

Adjudication by Algorithm: The Risks and Benefits of Artificial Intelligence in Judicial Decision-Making

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1 Artificial intelligence (AI) is expected to contribute US\$15.7 trillion to the global economy by 2030,¹ touching every sector and industry, with law being no exception. As Erik Brynjolfsson and Andrew McAfee explain:

The effects of AI will be magnified in the coming decade, as manufacturing, retailing, transportation, finance, health care, law, advertising, insurance, entertainment, education, and virtually every other industry transform their core processes and business models to take advantage of machine learning.²

2 In law, AI systems are already being used in many areas of practice - from mandate pricing and tracking, to document review and due diligence, to legal research and litigation strategy. While the technology is still relatively immature, the trifecta of better algorithms, more computing power and the availability of data and data storage³ is improving the complexity and accuracy of these systems.

3 AI is also being used in the adjudication of disputes to assist with dispute resolution and inform judicial decision-making. At a high level, AI can

- promote access to justice through automated legal research and online dispute resolution systems;
- reduce costs by deploying systems that can analyze large amounts of data in a manner that is cheaper, faster and more accurate than humans; and
- improve consistency in judicial outcomes by identifying trends based on a comprehensive body of historic decisions on a specific point of law.

4 These efficiencies matter in an era in which our legal system is under scrutiny. The Supreme Court of Canada in *Hryniak v. Mauldin* (2014) and *R. v. Jordan* (2016) has set a framework for how quickly a case should be resolved. As chief justice of Canada, Beverley McLachlin was an ardent advocate for reform to reduce trial delays.⁴ AI can and will help in this regard.

5 Yet the technology and its implications are poorly understood. United States Chief Justice John Roberts was recently asked whether he could foresee a day "when smart machines, driven with artificial intelligences, will assist with courtroom fact finding or, more controversially even, judicial decision making." He responded: "It's a day that's here and it's putting a significant strain on how the judiciary goes about doing things ... the impact of technology has been across the board and we haven't yet really absorbed how it's going to change the way we do business."⁵

6 This article explores the use of AI in legal adjudication, highlighting, as a use case, algorithm-based risk assessments in criminal proceedings. It begins with a brief explanation of the technology before discussing how AI is being used in criminal judicial decision-making. The last section explores some of the issues of bias and algorithmic accountability as two key concerns arising in the context of AI in legal proceedings. We conclude by

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encouraging the use of AI to promote efficiencies in judicial decision-making while calling for clear standards that promote responsible reliance on AI and algorithmic transparency.

What is Artificial Intelligence?

7 There is much debate about the definition of AI because it invokes philosophical discussions about what, for example, is "intelligence." However, AI can be defined as "[t]he theory and development of computer systems able to perform tasks normally requiring human intelligence."⁶ Alternatively, AI is an "activity devoted to making machines intelligent, and intelligence is that quality that enables an entity to function appropriately and with foresight in its environment."⁷

8 AI is an umbrella term that incorporates, for example, the following four processes:

- Natural language processing refers to a system's ability to process and understand human language to convert it into comprehensive representations (e.g., chat-bots, real-time text translation).
- Visual recognition uses deep-learning algorithms to analyze and understand images including scenery, objects, people and animals, and colours.
- Machine learning is, in short, a self-teaching computer system. Machine learning systems analyze large quantities of data to make decisions based on statistical predictions.
- Deep learning operates by using artificial neural networks (inspired in design by the human brain) to train computer systems on large quantities of data to recognize patterns in digital representations of sounds, images and other data.⁸

Artificial Intelligence Use in the Courts is Not a New Phenomenon

9 Simpler forms of AI have been used in the justice system for decades. For instance, in 1988, Justice Charles Rippey, administrative law judge of the US Department of Labor, co-authored a promotional paper about a specialized computer system for judicial decision-making called JEDA (Judicial Expert Decisional Aide).⁹ JEDA was created to assist administrative law judges with the processing of benefit claims from coal miners suffering from chronic pneumoconiosis (or black lung disease).¹⁰ Justice Rippey promoted the use of JEDA to assist in the claims process as follows:

At certain decision points, when JEDA detects a conflict in the evidence, it presents information about the conflicting evidence reports and allows the judge through use of the editing window to explain the resolution of the conflict and insert language setting forth a discussion and rationale in support of the judge's conclusion.

10 Justice Rippey seems to have been ahead of his time because there was little pickup of JEDA by other judges in his division. According to our research, Justice Rippey is likely the only judge to have used JEDA, which he did from 1987 to the early 1990s, after which it appears JEDA was decommissioned.

11 At the same time in the 1980s in Canada, the Law and Computer Project at the University of British Columbia was developing a database of sentencing decisions to allow judges to determine sentencing norms based on the nature of the crime, age, gender and marital status of the defendant, and any prior convictions of indictable offences. This system entered into circulation in 1987 in the Provincial Court, Supreme Court and Court of Appeal of British Columbia and was reportedly quite useful.¹¹

12 Fast forward 30 years and more sophisticated systems are coming into vogue in adjudication. For example, AI is being used today to predict verdicts in cases brought before the European Convention on Human Rights (ECHR). A UK-US collaboration among University College London, the University of Sheffield and the University of

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Pennsylvania has been testing a system's ability to determine whether there has been a violation of select articles of the ECHR. Through text analysis, the system has correctly predicted the verdict in 79 percent of cases (based on comparison with human decisions).¹²

13 Online dispute resolution (ODR) systems are also gaining in popularity as more efficient and expedient ways to resolve disputes. ODR - the use of technology to decide or assist in the adjudication of claims - takes many different forms including, among others, online arbitration, negotiation and Crowdsourced justice.¹³

14 In British Columbia and Quebec, ODR is being used to decide certain civil claims. British Columbia's Civil Resolution Tribunal resolves disputes about contracts, debts, personal injury, personal property, and consumer issues under \$5,000. Québec's Plateforme d'aide au règlement des litiges en ligne (PARLe) resolves certain disputes between consumers and retailers.¹⁴ The Ontario government, which has been looking for opportunities to incorporate ODR for several years, has announced a renewed interest in pursuing ODR for certain claims.

15 A more striking example of the use of AI in judicial decision-making is in the criminal context, where AI is being used to inform judicial decision-making in bail, sentencing and parole hearings.

Artificial Intelligence-based Risk Assessments in Criminal Proceedings

16 In certain jurisdictions in the United States and England, AI systems have been used in criminal proceedings for more than a decade. Specifically, judges and prosecutors are increasingly relying on AI-based tools to conduct risk assessments of defendants in bail, sentencing and parole decisions. Although risk assessments are not new to criminal proceedings, AI-based tools can analyze a deeper and broader set of data to predict recidivism, which includes the use of statistical probabilities based on individual characteristics, such as the defendant's age, prior criminal record and employment history,¹⁵ as well as group data.¹⁶

17 AI-based risk assessments are being credited for reducing the prison population in some parts of the United States. For example, Virginia, which was one of the first states to employ the now well-known system called COMPAS (Correctional Offender Management Profiling for Alternative Sanctions), has slowed the growth in the prison population from 31 to 5 percent in a decade.¹⁷ COMPAS, an AI-based tool that gathers individualized and group data and assigns a risk classification to a particular defendant, is now being used in more than 20 jurisdictions in the United States.

18 However, there is no law specifically regulating these tools so they tend to be "black-boxed," meaning the proprietary algorithm is a protected trade secret. The result is a lack of transparency in the system's decision-making process and accountability for outputs¹⁸ that creates barriers for defendants who wish to appeal an order that relies on the risk assessment output. The lack of transparency makes it difficult to understand and challenge the biases found in such algorithms, including racial and socio-economic discrimination.¹⁹

19 ProPublica, an investigative non-governmental organization, published an in-depth article in 2016 about the COMPAS system.²⁰ COMPAS measures the likelihood of three types of recidivism: pre-trial recidivism, general recidivism and violent recidivism. Although COMPAS does not ask the defendant's race, it is reported that many of the questions asked contain statistical biases pointing to a targeted group (such as postal code or prior arrests).²¹ ProPublica reported that a discrepancy in the data revealed that the system was differently calibrated for African Americans than for white individuals, such that African Americans are more likely to prompt positive predictions in proportion to the actual rate of recidivism.²² (That having been said, a recent study showed that COMPAS is at least as good at predicting recidivism as humans are.)²³

20 Let's look at a concrete example to better understand the impact. The case of *Wisconsin v. Loomis* illustrates the debate expected with the adoption of COMPAS-like technology. In this case, Eric Loomis, 35, was arrested for his involvement in an attempted drive-by shooting in La Crosse, Wisconsin.²⁴ Despite Mr. Loomis's guilty plea, the judge disregarded the plea deal and sentenced Mr. Loomis to six years imprisonment. At the sentencing hearing

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Judge Scott Horne stated: "The risk assessment tools that have been utilized suggest that you're extremely high risk to reoffend."²⁵

21 Mr. Loomis sought post-conviction relief on the basis that the court's reliance on COMPAS violated his right to due process for three reasons: (1) since the proprietary nature of the COMPAS software prevented Mr. Loomis from assessing the accuracy of the score, it violated his right to be sentenced based on accurate information; (2) it violated his right to an individualized sentence because the trial judge relied on information about the characteristics of a larger group to make an inference about his personal likelihood to commit future crimes; and (3) it improperly used "gendered assessments" in calculating the score.²⁶

22 In July 2016, the Wisconsin Supreme Court affirmed the lower court's decision that the risk assessment may be considered as one factor among many used in sentencing. The unanimous court also concluded that the tool did not violate Mr. Loomis's due process right to not be sentenced on the basis of gender.²⁷ The court's reasoning was that the system was only one tool for the judge to use in making his decision. The court's finding in this regard makes good sense, except that these systems are highly persuasive and, unlike human perception and judgment, can be viewed as hard data. Remiss would be the judge who releases the "high risk" defendant on parole and later learns the defendant reoffended. Will these systems, in time, replace human judgment?

23 Risk assessments are used in Canada,²⁸ though there is no indication that COMPAS or a system like it is being used here. It is likely a matter of time before such tools become available and, in time, widely adopted.

Concerns with Algorithmic Bias and Accountability

24 As stated, information derived from AI systems can be deeply persuasive given the breadth of information analyzed and their increasingly impressive accuracy rates. This technology can and will be informative in law. But as members of the legal profession, we should not be lulled into sleepy acceptance by the information these systems generate. Where AI is being used to affect human life, including in the criminal context where liberty interests are at stake, the ability to understand and scrutinize the decision is critical.

25 AI is often built by human programmers, at least at the outset, engaging a process that can involve unconsciously programming algorithms to reflect one's deeply ingrained biases. In other words, "machine bias is human bias."²⁹ In general, there are at least four basic kinds of biases that can be present in AI systems.

26 Data-driven bias (or latent bias) exists where the algorithm incorrectly correlates ideas with certain characteristics or stereotypes, such as gender, race, sexuality and income. The output of the system is determined by the data it receives - in other words, "garbage in, garbage out." A few common examples of this type of bias are the association of the word "doctor" with men, the word "nurse" with women, or the word "person" with white males - all of which are Google Image search results.³⁰

27 Selection bias occurs when the data used to train the algorithm over-represents one group of the population, which skews the output by making the algorithm operate better for that group at the expense of others. An example of selection bias is the online beauty contest called Beauty.ai, which promised to grade its human contestants by artificial intelligence. The algorithm considered factors such as face symmetry, blemishes, perceived age and race, and it appeared that race played a significant factor in the results: 36 of the 44 pageant winners were white.³¹

28 Emergent bias (or similarity bias) occurs when decisions made by the systems, which are aimed at personalizing the user's experience, create "bias bubbles." This results in a skewed flow of information to the user as the output. One example is the posts that appear in a user's timeline on Twitter or Facebook: The user is shown only similar posts based on the data that are liked and shared by that user.

29 Interaction bias exists when the user biases the algorithm by interacting with it. A recent example is Microsoft's Twitter-based chatbot called "Tay," which was programmed to learn from the behaviour of other Twitter users.

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Within 12 hours of its social media launch, it turned into an aggressive racist and Holocaust-denier bot that was quickly removed from Twitter.³²

30 Many of the most powerful emerging machine and deep learning techniques are so complex and opaque in their workings that they defy careful examination (see "The Dark Secret at the Heart of AI"³³). To address this issue, researchers are exploring ways to make these systems give some approximation of their workings to engineers and end-users.³⁴

31 To address and avoid bias in algorithmic adjudication, the legal community and AI programmers need to develop a thorough understanding of the technology involved and the complex nature of the social issues resulting from bias and discrimination.

32 A seemingly neutral variable, such as the defendant's number of prior convictions or annual salary, is not truly neutral. In the Canadian context, systematic biases demonstrate that Indigenous men and women are overrepresented in the judicial system as victims and offenders.³⁵ While algorithms are searching for a true pattern in the data, it is never certain whether the pattern is of the population as a whole, or whether there is something contextual (but not captured in the algorithm) found in the data. If algorithmic adjudication is the future of the legal profession, accountability is required.

Cautious Adoption is Necessary

33 The incorporation of AI in judicial decision-making can create more efficient and consistent processes and outcomes. However, where algorithms are used in a manner that will affect human life, it is imperative that there be a manner in which their decisions are able to be scrutinized, understood and explained. This process requires thoughtful debate about AI technology, law and ethics, to ensure an informed approach to incorporating and managing the use of such a powerful technology in law.


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condition and that the condition has disabled the miner from performing former coal mine duties. Processing the claim required a hearing with a federal administrative law judge in which the claimant would provide live testimony regarding the claim as well as documentary evidence largely consisting of medical records.

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