

Research

Balancing the scale: navigating ethical and practical challenges of artificial intelligence (AI) integration in legal practices

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Abstract

The paper explores the integration of artificial intelligence in legal practice, discussing the ethical and practical issues that arise and how it affects customary legal procedures. It emphasises the shift from labour-intensive legal practice to technology-enhanced methods, with a focus on artificial intelligence's potential to improve access to legal services and streamline legal procedures. This discussion importantly highlights the ethical challenges introduced by the integration of Artificial Intelligence, with a specific focus on issues of bias and transparency. These ethical concerns become particularly paramount in the context of sensitive legal areas, including but not limited to, child custody disputes, criminal justice, and divorce settlements. It underscores the critical need for maintaining ethical vigilance, advocating for developing and implementing AI systems characterised by a profound commitment to ethical integrity. This approach is vital to guarantee fairness and uphold transparency across all judicial proceedings. The study advocates for a "human in the loop" strategy that combines human knowledge and AI techniques to mitigate biases and guarantee individualised legal results to ensure AI functions as a complement rather than a replacement, the paper concludes by emphasising the necessity of preserving the human element in legal practices.

Keywords Artificial intelligence · Legal technologies · Algorithm bias · Decision making

1 Introduction

Artificial intelligence has inevitably become a central part of our lives integrating into our daily lives from being used in Global positioning systems (GPS) to using social media platforms like TikTok, Instagram and Facebook. AI algorithms are dominating in every field from finance where high-frequency data helps brokers to assess the volatile, unpredictable stock market to medical health care where AI address DNA models for cancer research purposes [1]. Moving away from its historically perceived reluctance to adopt technology, the legal industry has made significant strides in integrating artificial intelligence. This adoption aims to improve procedural efficiency, simplify case management, and increase access to legal services [2]. The legal industry now features an extensive array of AI-enabled tools. These innovative technologies equip individuals with the capability to execute tasks such as drafting wills, modifying contracts, or participating in depositions remotely from their homes, thereby enhancing the accessibility and efficiency of legal services [3].

The applications of this technology cover a wide spectrum. At one end, individuals representing themselves can use digital templates for divorce proceedings. On the other, law firms utilise advanced AI systems. These systems analyse data to predict the outcome of child custody cases in contentious divorces, focusing on statistical probabilities and precedents. This breakdown makes it easier to understand the diverse uses of technology in legal contexts [4]. AI's capabilities

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could include generating parenting plans between father and mother, separating agreements, equitably dividing assets among spouses, and planning divorce terms by leveraging historical and legal data [5]. This technological advancement is pivotal for the discipline to maintain its relevance in a developing, automation-driven landscape [6]. It offers a potential solution to expedite traditionally prolonged and complex legal proceedings.

Artificial Intelligence promises to enhance the precision of judgments in legal disputes, yet it concurrently harbours the risk of embedding biases within its outcomes. The efficacy and impartiality of AI algorithms are intrinsically linked to the nature and quality of the data they are trained on [7]. This relationship becomes particularly consequential in the handling of sensitive matters such as child custody, settlements, bail, and injunctions, where the data may inherently reflect societal biases related to racial and gender dynamics within families.

The genesis of these biases is not isolated to a single phase but permeates through the entire lifecycle of data processing and collection. Moreover, human involvement in the development and coding of AI systems introduces an additional layer of complexity [8]. The subjective decisions made during data modelling and the structuring process can inadvertently perpetuate existing prejudices, thereby undermining the integrity and objectivity of AI-facilitated legal decision-making.

This intricate interplay between AI's potential to refine legal analysis and its susceptibility to biases necessitates a vigilant and nuanced approach to its integration into legal practices [9]. Ensuring the ethical use of AI in the legal domain demands rigorous scrutiny of data sources, algorithmic transparency, and a commitment to eliminating systemic inequalities reflected in the data.

This paper will explore the evolving role of conventional lawyers in handling family law disputes within the justice system, contrasting their approach with futuristic AI technology. It will investigate how AI's potential to address legal issues might impact the legal paradigm, particularly concerning the ethical implications of algorithmic data modelling, which could introduce biases.

2 Understanding artificial intelligence

Before delving into the intersection of AI with the legal realm, it is crucial to first establish a clear understanding of what AI encompasses. While AI significantly influences various aspects of contemporary life, the expectation for a universally agreed-upon definition is not straightforward. This is due to AI's relative novelty and its evolving nature, which means its widespread adoption and understanding are still developing. Moreover, the absence of a cohesive international legal framework and the variability in legal definitions and regulations across different countries make the pursuit of a universal definition challenging in the current global landscape [10].

At its essence, AI can be succinctly characterised as a technological innovation designed to automate processes and tasks that have historically necessitated human cognitive abilities [11]. This broad category encompasses a range of computational techniques designed to augment machine functionality in complex cognitive tasks. These tasks include, but are not limited to, pattern recognition, computer vision, and natural language processing [12]. The dynamic and expansive nature of AI means that its definition is fluid, often evolving alongside advancements in the field. This phenomenon, sometimes referred to as the "AI effect", highlights the shifting boundary of what is considered AI [13]. Innovations once deemed revolutionary become standard over time, thus no longer classified under AI, while emerging, more sophisticated technologies are labelled as AI.

As we venture deeper into the specifics, AI's application in specialised fields, including the legal sector, represents its more advanced and complex forms. These forms require intricate coding for decision-making, case-based reasoning, and deep learning [14]. A recent development in this area is the concept of AI-based attorneys or lawyers. In this context, AI software is designed to undertake tasks and responsibilities traditionally performed manually by legal professionals, thereby reflecting, and potentially transforming the role of lawyers in legal proceedings [15].

To ensure a cohesive understanding of the diverse applications and implications of AI in law, it is essential to navigate this discussion through carefully structured sections and transitions. This approach will facilitate a smooth progression of ideas, aiding readers in comprehensively grasping the multifaceted relationship between AI and legal practices.

2.1 Exploring the dual facets of artificial intelligence: expert systems and machine learning

AI technology may be broadly divided into two areas. The first category includes knowledge-based systems, or expert systems, which function by inferring behaviour given a set of axioms [16]. These systems use programmed rules and formal logic to reason in certain domains. Commercial tax preparation software and early healthcare diagnosis algorithms are two examples. Their power is in analysing predefined circumstances to choose the best course of action based on predetermined guidelines. However, without incorporating new methods, these systems are incapable of learning or improving the quality of their decision-making over time [17].

The second category consists of technologies that continuously improve decision-making through probabilistic learning. This category, which encompasses machine learning and deep learning approaches, is driven by improved computer processing power, lower prices for digital storage, and increased data collection [18]. Applications include content moderation algorithms, automated language translation, and facial recognition in law enforcement. Although these systems demonstrate exceptional performance collectively, it is important to recognise that they operate on probabilistic principles at their foundation. Consequently, this can lead to unpredictable outcomes when applied to specific individual scenarios [19]. Deep learning computer vision systems, for example, can categorise pictures effectively but sometimes make mistakes that people wouldn't, such as mistaking a turtle for a pistol [20]. Additionally, they are susceptible to adversarial instances, intentionally modified inputs meant to trick the algorithm into producing accurate but confident results [21].

2.2 Advancements in legal technology: from COMPAS and E-discovery systems to AI-driven legal software

In the evolving field of legal technology, the Correctional Offender Management Profiling for Alternative Sanctions (COMPAS) emerges as a pivotal yet contentious innovation. Employed by adjudicators for its predictive capabilities, COMPAS symbolises the potential advancements and inherent challenges within legal tech. However, its introduction into the legal system has been met with mixed reactions, highlighting significant ethical and effectiveness concerns [22]. This complexity mirrors the broader dialogue in legal tech adoption, where diverse perspectives and ethical considerations converge [23]. Acknowledging COMPAS at this juncture is essential, setting the stage for a deeper examination of the controversies it embodies and emphasising the necessity for a nuanced analysis of both the opportunities and pitfalls presented by such technological tools in legal contexts.

E-discovery systems, which serve as all-inclusive database platforms, are also essential in this field [24]. These technologies, which provide complex solutions for information management and decision-making, are prime examples of the developments in legal software.

Programming and engineering approaches are used in the field of electronic software created for legal applications to improve the efficacy and efficiency of different procedures. These consist of the examination, investigation, recognition, gathering, and preservation of data relevant to court matters [25]. With the use of such software, data pertinent to case laws and legal discovery may be extracted and compiled into an easily navigable information repository. This software's underlying database is logically organised and has a collection of algorithms that can quickly process enormous amounts of legal data [26]. This feature allows attorneys and legal scholars to refocus their attention on more intricate and technically challenging jobs by drastically cutting down on the amount of time they would typically need to spend manually sorting through data. Consequently, e-discovery programmes that were formerly labour-intensive are now handled by AI-based systems [27]. These applications quickly produce easily understood papers that are prepared for legal experts to examine. This information processing revolution is a major step towards improving the efficacy and efficiency of legal research and documentation.

2.3 Rule-based architectures

AI systems deployed within the legal domain often employ rule-based architectures. These systems are characterised by a structured set of algorithms that govern the decision-making process, with outcomes determined by specific rules and criteria encoded within the system [28]. This framework allows for decisions to be made automatically when cases meet the predefined conditions set by these algorithms.

The operation of rule-based AI in the legal sphere is grounded in the application of clear, predefined rules to authorise decisions [29]. For example, in matters of family law such as alimony determination, the system might operate on a rule stating, "If a marriage lasted N years and one spouse earns significantly more than the other, then X amount of alimony is

recommended." This illustrates how the system applies its rules to specific cases to generate recommendations or decisions. A more detailed rule could specify, "If the marriage lasted over 20 years and one spouse's income is twice the other, then suggest alimony equal to 40% of the higher earner's income for half the duration of the marriage." Such specificity allows for tailored decision-making that reflects the unique circumstances of each case.

The implementation of rule-based AI systems in the legal field streamlines the decision-making process by automating the application of legal principles to relevant facts. This approach not only enhances efficiency but also ensures consistency in the application of the law. By defining explicit criteria for decisions, rule-based AI systems provide a transparent and objective basis for legal judgments, reducing subjectivity and potential bias [30]. However, the effectiveness and fairness of these systems hinge on the comprehensive and equitable formulation of the rules they are programmed to follow, underscoring the importance of careful and inclusive algorithm design.

In practice terms, this system could be employed in family legal proceedings to provide preliminary alimony recommendations and outcomes efficiently. This would enhance the process of negotiating settlements in divorce proceedings. Solicitors and mediators could input the marriage duration and income details of both spouses, and the system would automatically incorporate an alimony amount based on these established predetermined rules. This aids in making the initial phase of negotiations more flexible and grounded in a standardized framework, potentially reducing conflicts and hours spent in deliberations.

2.4 Case-based architecture

Beyond the traditional rule-based artificial intelligence models, the legal field has seen the emergence of the case-based reasoning (CBR) model of AI, a paradigm that significantly diverges from the rule-centric approaches. Unlike its rule-based counterparts, which operate within a rigid framework of pre-defined rules, the CBR model adopts a more flexible, case-by-case methodology [31]. This innovative approach entails the systematic archiving of previous cases within a database, categorising them based on shared attributes for subsequent retrieval and analysis [32]. By methodically comparing current situations with archived cases, the CBR system leverages historical data to predict outcomes, drawing on the parallels and consistencies found in the facts and circumstances of each case [33]. This technique harnesses the wealth of past legal data to construct forecasts and analyses, thereby facilitating decision-making processes that are both nuanced and contextually attuned.

In the realm of legal practice, the case-based reasoning approach represents a significant advancement, especially in areas where legal precedents play a pivotal role in determining case outcomes. By enabling the examination and comparison of decisions from similar past cases, CBR simplifies the decision-making process, grounding it in historical precedent and practical similarity rather than abstract rules [31]. A practical illustration of CBR's application can be found in family law, such as in a child custody dispute where one parent's proximity to the child's school and the other's flexible work-from-home arrangement are key considerations. In such scenarios, the CBR system would analyse and draw comparisons with similar cases in its database, potentially basing its judgment on precedents where custody was favourably awarded due to one parent's closer proximity to essential services like schools and the adaptability of the other parent's schedule to facilitate regular visitation [34].

This instance underscores the CBR model's capacity to yield informed, context-sensitive legal judgments by meticulously evaluating past cases that share key characteristics with the current dispute [32]. By doing so, it not only enriches the decision-making arsenal available to legal practitioners but also enhances the predictability and reliability of legal outcomes, ensuring they are deeply rooted in the rich tapestry of legal precedents and real-world complexities.

Advanced AI technologies have the potential to revolutionise the legal outlook by providing comprehensive and efficient solutions across various legal areas. Equipped with case laws, precedents, and a deep analysis of legal arguments, these AI instruments aim to enhance the accessibility of justice [35]. For instance, they can expedite processes like electronically submitting restriction orders or injunctions. As current research in advanced AI models progresses, these innovations could realistically materialise within the next 15 years, transforming legal practices and enhancing the efficiency of legal proceedings.

3 Evaluating empathy and technological innovation in legal practices

The transition from traditional to modern legal practices signifies a pivotal evolution within the legal profession, primarily driven by the introduction of AI systems. Historically, the field of law was marked by labour-intensive procedures, where manual research, document drafting, and physical document exchange were the norm. This era experienced a significant

transformation in the late 2000s, driven by key technological advancements in areas such as high-speed internet access, the rise of social media platforms, the proliferation of mobile devices, and the expansion of cloud computing services. These innovations further introduced efficiencies such as streamlined client intake processes, remote access to documents, and digital filing systems, thereby embedding technology deeply within legal workflows [36]. However, this technological integration did not supplant the inherently human-centric nature of legal work but instead enhanced it. Technologies enabling remote video conferencing have become indispensable in handling sensitive matters, such as domestic violence cases [37]. They facilitate the participation in Alternative Dispute Resolution (ADR) processes while simultaneously ensuring the safety of involved parties.

This technological evolution underscores not just an enhancement of efficiency but also the preservation of the human element in legal practices. As we pivot to discussing the indispensability of this human element, especially in family law, it becomes evident that while AI and digital tools offer significant advantages, the nuanced understanding and empathetic judgment of human professionals remain central [38]. These human qualities are particularly crucial in areas requiring delicate handling and personal touch, such as family law matters, underscoring the complementary role of technology in the broader legal prospect.

While AI has significantly enhanced the efficiency of legal processes, the crucial importance of human judgment remains paramount, especially in the nuanced field of family law. Unlike criminal law, where individuals often benefit from structured legal representation, including court-appointed prosecutors and defence attorneys, family law cases typically involve parties with limited legal support. This distinction emphasises the intricate and multifaceted nature of legal disputes, akin to the complexity encountered in the medical field, which necessitates specialised knowledge and expertise. The legal profession is specifically tailored to address these complexities, ensuring the integrity, fairness, and individualised attention required in each case, thereby reinforcing the indispensable role of human expertise in delivering justice [39].

Moreover, the advent of online digital resources has significantly improved access to legal information, offering vital support to individuals navigating the complexities of the legal system. Despite this accessibility, the vastness and complexity of legal information available online can be overwhelming for laypersons, complicating efforts to understand detailed legal documents and case law. This challenge is particularly pronounced in regions like certain U.S. states and the European Union, where options for Online Dispute Resolution (ODR) are limited, highlighting the necessity for legal representation in accessing domestic dispute resolution services effectively [40].

3.1 Dispute resolution through traditional methods in building empathy

This section delves into the distinct scenarios where traditional face-to-face dispute resolution, facilitated by neutral third parties like mediators or arbitrators, offers benefits surpassing those of Online Dispute Resolution. The personal interaction inherent in conventional settings fosters a unique environment conducive to empathy, non-verbal communication, and trust-building, elements often critical for complex or emotionally charged disputes [41].

For example, in family law cases, such as custody disputes or divorce proceedings, the nuanced understanding and compassionate mediation offered in face-to-face sessions can be pivotal. Studies have shown that parties are more likely to reach a mutually satisfactory resolution when they engage directly, benefitting from the mediator's ability to interpret body language and tone, which are essential cues in understanding underlying concerns and emotions [42].

Similarly, in commercial disputes involving intricate negotiations or significant relational investments between parties, the direct engagement facilitated by traditional dispute resolution methods can lead to more comprehensive and enduring agreements [43].

Traditional dispute resolution techniques are renowned for their effectiveness in promoting a relational outlook, guiding parties to consider their disputes within the broader spectrum of interpersonal relationships. This method significantly fosters mutual understanding and develops interpersonal competencies, which are crucial in scenarios where preserving relationships is of utmost importance [44]. Nevertheless, a comprehensive analysis necessitates acknowledging the limitations inherent to these methods.

One of the primary drawbacks is the significant demand for time and financial resources, attributed to the requirement for physical attendance. This can lead to logistical challenges, including scheduling conflicts and the incurrence of travel expenses [45]. Additionally, the formal atmosphere typical of traditional dispute resolution settings might intimidate some participants, potentially stifling rather than facilitating open communication.

Moreover, the risk of power imbalances poses a significant challenge. In scenarios where interactions are face-to-face, individuals with more assertive personalities might inadvertently suppress the contributions of less outspoken

participants [46]. Furthermore, the potential for misinterpreting non-verbal signals can compromise the equity of the resolution process. Traditional methods also face difficulties in keeping pace with rapid technological advancements, particularly in resolving disputes that involve novel issues, like those concerning digital assets [47].

3.2 Integration of traditional and digital strategies

In essence, while the value of traditional dispute resolution in enhancing communication and preserving interpersonal relations cannot be overstated, it is imperative to recognise its shortcomings. This understanding encourages the exploration of hybrid models that combine traditional methods with online solutions, striving for dispute-resolution frameworks that are more accessible, efficient, and equitable [48].

Research underscores that voluntary settlements in family disputes not only alleviate emotional and financial burdens but also facilitate customised agreements [49]. These agreements are better suited to the specific needs and values of the families involved, thereby potentially minimising the likelihood of future conflicts.

Moreover, traditional family mediation often results in higher client satisfaction with the legal process. Mediation restores a sense of control to the parties, facilitating fair negotiations without imposing the facilitator's biases. Agreements reached through human-facilitated dispute resolution tend to be more detailed and specific, likely leading to better compliance due to their bespoke nature [46]. Traditional methods also encourage constructive communication through emotional challenges, which, while uncomfortable, can provide valuable insights into each party's motivations—a dimension often absent in ODR [50].

For instance, in traditional mediation involving asset distribution post-divorce, the emotional dynamics can create obstacles but also opportunities for cathartic breakthroughs. A skilled mediator can guide parties through these emotionally charged moments, fostering empathy, and enhancing the potential for a favourable resolution [51].

4 The evolution of artificial intelligence in legal practice: innovations, challenges, and ethical implications

There are two major phases to the evolution of AI in the legal sphere. The first stage might be thought of as a moderate-innovative stage in which old legal practices are still prevalent but are enhanced by software and technical instruments. These legal technology tools help courts and solicitors handle cases more effectively [52]. The second stage represents a significant advancement in legal automation and process optimisation technology. This stage includes integrating machine learning, natural language processing, and automated document evaluation. These technologies make it easier to work with large databases, recognise patterns, and analyse human language to help with decision- and prediction-making [53]. AI will inevitably be incorporated into many legal procedures, especially through automation. This involves trial courts using complex algorithms, particularly in the pre-trial and sentencing stages of proceedings [54].

4.1 COMPAS and its analysis: criminal justice to family law

The Correctional Offender Management Profiling for Alternative Sanctions programme is a prominent illustration of this. By evaluating a defendant's information in connection with the claimed offence and contrasting it with historical information from related previous instances that is kept in its database, COMPAS uses its programme to make defensible choices [55]. This application's main goal is to evaluate the defendant's propensity for criminal activity in the future.

The AI-based programme COMPAS might have a great deal of promise for use even in family law settings. The main purpose of COMPAS software is to determine the likelihood that an offender would abscond after being released on bail or committing another crime while they are on parole. It uses a prediction algorithm to provide a risk score; higher scores denote a higher probability of criminal conduct in the future [56]. Although COMPAS is not currently used in family law, it may be used in this field, particularly in instances involving divorce and child custody [57]. For example, the programme might gather and examine detailed information on age, job history, behavioural tendencies, previous relationships, and criminal histories for both parents in child custody evaluations. To help with custody decisions, COMPAS may be extremely helpful in evaluating and analysing a variety of aspects, such as the possibility of conflict that might harm a child. The AI program can generate comprehensive profiles for every parent, aiding the court in comprehending the probability of each parent offering a secure environment for the child. This entails determining any possible dangers connected to each parent, such as a part of legal troubles or drug misuse [58]. The use of COMPAS in family court cases is an example

of how AI is becoming more widely applied in legal decision-making processes, providing a more analytical and data-driven approach to delicate family law issues.

Although this program adds a layer of opaque and complicated decision-making, on the surface it seems to help courts make custody decisions. The COMPAS algorithm, widely used within the criminal justice system, has come under scrutiny following extensive research by Pro Publica, an investigative journalism entity [59]. This investigation highlighted significant concerns regarding COMPAS's application in American courtrooms. Their findings revealed a clear racial bias in the algorithm's predicted results. According to the statistics, African American defendants were found to be nearly twice as likely to be mistakenly labelled as having a higher risk of reoffending. This occurred in 44% of cases, whereas just 23% of cases included white defendants. The opposite circumstance, in which white offenders were nearly twice as likely to be incorrectly classified as low risk when they reoffended, highlights this gap even more. This difference was shown in 47% of instances for white people and 28% for African American people. These results point to a systematic bias in the algorithm that disproportionately impacts African-American defendants by increasing their probability of being classified as high-risk and, as a result, subjecting them to harsher court decisions than their white counterparts [60].

The discourse on the Correctional Offender Management Profiling for Alternative Sanctions software, alongside the broader ethical quandaries enveloping AI within the legal framework, demands meticulous attention [61]. This scrutiny is paramount, particularly when examining the nuances of family law, where the implications of algorithmic biases could profoundly affect the lives of individuals and families. The essence of these ethical considerations centres on transparency, inherent biases, and the overarching integrity of legal decisions influenced by AI technologies.

4.2 Ethical considerations in AI and family law

In the realm of family law, the stakes are inherently personal and emotionally charged, involving matters such as custody disputes, divorce proceedings, and the allocation of familial resources. The introduction of AI and algorithms in these sensitive areas introduces a complex layer of ethical considerations. The potential for inherent biases within AI systems—stemming from skewed data sets, prejudiced algorithmic design, or the subjective predilections of developers—can inadvertently perpetuate discriminatory practices or unfair outcomes [62]. For instance, an AI system trained on historically biased data may favour one demographic over another in custody cases, without any transparent rationale for such a decision [63].

The impact of these biases is not merely theoretical but carries tangible consequences for the affected families, potentially altering the course of lives based on obscured, algorithmically determined factors [64]. Therefore, the moral imperative for transparency within AI systems becomes evident, necessitating that the mechanisms underpinning these technologies are openly disclosed and subject to rigorous scrutiny.

4.3 The imperative for transparency in AI systems

Transparency in AI systems, particularly those applied within the legal domain, is essential for several reasons. Firstly, it underpins the trust and credibility of the legal system, assuring the public that decisions are made on fair, understandable, and unbiased grounds [65]. Secondly, transparency allows for the independent assessment and validation of AI technologies, ensuring they adhere to ethical standards and do not infringe upon the rights or well-being of individuals [66]. This is especially critical in family law, where decisions can have lasting emotional and psychological impacts.

Moreover, the open disclosure of AI operational frameworks facilitates accountability, enabling the identification and rectification of errors or biases [67]. It empowers affected individuals with the knowledge to challenge and seek redress for decisions that may have been influenced by flawed AI determinations.

4.4 Navigating the ethical landscape

Navigating the ethical landscape of AI in family law necessitates a balanced approach that respects the nuanced needs of individuals while harnessing the potential of technology to enhance judicial efficiency and fairness. Central to this endeavour is the commitment to transparency, ensuring that AI systems are deployed in a manner that is both ethically sound and socially responsible [68]. By prioritising the open examination and critique of these technologies, the legal community can safeguard against the inadvertent perpetuation of biases, uphold the integrity of legal processes, and maintain the trust of those it serves [69]. This ethical vigilance is indispensable in realising the promise of AI as a tool for justice, rather than an instrument of inadvertent bias or division.

In the evolving landscape of family law, a suite of innovative software tools beyond COMPAS has emerged, each designed to enhance efficiency and facilitate less adversarial legal proceedings. Wevorce, for example, offers an online platform that merges legal and financial expertise with technology to create personalised, amicable divorce plans aimed at avoiding court disputes [70]. Similarly, SmartSettle employs an AI-powered negotiation system to find equitable solutions without litigation, catering to parties seeking fair resolutions [71]. coParenter aids separated or divorced parents in co-managing their responsibilities, providing essential tools for communication, scheduling, and decision-making to foster cooperation and reduce conflicts [72]. DivorceBot simplifies the initial stages of divorce through a chatbot that offers personalised guidance and resources [73]. OurFamilyWizard extends a comprehensive toolkit for co-parenting, featuring shared calendars, messaging, and expense tracking to improve relationship dynamics [74]. Lex Machina introduces legal analytics to family law, enabling practitioners to form strategies based on insights into case trends and outcomes [75]. Additionally, Modria stands out for its long-standing application in online dispute resolution within family law, employing data analysis and deductive reasoning to summarise disputes and propose resolutions [76]. Collectively, these tools represent the forefront of applying AI and technology to streamline family law processes, reduce adversarial interactions, and promote effective resolution strategies.

4.5 Integration of Toulmin's argumentation framework in the split-up tool

In the sophisticated realm of negotiation and legal dispute resolution, the integration of AI technologies, such as the Split-up tool, exemplifies the fusion of classical argumentation theory with advanced computational methods [77]. This tool is notably influenced by the Toulmin Model of Argumentation, a framework developed by philosopher Stephen Toulmin to analyse the structure and components of effective arguments [78]. This model delineates a comprehensive structure comprising six elements: claim (the statement being argued for), data (evidence supporting the claim), warrant (the logical connection between data and claim), backing (additional support for the warrant), rebuttal (counter-arguments), and qualifier (degree of truth of the claim) [79]. The application of this theory ensures that the tool's reasoning process is grounded in a well-established foundation of logical analysis.

Moreover, the tool incorporates the concept of the Best Alternative to a Negotiated Agreement (BATNA), a term coined in the field of negotiation theory. BATNA represents the most advantageous alternative course of action a party can take if negotiations fail, and an agreement cannot be reached. By employing BATNA as a strategic benchmark, the tool assesses potential outcomes and strategically navigates the negotiation process, aiming to reach a resolution that is preferable to each party's BATNA [80]. This approach not only aids in the resolution of conflicts but also guides parties towards mutually beneficial agreements.

The Split-up tool merges rule-based reasoning with neural networks to form a hybrid system capable of generating explanations for its conclusions. This blend allows the tool to leverage the precision of rule-based systems with the adaptive learning capabilities of neural networks, thus enhancing the quality and reliability of the decision-making process.

The process facilitated by the Split-up tool is particularly innovative, utilising argumentation tools to analyse conflicts among parties and deliver decisions that consider trade-offs, thereby striving for balanced judgment. A significant feature of this system is the provision that allows any party to object to any element of the judgment. This openness ensures that all parties have the opportunity to revisit and critically evaluate the settlement process at any stage, thereby promoting fairness and transparency [77].

By allowing for the thorough review of decision-making processes, this system ensures that conclusions reached are not only justified but also subject to scrutiny, thereby improving the integrity and acceptance of the outcomes. Through its application of the Toulmin Model of Argumentation and the strategic use of BATNA, coupled with the integration of advanced computational techniques, the Split-up tool represents a significant advancement in the application of AI in legal and negotiation contexts, ensuring that decisions are made through a process that is both analytically robust and inherently fair [81].

4.6 Augmenting through digital advancements

By giving them more flexibility to handle aspects of cases, like cases involving domestic violence or clients who are unable to attend court because of illness or childcare obligations, emerging technologies are greatly improving the capabilities of family law practitioners, including barristers and solicitors. These developments, which present novel strategies for wealth distribution and dispute resolution, mark the beginning of a new era in the administration of family-related legal affairs [82].

Moreover, these technological advancements play a pivotal role in enhancing the dynamics of attorney-client relationships, particularly in online environments. By leveraging sophisticated communication platforms and AI-driven tools, legal professionals are equipped to engage with their clients more effectively, fostering a sense of empathy, trust, and rapport [83]. This digital interface allows attorneys to maintain a continuous and interactive dialogue with clients, ensuring clarity and transparency in legal proceedings. Through features such as real-time updates, virtual consultations, and accessible online resources, these technologies bridge the physical gap between attorneys and clients [84]. As a result, clients feel more involved and informed about their legal matters, which is instrumental in building trust and confidence in their legal representation. Additionally, the use of empathetic AI, which can analyse and respond to clients' emotional cues, further personalises the client experience, reinforcing a sense of understanding and connection [85]. Ultimately, these technological advancements not only streamline legal processes but also enrich the attorney-client relationship, making it more responsive, empathetic, and grounded in mutual respect and trust.

5 Balancing promise and prudence: the impact of artificial intelligence on legal practices

The discourse surrounding the integration of AI into the legal sector is characterised by a complex interplay of enthusiasm and caution, reflecting a broad spectrum of perspectives from various stakeholders [86]. This nuanced dialogue underscores the necessity for a balanced examination of AI's multifaceted impact on legal practices, advocating for a judicious approach to leveraging AI's potential while conscientiously navigating its challenges.

5.1 Advantages of AI in legal practices: empirical insights

Proponents of AI in the legal domain underscore its transformative potential, citing increased productivity, enhanced data processing capabilities, and improved access to legal services as primary benefits. For instance, a study by McKinsey Global Institute highlights that AI and automation technologies have the potential to automate over 23% of lawyer work hours, thereby significantly increasing productivity [87]. Furthermore, platforms like ROSS Intelligence employ AI to sift through millions of legal documents in a fraction of the time it would take a human, illustrating AI's unparalleled efficiency in data analysis [88].

Moreover, AI democratises access to legal services, exemplified by tools like DoNotPay, which provides users with AI-generated legal advice for a variety of common legal issues [89]. This application has successfully contested hundreds of thousands of parking tickets, showcasing how AI can extend legal assistance to those who might otherwise lack the resources for traditional legal counsel [90].

5.2 Challenges and ethical concerns: implications

Conversely, the embrace of AI in legal processes is accompanied by significant ethical considerations and challenges. The potential for AI to replicate and amplify existing biases presents a profound concern. For example, the COMPAS software, used in the US criminal justice system to assess the likelihood of reoffending, has been critiqued for potential racial biases in its risk assessments, raising questions about the fairness of AI-driven judgments [91].

The opacity of AI decision-making processes also poses critical ethical dilemmas. The use of complex algorithms, whose decision-making rationales are not transparent, can undermine the foundational principles of accountability and fairness in the legal system [92]. The lack of transparency impedes stakeholders' ability to understand, challenge, or trust AI-generated legal decisions, thereby potentially eroding confidence in the legal process.

Moreover, the issue of accountability in AI-assisted legal decisions has become increasingly complex. When AI systems contribute to or directly influence legal outcomes, attributing responsibility for those decisions—especially in cases of errors or biases—becomes a convoluted task, challenging the traditional accountability structures within legal practices [93].

5.3 Toward a balanced integration of AI in legal practices

This discourse advocates for a balanced approach that acknowledges both the transformative advantages and the ethical challenges of AI in the legal domain. To fully realise AI's potential while mitigating its risks, it is imperative to implement

bias detection and correction mechanisms, enhance the transparency of AI processes, and establish clear accountability guidelines for AI-assisted decisions [94].

The integration of AI into legal practices presents a perspective brimming with both promise and caution. While specific instances and statistics affirm AI's capacity to revolutionise legal practices through increased efficiency and accessibility, case studies on biases and transparency issues serve as critical reminders of the ethical considerations that must guide AI's integration. A balanced and comprehensive examination of these facets is essential to navigate the complexities of AI in the legal domain, ensuring that its adoption enhances the integrity, fairness, and justice of legal outcomes.

6 The reliability of AI: dependent on the quality and bias of its data

The reliability of AI in the domains of law and technology is critically dependent on the integrity and quality of the underlying data. Much like the strength of a chain is determined by its weakest link, the effectiveness and dependability of AI systems are contingent upon the data used in their development. Flaws in the dataset, such as inadequate or biased training data, programming errors, and algorithmic design issues, can lead to inconsistencies and inaccuracies in AI outputs [95]. These shortcomings not only diminish the utility of AI for achieving client-specific objectives but also raise significant concerns regarding the perpetuation of existing biases.

A particularly troubling aspect of these deficiencies is their propensity to create feedback loops within algorithms. Such loops can exacerbate and entrench existing biases, potentially leading to unintentional discriminatory outcomes. The real-world implications of algorithmic bias in legal decisions have been documented in several instances, underscoring the practical consequences of reliance on flawed AI systems.

For example, the use of the COMPAS software in the United States for assessing the risk of recidivism has sparked controversy over its alleged racial bias. Investigations have suggested that the algorithm could unfairly predict higher risks of reoffending for Black defendants compared to their White counterparts, raising critical questions about fairness and equity in judicial decision-making processes [22].

In healthcare, AI systems have shown biases in diagnostic accuracy, affecting minority groups disproportionately [96]. Computer-aided diagnosis systems have returned lower accuracy results for black patients than for white patients, highlighting a significant risk of unequal healthcare outcomes based on race.

In the realm of law enforcement, the application of facial recognition technology (FRT) has come under intense scrutiny due to its notably higher rates of misidentification among people of colour, women, and other marginalised communities. Such inaccuracies jeopardize the integrity and efficacy of legal enforcement strategies, subjecting individuals to unjust suspicion and legal challenges. The case of *The Queen (on the application of Edward Bridges) v The Chief Constable of South Wales* [97], stands as a pioneering legal examination of the implications surrounding this emerging technology. While recognising the potential utility of automatic facial recognition (AFR) in law enforcement, the ruling underscores the imperative for its operation within a rigorously defined legal framework. This framework should minimise discretionary use and enforce stringent data retention protocols to mitigate the risk of significant human rights infringements [97]. This ruling signifies a critical juncture in the legal scrutiny of facial recognition technology within law enforcement, establishing a precedent for balancing technological advancement with fundamental rights and data protection standards.

These instances highlight the tangible impact of algorithmic bias on legal decisions and outcomes. They underscore the imperative for rigorous evaluation, transparency, and correction of AI systems within legal frameworks to ensure that these technologies serve to enhance, rather than undermine, the principles of justice and equity [98]. The challenge lies in developing AI solutions that are not only technologically advanced but also ethically sound and free from discriminatory biases, thereby safeguarding the integrity of legal processes and protecting the rights of all individuals [99].

The issue of algorithmic bias presents a profound challenge to the integrity of judicial processes, arising when AI systems generate prejudiced outcomes as a result of flawed programming or the use of biased or incomplete datasets [100]. This challenge underscores the urgent need for heightened vigilance among legal professionals and academics to safeguard the principles of fairness and impartiality within the judiciary.

6.1 Addressing fairness in machine-learning applications within legal AI

In the context of machine-learning applications, biases have the potential to become increasingly entrenched within the system's predictive algorithms. These algorithms, tasked with identifying pertinent features of cases and aligning them with historically similar outcomes, are susceptible to various forms of bias. Two primary sources of bias

are identified: the utilisation of biased or incomplete datasets for algorithm training, and the inherent design biases within the algorithm itself [101].

For example, the reliance on historical data to populate these AI systems' knowledge bases can introduce significant limitations. Often, this data does not comprehensively capture the breadth of legal disputes, as a significant portion of litigation concludes outside of court through settlements or is otherwise not pursued to a formal judgment [102]. This reliance on data derived exclusively from court judgments to the exclusion of mediated settlements or informal agreements distorts the AI's predictive capabilities. Such a narrow data scope fails to accurately reflect the diverse range of potential or 'typical' outcomes, skewing the system away from fair and unbiased decision-making.

The implications of algorithmic bias extend beyond mere technical concerns, striking at the heart of judicial equity. Legal systems must employ AI tools to critically assess and continuously monitor the data and algorithms underpinning these technologies. Ensuring that AI systems in the legal field are founded on comprehensive, balanced datasets, and are designed with inherent safeguards against bias, is crucial for upholding the fairness and integrity of judicial outcomes [37]. This endeavour requires a collaborative effort to refine AI technologies, making them not only more efficient but also equitable and representative of the principles of justice they are meant to serve.

6.2 Navigating the pathways of bias in legal AI systems

Case-based AI systems, which rely on historical data to predict legal outcomes, inherently risk perpetuating the biases embedded within that historical data [103]. This phenomenon can be especially pronounced in applications such as AI-mediated custody disputes, where patterns within the data may inherently favour one demographic—historically, mothers—over another, such as fathers, potentially placing male clients at a systemic disadvantage.

This risk is compounded in periods of rapid social change, where reliance on historical data may not accurately reflect evolving cultural norms and judicial perspectives. The legal landscape is dynamic, with societal attitudes and legal doctrines continuously evolving [104]. Hence, AI systems that depend solely on historical data for forecasting outcomes may struggle to align with current standards of fairness and equity.

For instance, although the impact of bias in court precedents may diminish over time through progressive judicial decisions and legislative reforms, AI systems that base their judgments exclusively on historical data risk replicating outdated patterns of discrimination [105]. This scenario underscores a critical challenge: ensuring that AI in legal contexts remains relevant and fair requires not only a reflection of past decisions but also an adaptive understanding of present-day legal and societal contexts.

To adeptly tackle the intricate challenges of bias within AI systems, a detailed examination of the mechanisms through which biases permeate these systems is essential. These mechanisms encompass data selection bias, where the dataset employed for AI training lacks representativeness of the broad array of legal scenarios due to the skewed presence of certain case types or outcomes [106]. Historical bias is another concern, with past data embedding the societal prejudices of its time, thus distorting the reflection of objective legal norms [107]. Additionally, algorithmic design bias may arise when the construction of an AI algorithm inadvertently favours specific patterns or outcomes, regardless of their equity or relevance in contemporary society [108]. Addressing these critical issues necessitates a dedicated approach to rigorously assess and periodically refresh both the datasets and algorithms underpinning AI in the legal field. By ensuring AI systems are fed with a varied and current data collection and are engineered with capabilities to detect and amend biases, the legal sector can advance towards leveraging AI not only for enhancing operational efficiency but also for championing the tenets of justice and fairness within a dynamically changing society.

7 The accountability conundrum in AI-driven legal decision-making

In the realm of legal scholarship, a significant concern arises from the inability of AI programs to elucidate the rationale behind their decisions, a dilemma commonly referred to as the "black box" problem [109]. This term describes the opaque nature of AI's data processing, which often remains enigmatic, even to the creators of these systems. This opacity harbours implications for the legal field, particularly in how AI-generated forecasts might influence future case outcomes.

7.1 The feedback loop and its legal implications

One notable consequence is the potential alteration of case strategies by legal professionals who rely on AI-generated predictions. This scenario is exacerbated by a feedback loop, where decisions influenced by AI forecasts generate new data, subsequently absorbed back into the AI system [110]. This cycle can perpetuate and amplify any biases or inaccuracies inherent in the original algorithm, potentially skewing legal outcomes and strategies over time.

7.2 Real-world illustrations of ai's impact on legal decision-making

A tangible example of the black box issue's ramifications can be observed in scenarios where AI systems predict case outcomes based on party gender in custody disputes. Such predictions, derived from historical data, may inadvertently reinforce gender biases, influencing legal professionals to strategies based on these flawed forecasts [111]. This reinforcement of bias exemplifies the critical challenge posed by the reliance on AI in legal decision-making processes.

For instance, if an AI program, analysing past court decisions, identifies a pattern where one gender is favoured over another in custody rulings, and legal professionals adjust their case approaches based on this analysis, the cycle of bias not only continues but strengthens [58]. This example underscores the profound implications of opaque AI systems in perpetuating discrimination within judicial proceedings.

7.3 Toward transparent and responsible AI in legal frameworks

The inherent opacity of AI decision-making processes in legal contexts raises pressing questions about the necessity for developing AI systems that are both responsible and transparent. The persistence of biases within these systems highlights an urgent need for mechanisms that ensure AI's accountability in legal procedures [112]. As the legal community navigates the integration of AI, a concerted effort toward implementing transparent, unbiased AI tools becomes paramount, ensuring that justice is administered fairly and equitably, free from the constraints of algorithmic prejudices [113].

8 AI and risk assessment in the criminal justice system: navigating legal and ethical terrain

It is widely acknowledged that how a government administers its criminal justice system—characterised by ethics, humanity, fairness, and effectiveness—serves as a critical measure of a democracy's health [114]. The criminal justice system, integral to the foundation of democratic societies, possesses significant authority concerning the protection and limitation of individual rights and maintaining law and order in society [115]. Historical evolution has introduced procedural safeguards to protect defendants and the incarcerated from the whims of arbitrary judgment, rooted in either deliberate misuse of power or unconscious biases such as fatigue or racism [116]. In a bid to enhance efficiency and impartiality, the justice system has increasingly turned to automated decision-making technologies, including risk assessment tools, at various stages of the legal process.

8.1 Global overview of the development and challenges facing risk assessment instruments

Originating in the 1920s, risk assessment methodologies sought to diminish prejudice and wrongful incarceration by analysing data on defendants, incorporating both dynamic (e.g., skills, psychological profiles) and static (e.g., age, gender) factors to predict recidivism risks [117]. Despite their intentions, these tools have historically been marred by biases stemming from skewed long-term incarceration data and a lack of reliability in subjective evaluations, such as assessing antisocial behaviour [118].

In the United States, risk assessment tools have faced criticism for inherent unfairness, particularly for their disproportionately adverse impacts on minority groups. This distortion in data skews recidivism predictions, compromising the accuracy and fairness of assessments [119]. Echoing similar concerns, the Canadian Supreme Court's examination in *Ewert v Canada* highlights the detrimental effects on rehabilitation prospects for offenders from racial and ethnic minorities, raising significant consideration regarding the intersection of risk assessment tools with constitutional rights, including due process, equal protection, and the right to a fair trial [120].

8.2 Algorithmic assessments: promises and pitfalls

Recent shifts toward fully automated algorithmic risk assessments aim to enhance consistency and reduce bias. Leveraging machine learning, these systems purportedly improve with continuous data integration. Some research findings indicate that the application of machine learning has the potential to enhance equality and non-discrimination rights, which could lead to a decrease in rates of pretrial detention and a reduction in overall crime levels [121]. However, systems like COMPAS have faced accusations of perpetuating racial biases, exacerbated by systematic biases in training data, which often reflect disproportionate policing of minority communities [59].

The opacity of machine learning processes and the proprietary nature of these technologies further complicate defendants' abilities to challenge convictions or appeal, raising profound questions about the balance between technological advancements and the safeguarding of fundamental rights.

8.3 Balancing innovation with equity

While automated risk assessment technologies offer potential benefits, such as lowered crime rates and support for low-risk offenders, their impact on the rights of historically marginalised groups remains a critical concern [122]. The transparency of these systems and their potential to automate existing societal biases pose significant challenges to ensuring fairness and impartiality in judicial proceedings.

To navigate this complex terrain, a comprehensive understanding of both the technological underpinnings and the legal implications of AI in risk assessment is essential. Recognising the dual potential of AI to both advance and hinder justice, it is imperative to strive for systems that are not only efficient but also equitable, upholding the principles of fairness and transparency in the pursuit of justice for all individuals [123].

9 Ethical integration of AI in family law practice: balancing technological advancements and human judgment

The incorporation of AI into family law dispute resolution raises significant ethical concerns, particularly regarding the potential for AI-generated agreements to neglect the distinctive complexities and interests of the parties involved [124]. Family law disputes are characterised by their deeply personal nature, with resolutions often hinging on nuanced considerations that defy straightforward digital quantification. For example, child custody decisions involve a myriad of factors deemed in the child's best interest, such as emotional, psychological, and financial well-being, which can vary significantly across jurisdictions [82]. These decisions become even more intricate in cases involving domestic violence, mental health issues, or co-parenting difficulties.

While AI has shown promise in streamlining processes like asset division, its capacity to address the intricacies of child custody and other highly personalised issues remains limited [125]. This limitation arises from AI's current inability to fully grasp and represent the vast spectrum of individual disputes' nuances.

9.1 The role of human judgment in AI-assisted dispute resolution

The essence of alternative dispute resolution lies in its flexibility to tailor solutions to the specific interests and needs of the parties, without being strictly bound by legal precedents or policy constraints. In such contexts, facilitators wield considerable discretion to interpret and apply the law in ways that honour the unique circumstances and fairness of the parties involved [50]. However, developing an AI tool that can accurately assess the fairness of a proposed judgment, especially in complex and subjective matters, is currently beyond reach.

Empirical research underscores that integrating AI with human expertise significantly enhances outcomes compared to utilising AI in isolation [126]. A judicious approach entails legal practitioners reviewing AI-generated recommendations or decisions through the lens of their professional judgment, considering the specific conflicts and interests at stake. This "human in the loop" (HITL) methodology not only aims to mitigate data biases but also ensures

adherence to public policies and enables a form of quasi-judicial oversight [127]. Such systems are instrumental in fields like medicine, demonstrating the value of combining automated analysis with human verification.

For AI in family law, incorporating HITL oversight is essential, both in the initial design phase and through regular audits to correct any biased data inputs. The designated HITL professional should possess a deep understanding of the AI program's decision-making criteria and the authority to address issues of transparency and accountability [128].

9.2 Legal precedents, jurisdictional variations, and the imperative for transparency

The ethical deployment of AI in family law also necessitates a careful examination of how legal precedents and jurisdictional differences shape AI development and application [51]. Understanding the legal landscape is crucial for developing AI tools that are both effective and equitable.

Moreover, the perceptions and impacts of AI-assisted decisions on all parties involved, including lawyers, judges, and families, require thorough consideration. Ensuring that AI applications in family law do not inadvertently compromise the fairness, equity, and transparency of legal outcomes is paramount [129]. As the legal community continues to navigate the integration of AI in family law, fostering a balanced approach that marries technological innovation with the indispensable insights of human judgment will be key to advancing justice and ethical standards.

10 Conclusion

In the legal sector's evolving landscape, the integration of AI holds the promise of transforming judicial systems by enhancing efficiency and broadening the range of solutions available to judges and facilitators. However, this technological evolution introduces significant challenges, particularly concerning the potential of AI to undermine the foundational principles of Alternative Dispute Resolution [130]. ADR aims to facilitate resolutions that are meticulously tailored to the unique needs and contexts of all parties involved. Yet, AI's inclination to prioritise efficiency through the analysis of historical data may inadvertently compromise these objectives [131]. By relying on past trends and precedents, AI systems risk delivering solutions that, while statistically optimal, might overlook the nuanced and personal aspects of disputes essential to achieving truly equitable resolutions.

The introduction of AI into legal practices also raises concerns about the perpetuation of systemic biases, a critical issue given the technology's potential to influence outcomes in family law and the criminal justice system, where fairness and impartiality are paramount. Historical instances within the criminal justice system have highlighted the manifestation of racial biases in AI-driven decisions, underscoring the need for caution.

To address these challenges, the Human-in-the-Loop emerges as a crucial strategy for integrating AI into legal contexts [132]. HITL emphasises the importance of human oversight in AI-driven processes, ensuring that decision-making algorithms are continuously monitored and adjusted by legal professionals [132]. This vigilant oversight is vital for identifying and correcting biases that AI systems might introduce, whether through flawed data sets or algorithmic predispositions.

Moreover, HITL processes play a pivotal role in aligning AI applications with the core objectives of ADR. Through active human engagement, legal practitioners can guide AI systems to consider the broader implications of efficiency-driven solutions, ensuring that the technology supports rather than detracts from the goals of personalised and equitable dispute resolution [130]. By fostering a collaborative dynamic between AI and human expertise, the HITL approach enables the legal field to harness the benefits of technological advancements while safeguarding against their inherent risks [132].

In conclusion, while AI has the potential to significantly enhance the legal sector's efficiency and accessibility, its integration into dispute resolution processes must be approached with caution. The prioritisation of efficiency through historical data, if not carefully managed, could undermine the very essence of ADR. However, by incorporating human oversight through the HITL approach, the legal community can mitigate the biases introduced by AI, ensuring that technological advancements contribute positively to fair and equitable outcomes. This balanced integration of AI and human judgment underscores the path forward in achieving justice in the digital age.

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Declarations

Competing interests The author declares no competing interests.

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