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AI, Machine Learning & Big Data

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Canada

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Introduction

In the past few years, we have seen artificial intelligence (AI) move from the periphery and become more and more mainstream, as real, practical use cases, such as chatbots, image and facial recognition, and robotic process automation, are starting to be deployed across industries. Across the globe, AI advocates are predicting that AI will fundamentally reshape the ways in which we live and transform the consumer and business experience.

As global competition to lead the AI race increases, Canada, propelled by a stellar research community 30 years in the making, and an innovative and dynamic ecosystem, is set to become a global leader in AI.

Canadian trends

Research and development

Canada has been at the forefront of AI advancements for decades and has gained notoriety for being a global AI hub. The research of Geoffrey Hinton, Yoshua Bengio and Richard Sutton, the so-called Canadian "founding fathers" of AI, underlie many of today's prolific AI advancements.

The Canadian research community continues to uphold this legacy. By some estimates, Canada boasts the third-largest concentration of AI experts in the world.[1] The students of the founding fathers are at the forefront. Ilya Sutskever, who studied under Geoffrey Hinton, is now a co-founder and director at OpenAI, an AI-focused non-profit co-founded by Elon Musk. The city of Montreal, where Yoshua Bengio was educated, has the highest concentration of researchers and students of deep learning in the world, with almost 9,000 students in AI and related programmes. Researchers from the University of Alberta, including Richard Sutton, rank #2 in Artificial Intelligence/Machine Learning combined, according to worldwide university rankings.[2]

Canada is already home to a dynamic technology ecosystem with more than 4,000 active startups, making it one of the world's largest innovation hubs.[3] The Toronto-Waterloo region, Canada's technology and innovation capital, is second only to Silicon Valley in the number of technology workers and companies.[4] AI is no exception; Toronto has the highest concentration of AI startups in the world.[5] In 2017–2018, there was a 28% increase in the number of active AI-related startups. Meanwhile, Canadian job opportunities in AI have grown more than 500% since June 2015.[6]

Key actors and significant developments

The Canadian AI industry is quickly accelerating, supported by research labs, government funding, and global investors. The Vector Institute, founded in Toronto and committed to

attracting, developing and retaining top Canadian AI talent, is where some of the world's top minds in machine learning and deep learning come together to collaborate on research, data and real-world problems.[7] It has received more than CAN$100 million in combined provincial and federal funding, and CAN$80 million from more than 30 private partners, including Air Canada, Shopify, Telus, Google, Uber, and Thomson Reuters.[8]

Other regions of Canada are also emerging as AI hubs. Montreal is home to the Montreal Institute for Learning Algorithms (Mila), one of the world's largest public deep learning labs with sponsors like IBM, Facebook and Google.[9] The Waterloo Artificial Intelligence Institute has partnered with more than a dozen research labs to create products and services actively used by many AI firms, such as MioVision (traffic data collection), Clearpath Robotics (autonomous mobile robots), and Kik Interactive (chat application).[10] In Edmonton, the Alberta Machine Intelligence Institute (Amii) is considered a global leader in machine intelligence research,[11] and the city of Ottawa is preparing to open a 16km test track for self-driving cars, which will be the first of its kind in North America.[12]

Businesses are already implementing innovative AI solutions developed by Canadian startups. When Corus Entertainment, a Canadian broadcaster, worked with Integrate.ai to win back viewers from giants such as Netflix and Amazon, their partnership was 50% more effective than past efforts in generating viewership for certain shows.[13] Acerta Analytics Solutions of Kitchener, Ontario, developed an AI-enabled quality control solution for the manufacturing industry and is already being used by major international car manufacturers, such as Daimler (Mercedes Benz) and Volkswagen. Finn.ai, which won the Best of Show at the Finovate conference in New York in 2017, supplies the Bank of Montreal with a personal chatbot to directly engage with customers.[14]

Finance and investment

The strength of the Canadian AI ecosystem has spurred a growing level of finance and investment from private and public actors. Funding to Canadian AI companies in 2017 surpassed 2016 totals by a wide margin, as US$252 million was invested across 31 deals.[15] This number increased by 51% in 2018, when Canadian AI companies raised US$418 million.[16]

Acquisitions have been driven by strategic buyers in recent years. Microsoft acquired Maluuba, a Montreal and Waterloo-based startup specialising in natural language understanding.[17] As of early 2016, Maluuba's natural language understanding technologies were being used in more than 50 million devices around the world.[18] Layer 6 is another successful AI company based in Canada. It developed AI that can transform financial banking data into more personalised services for consumers. TD Bank acquired Layer 6 in 2018, after which it integrated Layer 6's capabilities into the bank's operations in the hopes of providing more directed services for customers.

The Government of Canada is also committed to ensuring the country succeeds in this space. Announced as part of its federal budget released in March of 2017,[19] Canada was the first country in the world to adopt a national AI strategy.[20] The "Pan-Canadian Artificial Intelligence Strategy", a CAN$125 million commitment over five years, is led by CIFAR (Canadian Institute for Advanced Research) and is intended to build on Canada's long pioneering history in the field by attracting, developing and retaining top talent in Canada, advancing research and fostering collaboration across the country, and providing thought leadership on the impacts of AI. CIFAR is working with researchers and partners in Canada, France (CNRS) and the UK (UKRI) to explore economic, legal, ethical and social perspectives on AI as part of its AI & Society programme, and CIFAR and its partners have

also been running the AI Futures Policy Labs, which is a series of workshops to promote discussions across Canada about the future of AI, its impact on society, and potential public policy repercussions.[21] In 2018, the Government of Canada also announced it would be investing more than CAN$950 million in five "superclusters" of innovative industries – what it calls "made-in-Canada Silicon Valleys" – including two focused on AI and digital technology.[22]

AI-related issues

Despite the significant interest and private and public investment in AI in Canada, the Canadian legal and regulatory framework is playing catch-up to the realities of this new world. The application of Canada's legal and regulatory regimes, which were not created to address unique AI issues, presents unique challenges to legal advisors advising clients that are developing, using or otherwise seeking to commercialise AI solutions. Key examples include the following:

Intellectual property

The ownership of intellectual property in the AI models that incorporate machine learning algorithms (which are themselves often open source) is complex, and not always clear, as the legislation in Canada supporting intellectual property was not written and has not been adapted to deal with AI. For example, in the case where the AI model creates a work product, there is no "author", as this concept is understood in copyright law, and no "inventor", as this concept is understood in patent law. Moreover, it may turn out that the data comprising such work product does not meet the legal threshold necessary for intellectual property protection, as Canada does not have a statutory regime that protects ownership of raw data elements.

Data rights

Businesses in Canada that procure AI-based tools or services typically view their data as a valuable asset and expect AI suppliers to agree that use rights in data and insights derived from or based on the customer's data will be exclusively for the customer's benefit. However, this derived data (which includes both the final output data, as well as the intermediary meta-data that is generated during the course of processing the customer data) also has significant value for a supplier's future customers that are similarly situated. As such, suppliers also have an interest in obtaining the right to use this data. Without clear legislation or judicial guidance from the courts, it is imperative that suppliers and customers clearly allocate data use rights as between supplier and customer in their commercial contracts.

Privacy

Meaningful consent and reasonable purpose restrictions are at the heart of Canada's privacy legislation. Although limited exceptions exist, processing information about an identifiable individual requires meaningful, informed consent (typically separate and apart from a privacy policy). Even with consent, the collection, use of, or disclosure of personal information must satisfy a "reasonable purpose" test.[23] As AI increases in complexity, obtaining meaningful consent and satisfying the reasonable purpose test is becoming increasingly difficult and the importance of recognising alternative authority for processing personal information grows. As such, suppliers are increasingly seeking to limit the application of privacy laws by "anonymising" the data that their AI solutions require, but achieving "anonymisation" of such data, itself or in combination with other data, is not a trivial task;

and it is often the case that when suppliers are pushed to describe their anonymisation protocols, true anonymity is not achieved.

Torts

Under Canadian tort law (or extracontractual liability in the province of Québec), a party may be liable to another party for injury due to the first party's negligence with respect to the goods or services they provided. Suppliers of goods and services owe a duty of care to the users or consumers of such goods or services as is reasonable, taking into consideration all of the circumstances. There is little in the way of case law on the application of tort law to AI; however, the following are examples of areas where tortious liability has historically been applied, and which should be closely watched as having potential application to AI:

- Manufacturing and design defects – Generally, the manufacturer or supplier of defective products can be exposed to tort liability if a defective product or the flaw in the design of the product gives rise to harm or injury that should have been foreseen by the manufacturer or supplier, and if the standard of care has not been met in consideration of all of the circumstances.[24] In the context of AI, the question is whether a higher standard of care will be applied to manufacturing or design defects since (in theory) the use of AI in manufacturing and design should reduce the likelihood of defects or flaws. Note that in Québec, a manufacturer, distributor or supplier is not bound to repair the injury if it proves that, according to the state of knowledge at the time that the product was manufactured, the existence of the defect could not have been known.[25]

- Failure to warn – Tort liability can also arise for a supplier of products or services that fails to warn users or consumers of the potential danger in using or consuming the product or service. In the context of AI, this could require suppliers of AI-related technologies to consider the potential for the technology to cause suffering or harm and to provide sufficient notice or warning to users and consumers accordingly. It remains to be seen whether some of the less understood risks associated with using AI will become the norm and accepted, and therefore alleviate the need for such warnings.

Case law in this area may be slow to develop as Canadians are generally less litigious, particularly in relation to our U.S. neighbour. The challenge facing Canada will be in determining to what extent the creators/inventors or suppliers of an AI-related technology should be held liable under tort law, when the technology has evolved to be able to modify and even create products and services without any human intervention. It will be interesting to note in what respect decisions concerning "autonomous acts of things",[26] which includes, for example, x-ray machines, automatic car washes, and anti-theft systems, will be used in the AI context. Decisions around the duty and standard of care owed in such circumstances will need to address many policy considerations around responsible use of AI, including weighing the public benefit of advances in AI against necessary frameworks for oversight and accountability.

Consumer protection legislation

In addition to tort law, Canadian provinces and territories also have legislation that is applicable to consumer protection, sale of goods and product warranties that apply to goods and services. The extent to and the manner in which such legislation applies to AI-based products and services remains to be seen, but raises a number of interesting issues. For example, will the designer, the user or both be liable if an AI-based product is not compliant with such legislation? Navigating this regulatory landscape, which is comprised of a patchwork of provincial legislation that, while having similar themes, may have different requirements, may pose real challenges where AI-based goods or services are caught within its framework.

Criminal law

In Canada, criminal offences generally require both an act or failure to act (or *actus reus*) and a mental intent (or *mens rea*), with the standard of proof being beyond a reasonable doubt. Exceptions to the foregoing include strict and absolute liability offences. A material contributor to the uncertainty with respect to the application of criminal law to AI-related products or services is the *mens rea* requirement; and, as such, the following questions should be carefully considered:

- Although it may be possible for AI products or services to commit an act (or fail to act) in a manner that is contrary to Canada's *Criminal Code*, can AI products or services have the requisite *mens rea*?
- Who (or what) should be punished for a criminal offence for which an AI product or service was responsible, and what should that punishment be?

The lack of a legal regime to directly regulate AI currently poses challenges as the various stakeholders determine how to comply with or apply a regulatory framework that was established without considering AI-related issues.

Recognising the challenges presented by Canada's outdated legal and regulatory framework, the Government of Canada has begun to lay the groundwork for managing AI-related issues well into the future. These initiatives include the following:

National data strategy

The Minister of Innovation, Science and Economic Development launched a national consultation on digital and data transformation to better understand how Canada can drive innovation, prepare Canadians for the future of work, and ensure that Canadians can have trust and confidence in how their data is used.[27] This consultation includes a consideration of the multitude of issues presented by new and emerging AI capabilities.

Copyright review

As part of its review of the Copyright Act,[28] a committee of parliamentarians (the House of Commons' Standing Committee on Industry, Science and Technology) received numerous submissions from stakeholders – including Canada's leading machine learning institutes (the Vector Institute, the Alberta Machine Intelligence Institute and the Montreal Institute for Learning Algorithms) – recommending that using a computer to analyse lawfully acquired work should not require a separate licence. Submissions highlighted that Canada runs the risk of falling behind other countries, including the US, Japan and EU, which have copyright regimes that allow for information analysis of works without a separate licence, including for commercialisation purposes.

Privacy

Following a year-long review of federal privacy legislation, the House of Commons Standing Committee on Access to Information, Privacy and Ethics recommended that the Government of Canada consider amending the law to clarify the terms under which personal information can be used without consent where necessary to satisfy legitimate business interests.[29] Similarly, the Privacy Commissioner of Canada has recommended that the government identify "*ways to protect privacy where consent may not work, for instance in certain circumstances involving the development of artificial intelligence. The concept of 'legitimate interest' in the GDPR may provide one such alternate approach*".[30]

In addition, recognising the need for an international approach to and standards for AI, the Privacy Commissioner of Canada and its provincial counterpart in Québec, along with their

global counterparts in over a dozen other countries, adopted the *Declaration on Ethics and Data Protection in Artificial Intelligence* in October 2018.[31] The declaration sets out guiding principles, including those related to fairness, transparency and privacy by design. In furtherance of this adoption, the Office of the Privacy Commissioner of Canada has stated its intention to monitor AI developments in Canada and globally in anticipation of developing guidance.[32]

Algorithmic transparency

The Government of Canada has published a draft *Directive on the Use of Machine Learning for Decision-Making*[33] that seeks to ensure that automated decision systems based specifically on machine learning (any information technology that learns and improves from examples, data, and experience, rather than following pre-programmed rules) are designed and deployed in a manner that reduces risks to Canadians and federal institutions, resulting in improved transparency, accountability, legality and procedural fairness in administrative decisions.

Open data

The Government of Canada is a vocal proponent of open data – that is, making available structured, government-controlled and funded data that is machine-readable and freely shared, used and built on without restrictions. However, Canada ranks well behind several countries, including the United Kingdom and the United States, on the Open Data Barometer survey.[34] *Canada's 2018-2020 National Action Plan on Open Government*[35] aims to address many of the shortcomings with Canada's approach to date, which has so far included setting up an Advisory Committee on Open Banking in September 2018[36] and issuing a consultation paper on the merits of open banking in January, 2019.[37]

Governance and ethics

While the ethical issues raised by the application of artificial intelligence and machine learning are of global interest, Canada is at the forefront in considering the implications. Issues such as bias, safety, transparency, explainability, humanity, accountability and predictability, and their implications for everything from wealth inequality to discrimination to technology addiction, are all being considered by various stakeholders across the country and by Canadian representatives in international forums. Indeed, a number of initiatives supported by various levels of Canadian Government will consider the ethical dilemmas raised by advances in AI:

• March 2018: the Province of Québec announced funding for the creation of OMIA (*Organisation mondiale de l'intelligence artificielle*), an intergovernmental organisation whose mandate is to promote agreement among member states on standards and practices that should govern the development and use of AI.

• June 2018: Prime Minister Justin Trudeau and President Emmanuel Macron issued a joint Canada-France statement on AI, where they committed to establishing an international study group that would support global collaboration and expertise in AI, and address opportunities of common interest to, and their impacts on, citizens.

• September 2018: the Treasury Board of Canada Secretariat announced the Government of Canada Digital Standards. These standards are intended to guide the design and improvement of digital services provided to the public by the Canadian Government, and compliance with ethical guidelines in the design and use of automated decision-making systems (such as AI) is identified as one of the 10 standards.

• December 2018: the Treasury Board of Canada Secretariat also made the latest updates to its draft Directive on the Use of Machine Learning for Decision Making.

- December 2018: the Fonds de Recherche du Québec launched the International Observatory on the Societal Impacts of Artificial Intelligence and Digital Technologies. Its mandate is to collaborate with the Government and public and private sectors, both nationally and internationally, in informing public policy on the development and use of AI and digital technologies.

- December 2018: Montreal hosted the G7 Multistakeholder Conference on Artificial Intelligence[38] to build on the G7 Innovation Ministers' Statement on Artificial Intelligence, wherein a "common vision of human-centric AI" was propounded.[39] As a starting point for discussions at this meeting, Canada and Japan collaborated on an insightful paper about accountability and trust in AI.[40]

Most notably on the non-governmental front, the Université de Montréal, in collaboration with the Fonds de Recherche du Québec, published the *Montreal Declaration for Responsible Development of Artificial Intelligence* on December 4, 2018,[41] which sets out recommendations for informing the digital transition to ethical AI, based on 10 principles that promote fundamental human rights and interests. In addition, on January 31, 2019, the CIO Strategy Council, whose membership champions the transformation of the Canadian information and technology ecosystem, published a draft standard entitled *Automated decision systems using machine learning: Ethics by design and ethical use*, for public comment.[42]

These activities represent only the first steps in what will ultimately be, for Canada, a concerted, multi-year effort to achieve an appropriately balanced regulatory and governance framework that will effectively promote the growth of AI within Canada, while at the same time addressing the novel legal and ethical risks and issues that AI presents. In the meantime, in the absence of AI-specific regulatory or legislative oversight, it is especially important that the allocation of the risks and responsibilities associated with the issues presented by AI are addressed by the parties contractually.

Implications for business

Parties negotiating agreements for the development, deployment or use of AI are faced with a number of challenges, some of which are typical during the nascent phase of any new technology, and others that are unique to the technology. Canada operates within legal frameworks, both in its common law and civil law provinces and territories, that generally allow considerable freedom of contract, especially for business-to-business commercial arrangements. A number of typical clauses in technology agreements require reconsideration in the context of AI-related projects, including:

Ownership of AI

In Canada, negotiations around the ownership of the underlying AI solution are often multi-faceted, and a meaningful discussion of ownership often needs to involve a case-by-case consideration of the various elements of the solution, which are typically comprised of: (i) the AI model, which is a mathematical representation used to achieve the desired outcome (such as to make a prediction); (ii) the learning algorithms, many of which are open source and widely available; (iii) the ancillary algorithms, such as those used to select an AI model or to support the training of AI models; (iv) the data inputs; (v) the data outputs; and (vi) improvements or modifications to any of the foregoing. For example, the performance of a supplier's AI model will generally improve from processing large and varied data sets from multiple customers, so the supplier may not be interested in restricting or diluting its rights in enhancements and improvements to its AI model, as the supplier's AI model becomes increasingly valuable with each new customer. However, in other cases, the value to the

supplier may not lie in the AI model that is unique to a particular customer, but in the ancillary algorithms used to select or train the AI model, which can be broadly leveraged for future customers. In these circumstances, the supplier may be comfortable with the customer owning the AI model so long as it retains ownership of the ancillary algorithms. Ultimately, the typical allocation of ownership in standard technology agreements must be carefully assessed in the context of the specific AI in question, in order to effectively address the commercial intent of the parties. Traditional IP ownership frameworks, which address concepts of pre-existing (or background) IP and newly developed IP, will often not be appropriate in the context of an AI-based solution, and will not accommodate the nuanced treatment that may be needed to address the complexity of the AI world.

Data use rights

In Canada, the default position in a standard technology agreement in favour of the customer would allocate data use rights in the customer's data and any output that is based on that data to the customer, as well as limit the supplier's access to the data to the term of the agreement and for a limited purpose (note that this is often referred to by parties to commercial agreements as "ownership" of the data; however, within the Canadian legal framework, data is not owned, and it is therefore preferable that the parties clearly negotiate their respective use rights in the data). This typical default position with respect to data use rights may not meet the needs of a developer or supplier of AI, whose business model might rely significantly (or entirely) on continued access to and use of the data and any data derivations. Ongoing access to and use of the data could, for instance, permit greater flexibility to the supplier to later modify or optimise the performance of an AI solution, and derivations of the original data can sometimes be reused to develop or enhance AI solutions for similarly situated customers in the future.

As is the case with the AI solution itself, the negotiation of data use rights as between the parties requires a first principles discussion in the context of the particular AI solution, with a detailed understanding of the various data elements and their sources, which may be numerous and complex. Parties must ensure that their rights to the data, whether collected directly by one of the parties, obtained from third parties, or generated by the AI solution, are broad enough to permit the activities contemplated. Many data licences have scopes of use that were drafted and negotiated well before AI or even advanced data analytics attained widespread use. As a result, the licensee of data that is subject to such a licence may easily find itself in breach of the licence terms, by making the data accessible to an AI supplier or by using the data internally in new and, from the perspective of the licence terms, unanticipated ways.

Allocation of risk

Parsing through the allocation of risk in an AI-related contract can be challenging, and is highly fact-specific. Some algorithms that underpin the ability of a self-learning system to continue to develop and refine its capabilities without human intervention can be, or can quickly become, opaque – even to its creators. For example, this is often the case with deep neural network implementations of AI, where studying the structure of the underlying algorithm will not yield insights into how the implementation operates in practice. It is thus essential to ensure the proper risk allocation so that the right party is responsible for monitoring and promptly acting on issues as they arise.

To add additional complexity, it is often the case that many AI implementations (particularly in the machine learning category) are only as good as the data used to train them, with the result that inherent gaps or biases in data sets may be amplified. Whether damage has been

caused by a defect in the underlying algorithm, or by the quality of the data (or some combination of the two), may be difficult or impossible to determine. The fact that the data sets may originate from multiple sources can make this exercise even more difficult.

In addition, a failure to adequately understand the data and how the AI is consuming the data could expose the parties to liability if the end solution fails to meet basic legal and regulatory compliance requirements, such as where the AI operates in a discriminatory manner.

As a result, parties are approaching traditional risk allocation contract terms like warranty, indemnity and limitations of liability cautiously and often with dramatically different expectations. For example, suppliers of AI-related technologies may be willing to warrant their own performance in creating and providing the technology, but they may distinguish this obligation from any responsibility for the customer's reliance on results, which are probability-based and may therefore vary depending on the point in time at which they are relied upon by the customer.

Given that the current legal regime, as it applies to AI, remains untested in Canada, it is of particular importance that the parties set out their expectations with respect to use of data and ownership in AI, so that contract law will protect their intent with respect to each other (if not to third parties). Parties should also be aware that the rationale for allocating risk in these contracts can vary widely depending on the potential risk inherent to the AI being deployed. For instance, the risk allocation rationale for AI used to perform internal analytics will be dramatically different from that of AI used in customer-facing services, or which may injure or otherwise cause users to suffer loss or damage. The industry has yet to settle on anything like a standard or market position on such matters, and the resulting agreements remain highly contextual.

Concluding thoughts

Canada is poised to lead the conversation and, ultimately, to develop a made-in-Canada approach to AI that becomes the global standard. However, at this stage, the legal and regulatory framework and the uncertainty that it creates threatens to impede Canada's progress. If Canada is able to translate its early lead in developing AI and AI talent into being one of the first countries to develop a thoughtful and well-informed legal and regulatory framework in anticipation of managing the risks and promoting the benefits of AI, this country will be in a position to reap the rewards for generations to come. Until the legal and regulatory framework catches up to the technology, it is critical that legal advisors have an awareness of the unique legal issues and challenges that AI presents, and that they work to address these issues with their clients from first principles within the context, and with a full understanding of, the applicable AI technology.

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