; Corrales et al., 2022; Fitsilis et al., 2022).

Much like any ATM that caters to our banking requirements, LAM has been conceived as a legal ATM which facilitates the disposal of cases in the sense that it is capable of providing legal advice to the aggrieved parties. By engaging in a “dialogue” with the aggrieved party backed by robust verification, security and surveillance mechanisms, LAMs shall attempt at providing legal advice and provide further course of action to the aggrieved parties. LAM shall be a conduit for furthering the dispute resolution and arbitration process in the e-justice value chain. The study underscored the role of NLP components for instituting LAMs and threw light on the opportunities and challenges as far as the institutionalization of LAMs in the country is concerned. Besides, the study underlined the need to have the requisite policy framework in place for the institutionalization of LAM in case of any untoward eventuality like fraud or tampering. In a country where is clogging of legal cases and a queue of unsettled cases,

LAMs shall serve as a succor for the judicial system and the citizens as a whole. The bottomline is that the primary objective of any judicial system is access to justice and it holds true for LAMs in particular or legal informatics in general (Haney, 2020).

Limitations and Directions for Further Research

Legal informatics research, anyway, is yet to capture the attention of the academia (Hinson, 2005). Conceding this, definitely, the present study is a step forward in legal informatics research. However, the present study is limited in the sense that it provides the roadmap for the institutionalization of LAMs in a developing country, and this necessitates further research in understanding the improvisation of LAMs for being ready to face the challenges of Society 6.0 or Industry 5.0 in the near future. Further research is warranted to study the perspectives of the stakeholders in the developing and developed countries regarding the strategizing of LAMs. A third line of research approach could be to understand the role of LAMs in furthering direct democracy and citizen participation. Furthermore, multidisciplinary research is also warranted in understanding the invocation of other ICT tools like AI and blockchain to refurbish LAMs. Finally, the possibility of making LAMs portable, thereby providing services at the doorstep is another avenue for multidisciplinary research.

Practitioner Implications

The present study leaves insights for the policy makers, lawyers, jurists and the citizens alike. Policy makers have to appreciate the need for LAMs and, therefore, earmark sufficient resources for the roll-out and institutionalization of LAMs. Without a vision and direction, LAMs cannot succeed. Given the kind of demographic composition and literacy gulf among the citizens of the country, it is important that LAMs have a strong technological edifice to cater to the needs of all stakeholders. There is a need for the lawyers to be trained in the LAMs functionality and provide the necessary support for the algorithmic governance of LAMs to facilitate the smooth functioning of LAMs. Jurists and experts in the field of law should be geared for understanding the areas of conflict between LAMs and their opinions, and these conflicting areas must be factored into account while drafting legal documents for LAMs. Finally, the citizens must be abreast with the functioning of LAMs and the manner in which interactions and etiquettes are to be governed between them and LAMs.

References

- Agrawal, S., Sahu, A., & Kumar, G. (2022). A conceptual framework for the implementation of Industry 4.0 in legal informatics. *Sustainable Computing: Informatics and Systems*, 33, 100650. <https://doi.org/10.1016/j.suscom.2021.100650>
- Aguilo-Regla, J. (2005). Introduction: Legal informatics and the conceptions of the law. In: Benjamins, V. R., Casanovas, P., Breuker, J., and Gangemi, A. (Eds.) *Law and the semantic web. Lecture Notes in Computer Science*, 3369, Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-32253-5_2

- Akhigbe, O., Amyot, D., & Richards, G. (2019). A systematic literature mapping of goal and non-goal modelling methods for legal and regulatory compliance. *Requirements Engineering*, 24, 459–481. <https://doi.org/10.1007/s00766-018-0294-1>
- Al-Abdulkarim, L., Atkinson, K., & Bench-Capon, T. (2016). A methodology for designing systems to reason with legal cases using abstract dialectical frameworks. *Artificial Intelligence and Law*, 24, 1–49. <https://doi.org/10.1007/s10506-016-9178-1>
- Alexopoulos, C., Virkar, S., Loutsaris, M. A., Novak, A. S., & Loukis, E. (2020). Analysing legal information requirements for public policy making. 12th IFIP WG 8.5 International Conference, ePart, Linköping, Sweden, 95–108. https://doi.org/10.1007/978-3-030-58141-1_8
- Alrajeh, D., Kramer, J., Russo, A., & Uchitel, S. (2009). Learning operational requirements from goal models. *IEEE 31st International Conference on Software Engineering*, Vancouver, BC, Canada, 265–275. <https://doi.org/10.1109/ICSE.2009.5070527>
- Andres, A. R., Asongu, S. A., & Amavilah, V. (2015). The impact of formal institutions on knowledge economy. *Journal of the Knowledge Economy*, 6, 1034–1062. <https://doi.org/10.1007/s13132-013-0174-3>
- Ante, L. (2021). Smart contracts on the blockchain-A bibliometric analysis and review. *Telematics and Informatics*, 57, 101519. <https://doi.org/10.1016/j.tele.2020.101519>
- Antonioni, G., Baryannis, G., Batsakis, S., Governatori, G., Robaldo, L., Siragusa, G., & Tachmazidis, I. (2018). Legal reasoning and big data: Opportunities and challenges. *Workshop on Mining and Reasoning with legal texts*, Luxembourg. <https://doi.org/10.29007/tkmv>
- Bei, J., Pomerence, D., Schreiner, L., Sharbaf, S., Collins, P., & Roos, N. (2022). Explainable AI through the learning of arguments. *arXiv*, <https://doi.org/10.48550/arXiv.2202.00383>
- Bommarito II, M. J., Katz, D. M., and Detterman, E. M. (2021). LexNLP: Natural language processing and information extraction for legal and regulatory texts. Book chapter in Vogl, R. (Ed.). Research handbook on big data law. *Elgar Publishing*, 216–227. <https://doi.org/10.48550/arXiv.1806.03688>
- Busetti, S., & Vecchi, G. (2018). Process tracing change management: The reform of the Italian judiciary. *International Journal of Public Sector Management*, 31(5), 566–582. <https://doi.org/10.1108/IJPSM-06-2017-0158>
- Chandan, H. C. (2016). Corruption, organisations and culture in contemporary India. *Indian Culture and Work Organisations in Transition*. <https://doi.org/10.4324/9781315625447>
- Chandra, G. R. (2016). Cyber space for universal peace: The contribution of online dispute resolution. *IUP Law Review*, 6(4), 49–56.
- Charalabidis, Y., Loutsaris, M.A., Virkar, S., Alexopoulos, C., Novak, A. S., & Lachana, Z. (2019). Use case scenarios on legal text mining. Proceedings of the 12th International Conference on Theory and Practice of Electronic Governance. *Association for Computing Machinery*, Melbourne, Australia, 364–373. <https://doi.org/10.1145/3326365.3326413>
- Chatterjee, S., Sreenivasulu, N. S., & Hussain, Z. (2022). Evolution of artificial intelligence and its impact on human rights: From sociolegal perspective. *International Journal of Law and Management*, 64(2), 184–205. <https://doi.org/10.1108/IJLMA-06-2021-0156>
- Chowdhury, G. (2003). Natural language processing. *Annual Review of Information Science and Technology*, (37), 51–89. <https://strathprints.strath.ac.uk/2611/1/strathprints002611.pdf>, accessed on 21 July 2022.
- Contini, F., & Cordella, A. (2015). Assembling law and technology in the public sector: The case of e-justice reforms. *Proceedings of the 16th Annual International Conference on Digital Government Research*, 124–132. <https://doi.org/10.1145/2757401.2757418>
- Corrales, M., Fenwick, M., & Forgo, N. (2022). Robotics, AI and the future of law. *Springer*, Singapore. <https://doi.org/10.1007/978-981-13-2874-9>
- Cyras, V. (2009). Distinguishing between knowledge visualization and knowledge representation in legal informatics. <https://doi.org/10.38023/4FB3B291-F8DF-4535-B83F-3A4471337462>.
- Deeks, A. (2019). The judicial demand for explainable artificial intelligence. *Columbia Law Review*, 119(7), 1829–1850. <https://www.jstor.org/stable/26810851>
- Dewitz, S. (1995). Using information technology as a determiner of legal facts. In: Bankowski, Z., White, I., Hahn, U. (Eds.). Informatics and the foundations of legal reasoning. *Law and Philosophy Library*, 21, Springer, Dordrecht. https://doi.org/10.1007/978-94-015-8531-6_15
- Dolin, R. (2021). Legal informatics-Taking the tediousness out of law. *The Practice*, 8(1). <https://thepractice.law.harvard.edu/article/legal-informatics/>, accessed on 21 July 2022.
- Doringer, S. (2021). ‘The problem-centred expert interview’. Combining qualitative interviewing approaches for investigating implicit expert knowledge. *International Journal of Social Research Methodology*, 24(3), 265–278. <https://doi.org/10.1080/13645579.2020.1766777>

- Duran, M. B., & Mussbacher, G. (2019). Reusability in goal modeling: A systematic literature review. *Information and Software Technology*, 110, 156–173. <https://doi.org/10.1016/j.infsof.2019.03.004>
- Ebers, M. (2021). Regulating explainable AI in the European Union. An overview of the current legal framework(s). L.Colonna & S.Greenstein (eds.), *Nordic yearbook of law and informatics 2020: Law in the era of artificial intelligence*. <https://doi.org/10.2139/ssrn.3901732>
- Eliot, L. B. (2020). An ontological AI-and-law framework for the autonomous levels of AI legal reasoning. *arXiv*, <https://arxiv.org/abs/2008.07328>
- Erdelez, S., & O'Hare, S. (1997). Legal informatics: Applications of information technology in law. *Annual Review of Information Science and Technology (ARIST)*, 32, 367–402. <https://eric.ed.gov/?id=EJ565478>
- Fitch, A. (2020). Would you trust a lawyer bot with your legal needs. *Wall Street Journal*. <https://www.wsj.com/articles/would-you-trust-a-lawyer-bot-with-your-legal-needs-11597068042>, accessed on 11 Feb 2022.
- Fitsilis, F., Koryzis, D., & Schefbeck, G. (2022). Legal informatics tools for evidence-based policy creation in parliaments. *International Journal of Parliamentary Studies*, 2(1), 5–29. <https://doi.org/10.1163/26668912-bja10031>
- Fragidis, G. (2021). The use of goal modelling for the analysis of value co-creation in collaborative networks. In: Camarinha-Matos, L.M., Boucher, X., Afsarmanesh, H. (eds.). *Smart and sustainable collaborative networks 4.0. PRO-VE 2021, IFIP Advances in Information and Communication Technology*, 629. Springer, Cham. https://doi.org/10.1007/978-3-030-85969-5_32
- Francesconi, E., & Peruginelli, G. (2010). Semantic interoperability among thesauri: A challenge in the multicultural legal domain. In: Abramowicz, W., Tolksdorf, R., and Wecl, K. (Eds.). *Business information systems workshops. Lecture Notes in Business Information Processing*, 57, Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-15402-7_34
- Goldenfein, J., & Leiter, A. (2018). Legal engineering on the blockchain: 'Smart Contracts' as legal conduct. *Law and Critique*, 29, 141–149. <https://doi.org/10.1007/s10978-018-9224-0>
- Greenstein, S. (2021). Elevating legal informatics in the digital age In: Sonya Petersson (Ed.). *Digital human sciences: New objects-new approaches*, 155–180, Stockholm, Stockholm University Press. <https://doi.org/10.16993/bbk.g>
- Haney, B. S. (2020). Applied natural language processing for law practice. *Intellectual Property & Technology Forum*, Boston College Law School, <https://doi.org/10.2139/ssrn.3476351>, accessed on 16 June 2022.
- Hassine, J., & Amyot, D. (2017). An empirical approach toward the resolution of conflicts in goal-oriented models. *Software Systems and Modelling*, 16, 279–306. <https://doi.org/10.1007/s10270-015-0460-6>
- Hinson, C. L. (2005). Legal informatics: Opportunities for information science. *Journal of Education for Library and Information Science*, 46(2), 134–153. <https://doi.org/10.2307/40323866>
- Hirschberg, J., & Manning, C. D. (2015). Advances in natural language processing. *Science*, 349(6245), 261–266.
- IBM. (2020a). Artificial intelligence (AI). *IBM Cloud Education*. <https://www.ibm.com/in-en/cloud/learn/what-is-artificial-intelligence>, accessed on 14 June 2022.
- IBM. (2020b). Natural language processing (NLP). *IBM Cloud Learn Hub*. <https://www.ibm.com/cloud/learn/natural-language-processing>, accessed on 12 June 2022.
- IBM. (2022). What is blockchain technology?. <https://www.ibm.com/in-en/topics/what-is-blockchain>, accessed on 5 July 2022.
- Jamila, F., Rompegading, M., & Hidayat, W. (2020). The effectiveness of virtual trials for criminal proceeding as an effort to mitigate the spread of Corona virus during the COVID-19 pandemic. *1st International Conference on Law and Human Rights*. <https://doi.org/10.2991/assehr.k.210506.027>
- Jones, K. S. (1994). Natural language processing: A historical review. In: Zampolli, A., Calzolari, N., & Palmer, M. (Eds.). *Current issues in computational linguistics: In honour of Don Walker. Linguistica Computazionale*. 9–10, 3–16. Pisa, Dordrecht. https://doi.org/10.1007/978-0-585-35958-8_1
- Kalamkar, P., Venugopalan, J., & Raghavan, V. (2021). Indian legal NLP benchmarks: A survey. *arXiv*. <https://doi.org/10.48550/arXiv.2107.06056>
- Katz, D. M., Dolin, R., & Bommarito, M. J. (2021). *Legal informatics*. Cambridge University Press. <https://doi.org/10.1017/9781316529683>
- Katz, D.M., Hartung, D., Gerlach, L., Jana, A., & Bommarito, M. J. (2023). Natural language processing in the legal domain. *arXiv*. <https://doi.org/10.48550/arXiv.2302.12039>

- Kuhlthau, C. C., & Tama, S. L. (2001). Information search process of lawyers: A call for 'just for me' information services. *Journal of Documentation*, 57(1), 25–43. <https://doi.org/10.1108/EUM000000007076>
- Lettieri, N., Altamura, A., & Malandrino, D. (2017). The legal macroscope: Experimenting with visual legal analytics. *Information Visualization*, 16(4), 332–345. <https://doi.org/10.1177/1473871616681374>
- Liu, B. (2010). Sentiment analysis and subjectivity. In: Indurkha, N., & Damerau, F.J. (Eds.). *Handbook of natural language processing*. Chapman and Hall/CRC, New York, 664–704. <https://www.cs.uic.edu/~liub/FBS/NLP-handbook-sentiment-analysis.pdf>
- Liu, L., & Yu, E. (2004). Designing information systems in social context: A goal and scenario modelling approach. *Information Systems*, 29(2), 187–203. [https://doi.org/10.1016/S0306-4379\(03\)00052-8](https://doi.org/10.1016/S0306-4379(03)00052-8)
- Loutsaris, M. A., & Charalabidis, Y. (2020). Legal informatics from the aspect of interoperability: A review of systems, tools and ontologies. Proceedings of the 13th International Conference on Theory and Practice of Electronic Governance. *Association for Computing Machinery (ACM)*, 731–737. Athens, Greece. <https://doi.org/10.1145/3428502.3428611>
- Malmir, A., & Malmir, M. (2015). Government's civil liability towards individuals' privacy in cyberspace. *International Journal of Law and Management*, 57(2), 98–106. <https://doi.org/10.1108/IJLMA-09-2013-0042>
- Mania, K. (2022a). Legal technology: The new face of legal practice-Polish perspective. *Handbook of Research on Applying Emerging Technologies Across Multiple Disciplines*, 269–285. <https://doi.org/10.4018/978-1-7998-8476-7.ch015>
- Mania, K. (2022b). Legal technology: Assessment of the legal tech industry's potential. *Journal of the Knowledge Economy*, in Press. <https://doi.org/10.1007/s13132-022-00924-z>
- Markou, C. (2017). Are we ready for robot judges? Discover. <https://www.discovermagazine.com/technology/are-we-ready-for-robot-judges>
- Markovic, M. (2019). Rise of the robot lawyers. *Arizona Law Review*, 61, 325–350. <https://scholarship.law.tamu.edu/facscholar/1320/>
- Metsker, O., Trofimov, E., & Grechishcheva, S. (2020). Natural language processing of Russian court decisions for digital indicators mapping for oversight process control efficiency: Disobeying a police officer case. In: Chugunov, A., Khodachek, I., Misnikov, Y., & Trutnev, D. (Eds.). *Electronic governance and open society: Challenges in Eurasia. EGOSE 2019. Communications in Computer and Information Science*, 1135. Springer, Cham. https://doi.org/10.1007/978-3-030-39296-3_22
- Miles, M., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook*, (2nd ed.), Thousand Oaks, CA, Sage.
- Mishra, A. (2021). Compensatory mechanism for miscarriage of justice in cases of prolonged delay: The case of India. *Asian Journal of Legal Education*, 8(2), 194–204. <https://doi.org/10.1177/23220058211015689>
- Mochales, R., & Moens, M. F. (2011). Argumentation mining. *Artificial Intelligence and Law*, 19, 1–22. <https://doi.org/10.1007/s10506-010-9104-x>
- Mumcuoglu, E., Ozturk, C. E., Ozaktas, H. M., & Koc, A. (2021). Natural language processing in law: Prediction of outcomes in the higher courts of Turkey. *Information Processing & Management*, 58(5), 102684. <https://doi.org/10.1016/j.ipm.2021.102684>
- Nadkarni, P. M., Ohno-Machado, L., & Chapman, W. W. (2011). Natural language processing: An introduction. *Journal of the American Medical Informatics Association*, 18(5), 544–551. <https://doi.org/10.1136/2Famiajn-2011-000464>
- Nay, J. J. (2021). Natural language processing and machine learning for law and policy texts. In: D.M. Katz, R. Dolin and M. Bommarito (Eds.). *Legal informatics*. Cambridge University Press, 99–113. <https://doi.org/10.2139/ssrn.3438276>
- Oconitrillo, L. R. R., Vargas, J. J., Camacho, A., Burgos, A., & Corchado, J. M. (2021). RYEL System: A novel method for capturing and represent knowledge in a legal domain using explainable artificial intelligence (XAI) and granular computing (GrC). In: Pedrycz, W., Chen, S. M. (eds.). *Interpretable artificial intelligence: A perspective of granular computing. Studies in Computational Intelligence*, 937, Springer, Cham. https://doi.org/10.1007/978-3-030-64949-4_12
- Oracle. (2022). What is big data?. <https://www.oracle.com/in/big-data/what-is-big-data/#:~:text=Big%20data%20defined,What%20exactly%20is&text=The%20definition%20of%20big%20data,especially%20from%20new%20data%20sources>, accessed on 13 June 2022.

- Owoeye, J. E. (2011). “Information communication technology (ICT) use as a predictor of lawyers’ productivity”, *Library Philosophy and Practice (e-journal)*, No. 662, available at https://digitalcommons.unl.edu/libphilprac/662?utm_source=digitalcommons.unl.edu%2Flibphilprac%2F662&utm_medium=PDF&utm_campaign=PDFCoverPages, accessed on 15 June 2022.
- Portela, I. M., & Cruz-Cunha, M. M. (Eds.). (2010). Information communication technology law, protection and access rights: Global approaches and issues IGI Global, Hershey, PA. <https://doi.org/10.4018/978-1-61520-975-0>
- Powell, W. W., & Snellman, K. (2004). The knowledge economy. *Annual Review of Sociology*, 30, 199–220. <https://doi.org/10.1146/annurev.soc.29.010202.100037>
- Prakken, H., & Sartor, G. (2015). Law and logic: A review from an argumentation perspective. *Artificial Intelligence*, 227, 214–245. <https://doi.org/10.1016/j.artint.2015.06.005>
- Prasad, V., & Sharan, A. (2019). Hedging data privacy in the artificial intelligence age: Legal and technological tacks. In S. Raizada, & E. Jha (eds.). *Artificial intelligence: An inducement of technology in human affairs*. 115–130, Wolters Kluwer.
- Raine, J. W. (2000). Modernising courts or courting modernisation? *International Journal of Public Sector Management*, 13(5), 390–416. <https://doi.org/10.1108/09513550010350788>
- Ren, Y., Han, J., Lin, Y., Mei, X., & Zhang, L. (2022). An ontology-based and deep learning-driven method for extracting legal facts from Chinese legal texts. *Electronics*, 11(12), 1821. <https://doi.org/10.3390/electronics11121821>
- Robaldo, L., Villata, S., Wyner, A., & Grabmair, M. (2019). Introduction for artificial intelligence and law: Special issue “natural language processing for legal texts.” *Artificial Intelligence and Law*, 27, 113–115. <https://doi.org/10.1007/s10506-019-09251-2>
- Rodriguez, C. R. R., Fernandez, Y. A., Abreu, M. P., & Zuev, D. S. (2021). Legal decision support systems in Cuba: Some background and notes for future projects. *International Review of Law, Computers & Technology*, 35(3), 301–321. <https://doi.org/10.1080/13600869.2021.1942401>
- Sanson, C., & Sperli, G. (2022). Legal information retrieval systems: State-of-the-art and open issues. *Information Systems*, 106, 101967. <https://doi.org/10.1016/j.is.2021.101967>
- Sartor, G. (2008). Legal informatics and management of legislative documents. *Global Centre for ICT in Parliament Working Paper*, 2, 4–13. http://www.ictparliament.org/resources/WP002_legislativeinformatics.pdf
- Seipel, P. (2004). IT law in the framework of legal informatics. *Stockholm Institute for Scandinavian Law*, <https://www.scandinavianlaw.se/pdf/47-2.pdf>, accessed on 10 June 2022.
- Seth, S. (2019). Artificial intelligence: A social legal study. In S. Raizada, & E. Jha (eds.). *Artificial intelligence: An inducement of technology in human affairs*, 43–53, WoltersKluwer.
- Sharma, S., Gamoura, S., Prasad, D., & Aneja, A. (2022). Current status and future challenges and opportunities. *Legal Information Management*, 21(3–4), 218–235. <https://doi.org/10.1017/S1472669621000384>
- Sharma, S., & AL, R. S. (2021). ELegalls: Enriching a legal justice system in the emerging legal informatics and legal tech era. *International Journal of Legal Information*, 49(1), 16–31. <https://doi.org/10.1017/jli.2021.9>
- Shimazu, A., & Le Nguyen, M. (2014). Legal engineering and its natural language processing. In Huynh, V., Denoeux, T., Tran, D., Le, A., & Pham, S. (Eds.) *Knowledge and systems engineering. Advances in Intelligent Systems and Computing*, 244, Springer, Cham, https://doi.org/10.1007/978-3-319-02741-8_3
- Skorzewska-Amberg, M. (2017). Impact of ICT on the law. In: Zacher, L. (Ed.). *Technology, society and sustainability*. Springer, Cham, https://doi.org/10.1007/978-3-319-47164-8_11
- Snizek, J. A., & Henry, R. A. (1989). Accuracy and confidence in group judgment. *Organizational Behavior and Human Decision Processes*, 43(1), 1–28. [https://doi.org/10.1016/0749-5978\(89\)90055-1](https://doi.org/10.1016/0749-5978(89)90055-1)
- Sulis, E., Humphreys, L., Vernero, F., Amantea, I. A., Audrito, D., & Di Caro, L. (2022) Exploiting co-occurrence networks for classification of implicit inter-relationships in legal texts. *Information Systems*, 106, 101821. <https://doi.org/10.1016/j.is.2021.101821>
- Supreme Court of India. (2023). ICT initiatives. <https://ecommitteesci.gov.in/publication-type/ict-initiatives/>
- Susskind, R. (2010). Legal informatics-A personal appraisal of context and progress. In: Paliwala, A. (Ed.). *A history of legal informatics*. Zaragoza, Prensas Universitarias de Zaragoza, 119–146. <https://ejlt.org/index.php/ejlt/article/view/18>
- Svarc, J., & Dabic, M. (2017). Evolution of the knowledge economy: A historical perspective with an application to the case of Europe. *Journal of the Knowledge Economy*, 8, 159–176. <https://doi.org/10.1007/s13132-015-0267-2>

- Tchamyou, V. S. (2007). The role of knowledge economy in African business. *Journal of the Knowledge Economy*, 8, 1189–1228. <https://doi.org/10.1007/s13132-016-0417-1>
- Thøgersen, D. (2022). Managing innovation on the public frontline: Three approaches to innovation leadership. *International Journal of Public Sector Management*, 35(2), 150–171. <https://doi.org/10.1108/IJPSM-06-2021-0152>
- Vale, D., El-Sharif, A., & Ali, M. (2022). Explainable artificial intelligence (XAI) post-hoc explainability methods: Risks and limitations in non-discrimination law. *AI and Ethics*, 2, 815–826. <https://doi.org/10.1007/s43681-022-00142-y>
- van Opijnen, M., & Santos, C. (2017). On the concept of relevance in legal information retrieval. *Artificial Intelligence and Law*, 25, 65–87. <https://doi.org/10.1007/s10506-017-9195-8>
- van Opijnen, M. (2017). The European legal doctrine identifier-A missing link?. In: Sebastiano Faro and Ginevra Peruginelli (Eds.). *La Dottrina Giuridica e la sua Diffusione*. Turin, G. Giappichelli Editore. 213–227. <https://ssrn.com/abstract=3089176>
- Vassiliades, A., Bassiliades, N., & Patkos, T. (2021). Argumentation and explainable artificial intelligence: A survey. *The Knowledge Engineering Review*, 36, E5. <https://doi.org/10.1017/S0269888921000011>
- Virkar, S., & Novak, A. S. (2019). Investigating patterns of legal information access and use in Greece and Austria: Towards defining a legal information environment for egovernment. *International Conference EGOV-CeDEM-ePart*, San Benedetto Del Tronto, Italy. <https://drive.google.com/file/d/1otzg8gJB081u-t-waiUPrtyqfgukDM9r/view>
- Virkar, S., Alexopoulos, C., Stavropoulou, S., Tsekeridou, S., & Novak, A. S. (2020). User-centric decision support design in legal informatics: A typology of users. Proceedings of the 13th International Conference on Theory and Practice of Electronic Governance, Association for Computing Machinery (ACM), 711–722. Athens, Greece. <https://doi.org/10.1145/3428502.3428609>
- Virkar, S., Alexopoulos, C., Tsekeridou, S., & Novak, A. S. (2022). A user-centred analysis of decision support requirements in legal informatics. *Government Information Quarterly*, 39(3), 101713. <https://doi.org/10.1016/j.giq.2022.101713>
- Virkar, S., Udokwu, C., Novak, A. S., & Tsekeridou, S. (2019). Facilitating public access to legal information. In: Haber, P., Lampoltshammer, T., & Mayr, M. (Eds.). *Data Science – Analytics and applications*. Springer Vieweg, Wiesbaden, https://doi.org/10.1007/978-3-658-27495-5_10
- Virtucio, M. B. L. et al. (2018). Predicting decisions of the Philippine Supreme Court using natural language processing and machine learning. *IEEE 42nd Annual Computer Software and Applications Conference (COMPSAC)*, 130–135. <https://doi.org/10.1109/COMPSAC.2018.10348>
- Waltl, B., & Vogl, R. (2018). Explainable artificial intelligence the new frontier in legal informatics. *justletter it*, 4, 1–10. <https://law.stanford.edu/publications/explainable-ai-the-new-frontier-in-legal-informatics/>
- Wang, R. (2020). Legal technology in contemporary USA and China. *Computer Law & Security Review*, 39, 105459. <https://doi.org/10.1016/j.clsr.2020.105459>
- Weidong, J. (2022). The domain of computational law. *Peking University Law Journal*, 10(2), 109–130. <https://doi.org/10.1080/20517483.2023.2171593>
- World Bank. (2007). Building knowledge economies: Advanced strategies for development. *World Bank Institute Development Studies*. Washington D.C. <https://openknowledge.worldbank.org/handle/10986/6853>
- Zuo, W., & Wang, C. (2020). Judicial big data and big-data-based legal research in China. *Asian Journal of Law and Society*, 7(3), 495–514. <https://doi.org/10.1017/als.2020.34>

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