AI, Machine Learning & Big Data

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Contributing Editors:
Matt Berkowitz and Joshua Thompson

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Singapore

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Trends

Artificial intelligence ("**AI**"), big data, and machine learning have been the subject of tremendous interest in Singapore in recent years. Advances in mobile computing and increasingly widespread Internet and social media usage, amongst other things, have contributed to the availability of large volumes of data, which are increasingly being analysed by machine learning algorithms to make predictions or decisions.

In line with the Singapore Government's vision of transforming Singapore into a "Smart Nation", it aims to position Singapore as a world leader in the adoption and use of AI technologies to drive economic growth and improve the life of its citizens, and to position Singapore as a big data hub. To these ends, the Government has launched a slew of initiatives to promote the adoption and development of these technologies in Singapore across the public and private sectors, to build AI capabilities, and to create a highly conducive environment for businesses to thrive in these fields.

On 28 February 2019, Minister-in-Charge of the Smart Nation Initiative, Vivian Balakrishnan, speaking in Parliament during the Committee of Supply Debate 2019, stated that "AI, and in particular deep machine learning, has revolutionised the scene in recent years" and that Singapore needs to "double down" on efforts to develop AI as a strategic capability and for Singapore to become a trusted global hub for test-bedding, deploying and scaling up AI solutions.

Some of the initiatives that have been launched in Singapore in recent years include:

(a) the Smart Nation initiative, a Government-led nationwide effort which seeks to transform Singapore into a "Smart Nation" by harnessing digital technologies across all segments of society;

(b) the establishment of the Smart Nation and Digital Government Group Office under the Prime Minister's Office, helmed by a committee of Ministers, to lead digital transformation efforts as part of the Smart Nation initiative;

(c) the establishment of the Government Technology Agency, a statutory body that serves as the implementing agency of the Smart Nation initiative. Its roles include transforming the delivery of Government digital services and building Smart Nation infrastructure;

(d) the establishment of SGInnovate, a Government-owned company under the purview of the National Research Foundation, which invests in and develops deep tech startups in Singapore;

(e) the launch of AI Singapore, a national AI programme by the National Research Foundation (a department within the Prime Minister's Office which sets the national

direction for research and development) to build AI capabilities, grow local talent, build an AI ecosystem, and put Singapore on the world map. Its activities include seeding and providing support for AI research, accelerating the adoption of AI by Singapore-based organisations, and AI talent development;

(f) the formation of the Advisory Council on the Ethical Use of AI and Data, to tackle ethical questions raised by the growing use of AI, in order to develop a trusted AI ecosystem. The 11 council members are drawn from a range of backgrounds and comprise international leaders in AI such as Google and Alibaba, advocates of social and consumer interests, and leaders of local companies keen to make use of AI;

(g) under the key performance indicators stated in the Digital Government Blueprint released in 2018, all ministries and their related agencies are to have at least one AI project for service delivery or policy-making; and

(h) the launch of the Future Law Innovation Programme by the Singapore Academy of Law, aimed at encouraging the adoption and invention of new technology amongst law firms, legal departments and legal tech startups.

Various governmental and regulatory agencies have also issued policy papers setting out their views on matters relating to AI and big data, and have invited stakeholder feedback on certain policy issues and proposals by way of consultation exercises. Recent examples include:

(a) the Proposed Model AI Governance Framework ("**Model Framework**") issued by the Personal Data Protection Commission ("**PDPC**") for public consultation, pilot adoption and feedback. The Model Framework is the first in Asia and is intended to provide detailed and readily implementable guidance to private sector organisations to address key ethical and governance issues when deploying AI solutions;

(b) a research paper entitled "*Data: Engine for Growth – Implications for Competition Law, Personal Data Protection, and Intellectual Property Rights*", published by the Competition & Consumer Commission of Singapore ("**CCCS**", formerly the Competition Commission of Singapore) in collaboration with the Intellectual Property Office of Singapore ("**IPOS**"); and

(c) a discussion paper on data portability issued by the PDPC in collaboration with the CCCS, setting out the findings of a study on the potential introduction of a data portability requirement and discussing the impact and benefits of such a requirement.

Ownership/protection

The Singapore Government has sought to facilitate the protection of intellectual property ("**IP**") rights in AI technologies, in order to support innovative enterprises to bring their AI products to market faster. Notably, on 26 April 2019, the IPOS launched an Accelerated Initiative for Artificial Intelligence ("**AI^2**") scheme, which will accelerate the grant of AI-related patent applications to six months, compared to the typical period of two years or more. This represents the world's fastest patent application-to-grant process for AI inventions. The scheme is limited to the first 50 applications filed, subject to the IPOS's discretion to adjust the cap and/or criteria subsequently.

The IPOS's circular on the AI^2 scheme defines AI as follows:

> "AI refers to a set of technologies that seek to simulate human traits like: sense, comprehend, act and learn to achieve specific tasks. AI inventions are commonly associated with, but not limited to, machine learning. Machine learning is the form of AI that uses algorithms and statistical models to enable computers to make decisions without having to be explicitly programmed to perform a particular task…"

Eligibility for the AI[2] scheme is subject to compliance with the following criteria:

(a) the application is an AI invention (e.g., image recognition, speech/voice recognition, natural language processing, and autonomous systems);

(b) the application has to be first filed in Singapore;

(c) Form PF1: Request for Grant of Patent, and Form PF11: Request for Search and Examination Report have to be filed on the same day;

(d) the application contains 20 or fewer claims;

(e) the applicant must respond within two weeks from the date of receipt of a Formalities Examination Adverse Report;

(f) the applicant must respond within two months from the date of receipt of a written opinion; and

(g) a supporting document tagged as a Fast Track document stating that the application is an AI invention must be furnished during the submission of Form PF11.

Under section 13 of the Patents Act, for an invention to be patentable, it must satisfy three conditions:

(a) the invention is new;

(b) it involves an inventive step; and

(c) it is capable of industrial application.

Companies considering the possibility of patent protection for AI inventions may wish to note that potential issues may arise in light of the principle that a mathematical method *per se* is not a patentable invention. In this regard, the IPOS has stated in its circular on the AI[2] scheme that a claim to an AI method characterised by the mathematical steps of an algorithm would be considered a mathematical method *per se*, and therefore not an invention. Furthermore, where the said AI method is defined to be implemented on a generic computer or using conventional computer hardware, the mere recitation of said generic hardware in the claim is unlikely to be enough for the actual contribution of the claim to be considered anything more than the underlying mathematical method.

That said, the IPOS's circular also states that a claim to an AI method implemented on a computer and directed to solving a specific problem, such as a machine learning method implemented on a computer for speech or image recognition or natural language processing, would likely be considered as an AI invention in the patent application.

Apart from protection of AI solutions under patent law, the source code of a computer program may also be protected by copyright. Section 7A of the Copyright Act (Cap. 63) expressly provides that a computer program falls within the meaning of a "literary work" which is protected under the Copyright Act.

In the context of AI, a couple of further issues may become increasingly relevant. These are: (i) rights in relation to data; and (ii) rights in relation to works generated by AI.

Protection of data

The ability of IP laws to protect data may become an increasingly relevant issue in cases involving analytical applications or algorithms which derive their value from the underlying datasets.

In general, data *per se* is not protected under copyright law. Under the Copyright Act, a compilation of data may be protected as a literary work if it constitutes an intellectual creation by reason of the selection or arrangement of its contents.[1] In this regard, the

Singapore courts have held that, for copyright to subsist in any literary work, there must be an authorial creation that is causally connected with the engagement of the human intellect. In the context of compilations, the compiler must have exercised sufficient creativity in selecting or arranging the material within the compilation to cloak the original expression with copyright.[2] Thus, it has been held by the Singapore courts in a case involving two publishers of phone directories that such data is not protected by copyright law. It remains to be seen, in the context of AI datasets, what level of creativity may be sufficient to render a selection or arrangement of facts or data capable of copyright protection.

Singapore copyright law does not provide for a *sui generis* database right such as the one recognised in the European Union.[3]

As an alternative, data may be subject to protection under the common law of confidence if three elements are fulfilled:[4]

(a) the data has the necessary quality of confidence about it; i.e., it cannot be available to the public at large;

(b) the data must have been imparted in circumstances importing an obligation of confidence; and

(c) there is an unauthorised use of the data to the detriment of the party communicating it.

Where the aforementioned three elements are fulfilled, the owner of the confidential information may be able to bring an action for breach of confidence.

Protection of AI-generated works

At this juncture, it remains to be seen whether and how current IP laws may be applied to protect AI-generated works. Under the present IP legal framework, a number of issues are likely to arise with respect to the protection of AI-generated works. Programs capable of generating such works already exist and are in use. For instance, certain news outlets currently use AI to automate repetitive news reports; e.g., financial reports or sports results.[5]

The Singapore courts have recognised that, under existing Singapore copyright law, only natural persons may be considered authors of works, although legal persons like companies may own the copyright in works. It is therefore necessary to be able to attribute the creative elements of a work to a natural person in order for copyright to vest.[6] Under the present statutory regime, the courts have further observed that "in cases involving a high degree of automation, there will be no original work produced for the simple reason that there are no identifiable human authors",[7] authorship being the exercise of independent original or creative intellectual effort.[8]

Antitrust/competition laws

The Competition Act (Cap. 50B) establishes a general competition law in Singapore. The Competition Act generally prohibits:

(a) anti-competitive agreements (the section 34 prohibition);[9]

(b) the abuse of a dominant position (the section 47 prohibition);[10] and

(c) mergers and acquisitions that substantially, or may be expected to substantially, lessen competition within any market in Singapore (the section 54 prohibition).[11]

The CCCS is the statutory authority responsible for administering and enforcing the Competition Act.

Competition issues pertaining to AI and big data have been the subject of two studies[12] by the CCCS.

Anti-competitive agreements and concerted practices facilitated by algorithms

Amongst the topics discussed in one of the CCCS' papers[13] is that of anti-competitive agreements and concerted practices facilitated by algorithms.

In its paper, the CCCS recognised the need to balance efficiency gains against the increased risk of collusion. In this regard, the CCCS has identified a couple of concerns in relation to algorithms providing new and enhanced means of fostering collusion. First, monitoring algorithms may enhance market transparency and organisations may be able to automatically extract and evaluate real-time information concerning the prices, business decisions and market data of competitors. Second, algorithms increase the frequency of interaction between organisations and the ease of price adjustments, as automated pricing algorithms may be able to automate the decision process of colluding organisations so that prices react simultaneously and immediately to changes to market conditions.[14]

In terms of applying competition enforcement to algorithms, the CCCS has observed that, where the use of algorithms is in furtherance of, or to support or facilitate any pre-existing or intended anti-competitive agreements or concerted practice, such cases fall squarely within the existing enforcement framework. For example, where algorithms are used to assist in the implementation of an anti-competitive agreement and are ancillary to the main infringement, liability for breaching the section 34 prohibition may be established based on evidence of the underlying agreement or concerted practice. As another example, where a common third-party pricing algorithm is used by competitors to coordinate prices (i.e. "hub-and-spoke" scenarios), such activity may be caught by the section 34 prohibition.[15]

The CCCS has identified certain concerns about whether the existing competition enforcement framework is adequately equipped to deal with future developments involving algorithms. The main concern identified by the CCCS lies in how algorithms may lead to greater instances of tacitly collusive equilibriums which may fall outside the current scope of competition enforcement. Other concerns relate to how an organisation's independent and rational business justifications for using a third-party pricing algorithm may be weighed against any anti-competitive effect that may result from such use, and how liability may be established for any autonomous decision-making that results in collusive outcomes in situations involving self-learning algorithms. The CCCS has noted that, while its current analytical framework is equipped to assess anti-competitive conduct involving algorithms, there are no settled positions on the aforementioned concerns. As such, this remains an evolving field.

Data portability

Another recent development is the issuance of a discussion paper jointly by the CCCS and the PDPC on the possible introduction of a data portability requirement.

Essentially, the data portability requirement would allow individuals to request from an organisation a copy of their personal data held by that organisation in a structured, machine-readable format, and for the organisation to transmit the data to another organisation.[16] From a competition perspective, data portability may lead to efficiencies for organisations, as they may find it easier to gain access to more varied datasets. Data portability may also lead to a reduction of switching costs, as customers can request for their data to be transferred to a competitor without having to re-enter that information, ultimately enhancing competition. For organisations that rely on data as an important or essential input, a data portability requirement may facilitate access to this input and lower the barriers to entry and expansion, thereby enhancing competition.

Board of directors/governance

On 23 January 2019, the PDPC published the first edition of its Model Framework for public consultation and pilot adoption and feedback.[17] The Model Framework is the result of efforts by policy makers and regulators in Singapore to articulate a common AI governance approach and a set of consistent definitions and principles relating to the responsible use of AI. It also represents Singapore's attempt to contribute to the global discussion on the ethics of AI by providing a framework that helps translate ethical principles into pragmatic measures that businesses can adopt. Adoption of the Model Framework is on a voluntary basis.

The Model Framework comprises guidance on four key areas, including organisations' internal governance structures and measures. The Model Framework also expressly recognises that "[t]he sponsorship, support, and participation of the organisation's top management and its Board in the organisation's AI governance are crucial". One of the suggested practices also includes (without limitation) establishing a coordinating body having relevant expertise and proper representation from across the organisation to oversee the ethical deployment of AI.

Briefly, the principles set out in the Model Framework across the four key areas include the following (without limitation):

- Internal governance structures and measures: organisations should ensure that there are clear roles and responsibilities in place for the ethical deployment of AI, and that there are risk management and internal controls in place.
- Determining AI decision-making models: organisations should consider the risks of using a particular AI model based on the probability and severity of harm, and determining what degree of human oversight would be appropriate based on the expected probability and severity of harm.
- Operations management: organisations should take steps to understand the lineage and provenance of data, the quality of their data, as well as the transparency of the algorithms chosen.
- Customer relationship management: organisations should take steps to build trust and maintain open relationships with individuals regarding the use of AI, including such steps as general disclosure, increased transparency, policy explanations, and careful design of human-AI interfaces.

Regulations/government intervention

As explained in a Parliamentary statement by the then Senior Minister of State for Communications and Information Education, the Singapore Government's current regulatory approach towards AI applications is a domain-specific one. In other words, the Government's approach is to seek to address issues thrown up by new forms of technology such as AI into existing laws and regulations specific to each domain.

In his Parliamentary statement, the Senior Minister of State recognised the distinction between "strong AI" and "weak AI":

(a) "strong AI" – AI that is sentient or conscious – that is, a general purpose artificial intelligence which is able to apply its intelligence and capabilities to any problem or task; and

(b) "weak AI", or task-specific AI.

Given that AI applications on the market are weak AI for the most part, and strong AI remains a distant reality, current regulatory efforts are largely focused on weak forms of AI.

Data protection

The use of datasets in conjunction with AI applications has the potential to raise data protection ("**DP**") issues where such datasets include personal data. Companies that utilise such AI applications may find it relevant to consider issues such as: whether the dataset may constitute personal data; and/or whether they may be permitted to use the datasets for the particular purpose.

The Personal Data Protection Act 2012 (No. 26 of 2012) ("**PDPA**") sets out the general DP framework which governs the collection, use and disclosure of personal data by private sector organisations in Singapore.

Under the PDPA's general DP framework, there are nine main obligations. Since the enactment of the PDPA, the general DP framework has been substantially a consent-based regime. In this regard, including the "consent obligation" under the PDPA requires an organisation to obtain an individual's consent before the collection, use or disclosure of the individual's personal data, unless an exception applies.[18]

In 2017, the PDPC issued a public consultation paper in which it recognised that the existing consent-based approach to DP[19] may present challenges in the new digital economy. For example, it may not be possible for organisations to always anticipate all the purposes for using or disclosing personal data at first instance.

Given the state of technological advances and global developments, the PDPC therefore undertook a review of other bases for collecting, using and disclosing personal data under the PDPA. It proposed to introduce "notification of purpose" as a basis for the collection, use and disclosure of personal data, subject to the following conditions.[20] In this regard, it has been proposed that an organisation would only be able to rely on notification of purpose as a basis when it is impractical for the organisation to obtain consent, and the collection, use or disclosure of personal data is not expected to have any adverse impact on the individual.[21] It remains to be seen how this policy proposal would be formally implemented. At the time of writing, legislative changes to the PDPA have yet to be tabled.

A further issue that may be of relevance to organisations using large datasets is whether anonymised data may nevertheless be regarded as personal data for the purposes of the PDPA.

Technological advancements may increase the risk that a dataset that was previously anonymised may be de-anonymised, and thereby be considered personal data.[22] In this regard, the use of algorithms and/or machine learning technologies that are able to draw inferences about certain personal identifiers of individuals from voluminous datasets may increase the risk of data which is assumed to be anonymised to constitute personal data. Companies which intend to engage in such operations should therefore exercise diligence in order to ensure that they do not inadvertently collect, use and/or disclose personal data without fulfilling the requisite requirements, thereby infringing the obligations under the PDPA.

The Info-communications Media Development Authority, which is the current designated PDPC, has also put in place a data-sharing sandbox scheme to encourage innovation in the use of personal data to offer new products or services, under circumstances where: (i) sharing of data is not likely to have an adverse impact on individuals; or (ii) where there is a need to protect legitimate interests, and benefits for the public outweigh adverse impacts on individuals, to be tested on the market.[23] Interested organisations may approach the PDPC to submit an application. If approved, the sandbox will be effected by way of an exemption

for the relevant organisation from provisions of the PDPA, subject to specified terms and conditions. The criteria for application are:

(a) the data is to be shared with a specific group for a specified period of time;

(b) the sharing of data is for defined and specific purposes; and

(c) data sharing is not likely to have an adverse impact on the individual, or the benefits to the public outweigh any adverse impact on the individual.

Autonomous vehicles

The Singapore Government has also recognised the potential benefits that AI may bring to the transportation sector, and has sought to facilitate trials involving autonomous vehicles. In this regard, in 2017, the Road Traffic (Autonomous Motor Vehicles) Rules 2017 were introduced to regulate the trials of autonomous vehicles.

The framework established under the Road Traffic (Autonomous Motor Vehicles) Rules 2017 sets out that parties interested in conducting trials of autonomous vehicles must submit an application to the Land Transport Authority ("**LTA**"). The application to the LTA must include, amongst others, the objectives of the trial, the type of autonomous vehicle to be used and how the autonomous vehicle is intended to be used. In granting a party the authorisation to conduct such trials, the LTA retains the discretion to impose conditions, such as a condition for an autonomous vehicle to be accompanied by a safety driver that has been trained to take over full control of the autonomous vehicle when required, and to state the geographical area in which the trial may be conducted.

In 2018, in response to queries raised in Parliament in respect of the safety measures that are currently in place for the conducting of trials of autonomous vehicles, the Senior Minister of State for Transport stated that to ensure the safety of all road users, trials must fulfil stringent requirements. For instance, an autonomous vehicle must pass a safety assessment to demonstrate that it can adequately handle basic manoeuvres and safely stop upon the detection of an obstacle. An autonomous vehicle must also have a vehicle fault alert system that will alert the safety driver of any faults, and allow the control of the autonomous vehicle to be immediately transferred to the safety driver.

More recently, in January 2019, Enterprise Singapore has published Technical Reference 68, a set of provisional national standards to guide the industry in the development and deployment of fully autonomous vehicles. Technical Reference 68 promotes the safe deployment of fully autonomous vehicles in Singapore and contains standards with respect to vehicle behaviour, vehicle safety, cybersecurity and data formats. As a provisional standard, Technical Reference 68 will continue to undergo refinement as autonomous vehicle technologies mature.

* * *

Endnotes

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3. *Ibid* at [34]–[35].
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5. The New York Times, *The Rise of the Robot Reporter* (5 February 2019), accessible at https://www.nytimes.com/2019/02/05/business/media/artificial-intelligence-journalism-robots.html.
6. *Asia Pacific Publishing Pte Ltd v Pioneers & Leaders (Publishers) Pte Ltd* [2011] 4 SLR 381 at [41], [72].
7. *Ibid* at [81].
8. *Ibid* at [75].
9. Section 34 of the Competition Act.
10. Section 47 of the Competition Act.
11. Section 54 of the Competition Act.
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13. Competition & Consumer Commission of Singapore, *Data: Engine for Growth – Implications for Competition Law, Personal Data Protection, and Intellectual Property Rights* (16 August 2017).
14. Competition & Consumer Commission of Singapore, *Data: Engine for Growth – Implications for Competition Law, Personal Data Protection, and Intellectual Property Rights* (16 August 2017), at pages 66 to 68.
15. Competition & Consumer Commission of Singapore, *Data: Engine for Growth – Implications for Competition Law, Personal Data Protection, and Intellectual Property Rights* (16 August 2017), at pages 69 and 70.
16. Personal Data Protection Commission (in collaboration with the Competition & Consumer Commission of Singapore), *Discussion Paper on Data Portability* (25 February 2019), at page 3.
17. The AI Framework was recognised as a top award in the "Ethical Dimensions of the Information Society" category by the World Summit on the Information Society Prizes.
18. Section 13 of the Personal Data Protection Act 2012.
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Chambers 2019 lists him as a band 1 Competition and TMT lawyer, noting, "[Chong Kin] commands a leading reputation in the TMT sector and is especially noted for his regulatory expertise"; and: "He attracts praise for both his 'knowledge and responsiveness' as well as for offering 'clarity in his advice' to clients. He is adept at advising corporations on a range of competition mandates, including compliance, transaction reviews and filings both in Singapore and across the ASEAN region."

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