Working paper

Cross-border neural networks:
Australia-China collaboration in artificial intelligence research

James Laurenceson and Michael Zhou
December 2019

UTS:ACRI working papers are research papers in progress. Feedback is welcomed by the author(s).

The analysis and conclusions in this paper are formulated independently by its author(s). UTS:ACRI does not take an institutional position on any issue; the views expressed in this publication are the author(s) alone.

The Australia-China Relations Institute (ACRI) is an independent, non-partisan research institute based at the University of Technology Sydney (UTS). UTS:ACRI's mission is to inform Australia's engagement with China through substantive dialogue, and research and analysis grounded in scholarly rigour.

Key findings

- Driven by transformative technologies like artificial intelligence (AI), the Fourth Industrial Revolution is reshaping economies and societies across the globe. A 2018 report by the McKinsey Global Institute identifies the United States and China as 'active global leaders' in the supply of AI. The ability of countries like Australia to create AI knowledge and make use of it will depend significantly on their ability to connect to these leaders. McKinsey estimates that AI adoption and absorption could potentially account for around half of Australia's aggregate economic growth over the period 2017-2030.

- In the absence of home-grown technology giants like Google and Tencent, universities are positioned as Australia's key actors in conducting AI research. The fact that universities openly publish their research enhances our ability to survey their contribution and patterns of international collaboration. In 2018, Australia produced 2.9 percent of the world's total AI publications. Two-thirds of Australian AI publications featured a collaborator affiliated with an overseas institution. This was up from one-third a decade ago, starkly illustrating the importance of global connectedness for smaller players like Australia.

- China is Australia's leading AI research partner by a large margin. In 2018, researchers affiliated with Chinese institutions featured in 31.3 percent of all Australian AI publications, or 33.9 percent if Hong Kong SAR is also included. This is triple the share of Australia's next most important partner, the US. Both China and the US have grown in significance as research partners, but China has been the clear standout, having increased as a share of the Australian total by 24.3 percentage points over the past decade compared with 6.8 percentage points for the US.

- While researchers affiliated with Chinese institutions feature in around one-third of Australian AI publications, collaborators in Australia only appear in 3.3 percent of China's total.

- The quality of AI research can be proxied by the frequency with which a publication is cited. In 2017, of Australian publications in the top one percent of most-cited AI publications globally, more than half (52.1 percent) involved a China-affiliated collaborator, or nearly two-thirds (64.4 percent) if Hong Kong SAR is also included. The share featuring a US collaborator is just over one-fifth.

- Australia's AI research with China is being led by specific institutions. In 2018, 22.4 percent of all Australia-China AI publications were written by researchers at the University of Technology Sydney. Next were researchers at the University of Sydney with a 15.5 percent share.

- As 'general purpose' technologies, concerns have been raised that Australia's research with China on AI might assist in building the capabilities of China's People's Liberation Army (PLA). But in terms of working with researchers at Chinese institutions identified as having PLA affiliations, a sample estimate suggests these comprise a small fraction of total Australia-China AI publications each year (between zero to 6.1 percent) and there is no obvious upward trend.

- As national interest considerations evolve, reflecting economic, security and ethical dimensions, the Australian government is not without options for facilitating Australia–China AI research connections (such as through the Australia–China Science and Research Fund) or curbing them (such as through the application of Defence Export Controls to projects involving Chinese partners). Media outlets and non-government organisations can also provide valuable data to assist Australian universities in their selection of Chinese partners and ongoing scrutiny as these connections develop.

- China is already a global AI leader, irrespective of Australia's engagement with it. This makes it essential that the Australian government actively contributes to international forums and agreements involving China and that serve to promote AI's responsible use.

1. Introduction

The Australia-China economic relationship is about far more than just exports of mining and energy products for imports of manufactured goods. A paper published by the Australia-China Relations Institute (UTS:ACRI) in July 2019 documented China's rapid growth as a partner for Australia in conducting research and creating knowledge (Laurenceson and Zhou, 2019). 2019 marks a significant milestone: for the first time, more Australian scientific publications will feature a co-author affiliated with a Chinese institution than a US one. To be sure, China is not replacing the US. Rather, collaborations with the US have also continued to increase and are highly complementary to those with China, concentrating in different subject areas. For example, in 2017 a China-affiliated researcher was included in 71.2 percent of Australian publications in the top one percent of globally most-cited computer science publications. Meanwhile, US researchers featured in 85.3 percent of Australian publications in the top one percent of globally most-cited space science publications.

This report homes in on one particular strand of Australia-China research, that around artificial intelligence (AI). On the one hand, technologies under the umbrella term of AI are seen as a pillar of the Fourth Industrial Revolution (Industry 4.0) (Schwab, 2015). AI is one of four 'transformative technologies' in the Australian government's Industry 4.0 strategy identified as having 'potential to provide a major boost to Australia's economic competitiveness' (Department of Industry, Innovation and Science, 2019). A report released in September 2018 by the McKinsey Global Institute (MGI) analysed different countries' readiness for AI, placing the US and China in its highest tier as 'active global leaders' based on 'unique strengths' in scale effects (such as economic output enabling greater investment in AI research and development) and network effects (such as connectedness with the global economy enabling them to attract larger flows of AI talent) (Bughin, et al., 2019). The capacity for countries like Australia to create AI knowledge and make use of it will depend significantly on their ability to connect to these global leaders. Modelling by MGI suggests that AI adoption and absorption could potentially account for around half of Australia's aggregate economic growth over the period 2017-2030.

On the other hand, as emerging 'general purpose' technologies, the applications of AI have yet to be fully determined. But it would be naïve to assume they could not serve military or other objectives that raise sharp ethical and human rights concerns. For these reasons the Chinese government's announcement of intent to lead the world in the development and application of AI technologies through its New Generation Artificial Intelligence Development Plan, as well as a 'civil-military fusion' strategy, has drawn attention and scrutiny (Webster et al., 2017).

In July 2019 media reporting suggested that Australian universities' AI research undertaken with Chinese entities had enhanced technologies used by the Chinese government in the mass surveillance of its minority Turkic Muslim population in the western autonomous region of Xinjiang. The Australia Director of Human Rights Watch (HRW) said that (McNeill et al., 2019):

> [T]his should cause a rethink for all Australian institutions, companies, organisations, that are collaborating with Chinese state institutions.

An analyst at the Australian Strategic Policy Institute (ASPI), cautioned that research collaboration could bolster Chinese Communist Party (CCP) efforts to 'monitor citizens, commit human rights abuses and develop unmanned warfare' (*The Australian Financial Review*, 2019).

There is overlap between Australian concerns and those of the US. The US Export Control Reform Act of 2018 (ECRA) authorises the Department of Commerce to 'establish appropriate controls, on the export, re-export and/or transfer (in country) of emerging and foundational technologies'. The Act only states that emerging and foundational technologies 'are those essential to the national security of the United States', leaving open their precise identification to an interagency process that takes into account public and classified input. Artificial intelligence is cited as one of the

possible technologies (Braumiller, Mohler and Wu, 2019). The US Commerce Department is reportedly preparing to announce an 'initial set of restrictions on exporting some technologies, including...an algorithm that guides artificial intelligence' (Swanson, 2019).

AI's importance to Australia's potential economic growth and China's position as a 'global leader', together with intensifying concerns around the implications of such mean that fittingly, Australia's research links to China are receiving growing attention and analysis. To date, this has mostly taken the form of case studies that raise concerns (e.g., Kania (2018) and Joske (2019)). However, there has been little investigation of the broader context from which these cases are being drawn. Scrutiny of particular cases is warranted, but understanding the bigger picture is also necessary for thinking about appropriate public policy settings, as well as understanding the scale of both the challenges and the opportunities.

Where much progress in AI technologies has been underpinned by neural networks consisting of artificial neurons, this paper examines patterns in a more organic form of neural network: human minds collaborating across regional boundaries to conduct research and create knowledge.

2. Australia as an AI knowledge creator

Despite the emergence of AI-focused startups (Redrup, 2019), Australia lacks home-grown technology giants such as the FAAMG quintet in the US or the BAT trio in China, which are responsible for producing a substantial volume of AI research in their own right[1]. In Australia universities are positioned as the key actors. The fact that universities openly publish their research and the knowledge they create enhances our ability to survey their contribution and patterns of international collaboration.

This paper uses data from the InCites database of peer-reviewed scientific literature to examine trends in Australia's AI research over the last 10 years. Specifically, data relates to publications appearing in academic journals and those published in conference proceedings under the 'computer science, artificial intelligence' subject area as defined by InCites. Publications identified as 'Australian' can have multiple authors affiliated with different regions, but must have at least one author affiliated to an Australian institution. All data presented in this paper are subject to these parameters unless otherwise stated.

It should be noted that publications indexed in the InCites database are not fully representative of all AI research. Technologies and techniques under the AI umbrella encompass several rapidly growing fields of research and there is an urgency to disseminate and discuss findings (O'Meara, 2019). In this context, presenting new research findings at conferences and self-publishing of code or data to public repositories such as GitHub is popular and may sometimes be favoured over submission to scientific journals, which can require several months for peer-review and publication. Nonetheless, such publications remain useful as an indicator of a country's ability to create foundational AI knowledge that could, over time, support more advanced AI applications.

Figure 1 shows that in 2018, Australia accounted for a 2.9 percent share of global AI publications. The volume of Australian publications over time has largely followed global trends, suggesting that it is strongly influenced by international dynamics. Over the past decade the Australian share has averaged 2.8 percent. This compares to an average 24.7 percent share by China and a 14.2 percent share by the US.
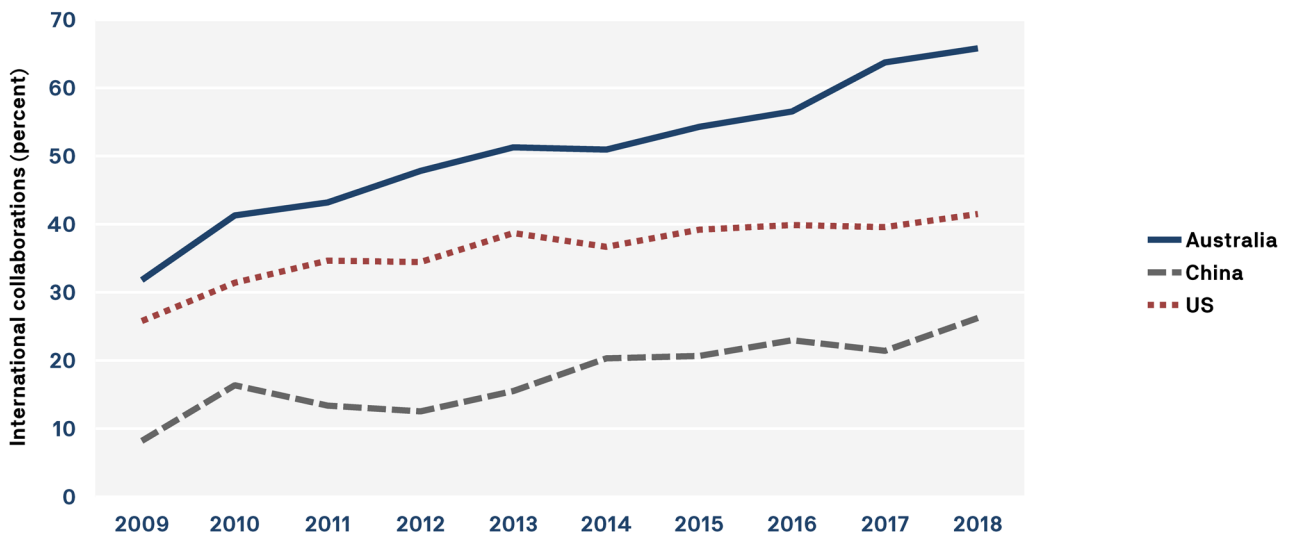
Figure 1. Australian AI publications
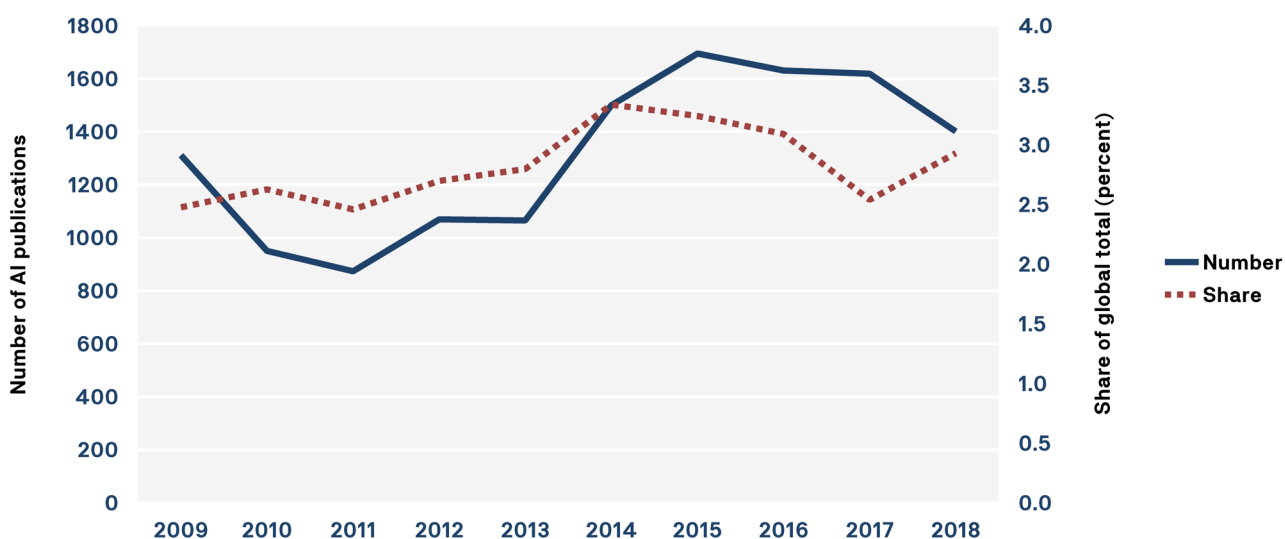
Source: InCites (2019)

---

1   FAAMG refers to Facebook, Apple, Amazon, Microsoft and Google, which are the largest publicly traded technology companies in the US by market capitalisation; BAT refers to Baidu, Alibaba and Tencent, which are three of China's most well-known technology companies.

Figure 2. Proportion of Australia/China/US AI publications with international collaborators

Source: InCites (2019)

Figure 2 uses the same dataset as Figure 1 and shows the proportion of Australia's AI publications with at least one international collaborator over the last 10 years. An international collaborator is defined in the InCites database as an author with an affiliation to an institution outside Australia. The proportion of Australian AI publications with international collaborators grew by 34 percentage points, from 31.8 percent in 2009 to 65.8 percent in 2018. This starkly illustrates the importance of global connectedness for smaller players like Australia in conducting AI research. International partnerships have also become more important for China over time but, befitting its status as a global leader, in 2018 only 26.2 percent of China's total featured an overseas-affiliated collaborator. Similarly for the US, the corresponding share is 41.5 percent.

3. Quantity patterns of Australia's international AI research collaboration

The proportion of publications featuring international collaboration can be further broken down to show the extent to which Australia collaborates with specific countries and regions. Table 1 lists Australia's top five partners for AI research in 2009 and 2018 in terms of the number of AI publications produced, as well as the proportion of the Australian total written in collaboration with each. In 2009, for instance, 96 publications featured both an Australia-affiliated author and a China-affiliated one. This constituted 7.3 percent of all Australian AI publications in that year.

Table 1 shows that China is currently Australia's most important AI research partner by a large margin. Publications featuring a China-affiliated collaborator accounted for 31.3 percent of the Australian total in 2018. If collaboration with Hong Kong SAR is also included, this share increases to 33.9 percent, triple that of Australia's next most important partner, the US, with 10.8 percent.

To put this in a cross-disciplinary setting, in 2018 China-affiliated collaborators featured in around 15 percent of Australia's total output of scientific publications (Laurenceson and Zhou, 2019). In other words, at around one-third

of total AI output, Australia's connections to China are particularly strong in the field of AI. In contrast, US-based collaborators appeared in around 16 percent of all Australian scientific publications (Laurenceson and Zhou, 2019). At just 10.8 percent, Australia's connectedness to US-affiliated researchers in the AI field is significantly less than the overall figure.

Still, reflecting their status as global AI leaders, both China and the US have grown in significance as partners for Australia in creating AI knowledge. However, China's growth has been far more rapid. Over the past decade, the share of Australian AI publications produced in collaboration with China (and including Hong Kong SAR) increased by 24.3 percentage points, compared with 6.8 percentage points for those with the US.

A final observation is that while China-affiliated researchers play a prominent role in Australia's AI research, Australia-affiliated researchers are far less crucial to China. Whereas China-affiliated researchers feature in around one-third of Australian AI publications, Australia-affiliated researchers contributed to a much smaller 3.3 percent of China's total in 2018.

Table 1. Australia's top five AI research partners, by number of joint publications				
	2009		**2018**	
Region	**Number of publications**	**Percent of Australian total**	**Number of publications**	**Percent of Australian total**
China, Mainland	96	7.3	438	31.3
US	53	4.0	152	10.8
UK	34	2.6	63	4.5
India	8	0.6	48	3.4
Hong Kong SAR	30	2.3	37	2.6

Source: InCites (2019)

4. Quality patterns of Australia's international AI research collaboration

The number of AI publications are one dimension in which collaboration can be measured. But whether the same patterns hold true for those of the highest quality is a different question. The frequency with which a publication is cited by other researchers can serve as a proxy for its quality. Table 2 lists the countries and regions of affiliation for collaborating authors on Australian publications appearing in the top one percent of most-cited AI publications globally. Along with the number of publications, the proportion of the Australian total produced in collaboration with each region is also presented.

Table 2 shows that in 2017, China and the US led as partners for Australia's highest quality AI research, contributing to 38 and 16 Australian publications in the top one percent of globally most-cited AI publications, respectively. Publications including a China-affiliated researcher accounted for more than half (52.1 percent) of all Australian publications appearing in the top one percent. If Hong Kong SAR is also included, this rises to nearly two-thirds (64.4 percent). This compares with just over one-fifth featuring a US collaborator.

The number of Australian publications that included a China-affiliated researcher (including those in Hong Kong SAR) grew from just three in 2008 to 47 in 2017. This compares with an increase from two to 16 publications with the US, in the same period.

The shares of most-cited publications in AI produced with China and the US contrast with the shares of most-cited output across all disciplines presented in Laurenceson and Zhou (2019). For example, of all Australian scientific publications in the global top one percent, those including a China-affiliated collaborator accounted for 29.1 percent. Meanwhile, those with a US-affiliated collaborator accounted for 53.8 percent. In AI research however, the tables are turned with China proving to be the leading collaborator on quality as well as quantity metrics.

There is also again a disparity between the relative importance of Australia to China and China to Australia in conducting high quality AI research. Whereas China-affiliated researchers feature in nearly two-thirds of Australian publications in the global top one percent, for China joint output is responsible for a much smaller 10.2 percent share.

Table 2. Australia's top five AI research partners, by number of top one percent most-cited joint publications				
Region	**2008**		**2017**	
	Number of publications	**Percent of Australian total**	**Number of publications**	**Percent of Australian total**
China, Mainland	2	11.8	38	52.1
US	2	11.8	16	21.9
Hong Kong SAR	1	5.9	9	12.3
UK	1	5.9	4	5.5
South Korea	0	0.0	4	5.5

Source: InCites (2019)

Table 3. Top five Australian and Chinese institutions in Australia–China AI research collaboration, by number of publications

	Australia			China			
Institution	2009	2018	Cumulative total	Institution	2009	2018	Cumulative total
University of Technology Sydney	20	98	701	Chinese Academy of Sciences	10	35	362
University of Adelaide	4	42	239	Harbin Institute of Technology	4	15	109
University of Sydney	6	68	235	Shanghai Jiao Tong University	2	12	104
Victoria University	5	29	181	Huazhong University of Science & Technology	3	16	82
Australian National University	5	28	165	Northwestern Polytechnical University	5	20	81

Source: InCites (2019)

5. Who is driving Australia–China AI research?

Table 3 lists the top five institutions in both Australia and China according to the number of AI publications with at least one author from each institution.

The University of Technology Sydney (UTS) occupies the leading position, having grown from 20 publications in 2009 to 98 in 2018. This constitutes a 22.4 percent share of all Australia-China AI publications in 2018, compared to 15.5 from the University of Sydney. UTS' lead becomes dramatically more pronounced when cumulative output is considered. Between 2009 and 2018, UTS researchers collaborated with China-affiliated researchers to produce a cumulative total of 701 articles and papers, or 26.4 percent of all Australia-China AI publications during that period. This is 462 publications more than the 239 from the University of Adelaide, the next most frequent collaborator with China over the last decade. The next largest gap between consecutively ranked Australian institutions

is 54 publications, between the University of Sydney (235) and Victoria University (181).

On the Chinese side, Table 3 shows that the leading collaborator is the Chinese Academy of Sciences, with 35 joint publications in 2018. With a cumulative total of 362 publications between 2009 and 2018, the frequency of collaboration with the Chinese Academy of Sciences is more than 3.3 times greater than with the next most frequent collaborator, the Harbin Institute of Technology.

6. Australia's AI research collaboration with PLA-affiliated entities

This paper next uses Scopus, a different database of peer-reviewed scientific literature, to investigate the pattern of Australia-China collaboration in AI research with institutions previously identified as being affiliated with the People's Liberation Army (PLA) in Joske (2018). The Scopus database is used as some PLA-affiliated institutions are not included in the InCites database. A drawback however is that in contrast to the InCites database, the Scopus database does not feature a subject area label specifically for artificial intelligence, with AI publications categorised under the computer science subject area alongside other computer science topics such as signal processing. This paper adapts the Scopus search methodology utilised in Shoham et al. (2018) to retrieve data on publications pertaining more specifically to AI. The Scopus database was used to search for published journal articles and conference papers with the title or abstract keyword 'artificial intelligence' as well as having at least one author affiliated with an Australian institution and at least one author affiliated with a Chinese institution. The search was performed a second time with data restricted to publications featuring at least one author from PLA-affiliated institutions. Table 4 presents the data from these search results, beginning from 2009.

The key finding in Table 4 is that collaborations with PLA-affiliated institutions represent only a small fraction of total Australia-China AI research, ranging from zero percent in 2009 to 6.1 percent in 2015. There is also no obvious upward trend in the volume of such collaborations with the share in 2018 being just 3.2 percent.

Caveating these findings is that the single keyword 'artificial intelligence' in the Scopus database retrieves a significantly lower proportion of total AI publications than methodologies used by InCites (2019) or Elsevier (de Kleijn and Fowler, 2018), which utilise subject expert curation and/or larger

Table 4. Sample estimates of proportion of Australia-China AI publications featuring PLA-affiliated institutions			
Year	Total number of Australia-China AI publications	Number of publications with PLA affiliations	Percent of Australia-China AI publications
2018	158	5	3.2
2017	127	2	1.6
2016	80	4	5.0
2015	99	6	6.1
2014	71	2	2.8
2013	57	2	3.5
2012	49	0	0.0
2011	38	0	0.0
2010	41	1	2.4
2009	15	0	0.0

Source: Scopus (2019)

keyword sets. This is evident when data in the 'total number of Australia-China publications' column in Table 4 is compared to Table 1, with Table 1 listing 438 publications while Table 4 lists 158. It is therefore possible that the true proportion of Australia-China AI publications produced in collaboration with PLA researchers is higher or lower than shown. For this reason, data presented in Table 4 should be considered as sample estimates of actual proportions only. There is also a more extensive discussion to be had around whether 'civil-military fusion' in China means that only collaborations with institutions that have clear PLA affiliations have bearing on security issues.

7. Discussion

China's leading position in the global AI ecosystem means it will likely remain an attractive collaborator for Australian AI researchers going forward. Indeed, the findings presented above make clear that without such partnerships, Australia's ability to conduct research and create AI knowledge would be seriously degraded, with consequent negative implications for Australia's economic welfare, and potentially, national security. Yet as 'general purpose' technologies, AI's possible applications can also include autonomous weapons systems and the build-out of mass surveillance apparatus, raising acute national security and ethical challenges.

As national interest considerations evolve, reflecting economic, national security and ethical dimensions, the Australian government is not without options for facilitating Australia-China AI research connections (such as through the Australia-China Science and Research Fund) or curbing them (such as through the application of Defence Export Controls to projects involving Chinese partners). Moreover, media outlets and non-government organisations can also provide valuable data to assist Australian universities in their selection of Chinese partners and ongoing scrutiny as these connections develop.

There is evidence that this is already happening. In May 2019 an HRW report documented that a subsidiary of China Electronics Technology Corporation (CETC), a large Chinese state-owned conglomerate with military connections, had designed a surveillance application being used in Xinjiang. In the first half of 2017 UTS had announced a research partnership with CETC. A media enquiry from the *Financial Times*, acting on an embargoed copy of the HRW report, prompted UTS to launch an internal review of its CETC collaboration (University of Technology Sydney [UTS], 2019a). In July 2019 the ABC's *Four Corners* program followed up by reporting on the preliminary assessments of the UTS review, which was at the time still ongoing (McNeill et al., 2019). UTS made its full statement to *Four Corners* available on its website (UTS, 2019b). In October, a researcher at ASPI

worked with *Four Corners* to draw attention to a new report alleging a separate potentially problematic research connection between UTS and a Chinese corporate entity that included the establishment of a 'joint AI laboratory' (Hoffman, 2019; Rubinsztein-Dunlop et al., 2019). UTS once again made its full statement publicly available, pointing out that the Chinese media source cited in the ASPI report referring to a 'joint AI laboratory' was 'a complete misrepresentation' of the collaboration with its Chinese partner (UTS, 2019c). By then UTS had also completed its review of the partnership with CETC, with *Four Corners* reporting that this included abandoning two projects 'because of concerns raised by Australia's Defence Department' (Rubinsztein-Dunlop et al., 2019). Yet the UTS review also made clear that its researchers could not have contributed to surveillance technologies being used in Xinjiang. Under its collaboration agreement, five projects with CETC had been instigated and only one of these was of any potential relevance, involving video analysis. But this project began after HRW had already obtained and dissected the surveillance application of concern. The UTS review also confirmed that all projects with CETC had been submitted for approval to the Defence Department as required by Australia's Defence Trade Controls (UTS, 2019a).

Australia is not alone in grappling with the challenges arising from working with China on AI. For example, in the US context an interim report by the National Security Commission on Artificial Intelligence released in October 2019 noted (Schmidt et al., 2019):

> There are no easy answers to the question of what to do about a general purpose technology that gives rise to outcomes that range from beneficial and benign to, potentially, existentially threatening.
>
> ...
>
> [T]he deep human, hardware, supply chain, investment, and corporate connections between the United States and China in AI cannot be unwound without economic costs and unintended consequences for the U.S. economy and U.S. research environment.

These debates on balancing opportunities and risks are also not without historical precedent. A 1982 report on scientific communication and national security addressed similar issues, albeit in a different context and in relation to the publication of scientific findings more generally, finding that 'controls [on scientific communications] may...reduce the rate of technological innovation...impose economic costs for US high-technology firms...[and] limit university research and teaching in important areas of technology' (Corson et al., 1982).

It is therefore clear that a significant global discussion on AI's applications is both necessary and in many respects, already underway. China is a global AI leader, irrespective of Australia's engagement with it. This makes it essential that the Australian government actively contributes to international forums and agreements involving China and that serve to promote AI's responsible use.

About the authors

James Laurenceson

Professor James Laurenceson is Acting Director of the Australia-China Relations Institute at UTS.

He has previously held appointments at the University of Queensland (Australia), Shandong University (China) and Shimonoseki City University (Japan). He was President of the Chinese Economics Society of Australia from 2012 to 2014.

His academic research has been published in leading scholarly journals including *China Economic Review* and *China Economic Journal*.

Professor Laurenceson also provides regular commentary on contemporary developments in China's economy and the Australia-China economic and broader relationship. His opinion pieces have appeared in *The Australian Financial Review*, *The Australian*, *Sydney Morning Herald*, *South China Morning Post*, amongst many others.

🐦 @j_laurenceson

Michael Zhou

Michael Zhou is a Project and Research Officer at the Australia-China Relations Institute, University of Technology Sydney.

Michael completed a Bachelor of Commerce majoring in Economics at the University of Western Australia. His research interests include the Australia-China economic relationship, China's economic development, and regional trade. He has studied in China at Shanghai Jiao Tong University under the New Colombo Plan, and has previously interned at the Australian Chamber of Commerce Shanghai and the Perth USAsia Centre.

🐦 @michael_m_zhou

References

Australian Government Department of Industry, Innovation and Science. 2019. 'Industry 4.0', November 27 <https://www.industry.gov.au/funding-and-incentives/industry-40>.

Braumiller, A., Mohler, M., Wu, V. 2019. 'United States Export Control Reform Act and 'emerging technologies'', Lexology, August 16 <https://www.lexology.com/library/detail.aspx?g=a4db4c22-58fa-49e2-a174-df4b10c45379>.

Bughin, J., Seong, J., Manyika, J., Chui, M., Joshi, R. 2018. Notes from the AI frontier – modelling the impact of AI on the world economy, McKinsey Global Institute, September <https://www.mckinsey.com/~/media/McKinsey/Featured%20Insights/Artificial%20Intelligence/Notes%20from%20the%20frontier%20Modeling%20the%20impact%20of%20AI%20on%20the%20world%20economy/MGI-Notes-from-the-AI-frontier-Modeling-the-impact-of-AI-on-the-world-economy-September-2018.ashx>.

Corson, D., Atkinson, R., Deutch, J., Dicke, R., Ginzton, E., Good, M., Hackerman, N., Killian, J., Lindsay, F., Meserve, R., Panofsky, W., Perry, W., Phillips, S., Rich, A., Roberts, J., Shapiro, H., Slichter, C., Sovern, M., Staats, E. 1982. *Scientific Communication and National Security*, National Academy Press, Washington D.C., October.

de Kleijn, M., Fowler, N (ed). 2018. *Artificial Intelligence: How knowledge is created, transferred, and used – trends in China, Europe, and the United States*, Elsevier, December 10 <https://www.elsevier.com/__data/assets/pdf_file/0010/823654/ACAD-RL-AS-RE-ai-report-WEB.pdf>.

Hoffman, S. 2019. *Engineering global consent: the Chinese Communist Party's data-driven power expansion*, Australian Strategic Policy Institute, Canberra, October 14 <https://www.aspi.org.au/report/engineering-global-consent-chinese-communist-partys-data-driven-power-expansion>.

Human Rights Watch. 2019. *China's Algorithms of Repression – Reverse Engineering a Xinjiang Police Mass Surveillance App*, May 1 <https://www.hrw.org/report/2019/05/01/chinas-algorithms-repression/reverse-engineering-xinjiang-police-mass-surveillance>.

Joske, A. 2018. *Picking flowers, making honey – the Chinese military's collaboration with foreign universities*, Australian Strategic Policy Institute, Canberra, October 30 <https://www.aspi.org.au/report/picking-flowers-making-honey>.

Joske, A., Jones, C., Fritz, A., Kania, E., Hoffman, S. 2019. 'China defence universities tracker', Australian Strategic Policy Institute, Canberra, November 25 <https://unitracker.aspi.org.au/>.

Laurenceson, J., Zhou, M. 2019. *Partners in knowledge creation: trends in Australia-China research collaboration and future challenges*, Australia-China Relations Institute, University of Technology Sydney, July 19 <https://www.australiachinarelations.org/content/working-paper-partners-knowledge-creation-trends-australia-china-research-collaboration-and>.

McNeill, S., McGregor, J., Griffiths, M., Walsh, M., Hui, E. 2019. 'UTS, Curtin unis announce reviews over links to surveillance tech used by Chinese government', *ABC News*, July 16 <https://www.abc.net.au/news/2019-07-16/australian-unis-to-review-links-to-chinese-surveillance-tech/11309598>.

O'Meara, S. 2019. 'AI researchers in China want to keep the global-sharing culture alive', *Nature*, May 29 <https://www.nature.com/articles/d41586-019-01681-x>.

Redrup, Y. 2019. 'Aussie AI start-up raises $20m after hooking Boeing and Tesla deals', *The Australian Financial Review*, November 26 <https://www.afr.com/technology/aussie-ai-start-up-raises-20m-after-hooking-boeing-and-tesla-deals-20191120-p53ci7?btis>.

Rubinsztein-Dunlop, S., Christodoulou, M., Koloff, S., Day, L., Hui, E. 2019. 'Are Australian universities putting our national security at risk by working with China?', *ABC News*, November 4 <https://www.abc.net.au/news/2019-10-14/chinese-communist-party-gtcom-connection-australian-universities/11586118>.

Schmidt, E., Work, R., Catz, S., Chien, S., Clyburn, M., Darby, C., Ford, K., Griffiths, JM., Horvitz, E., Jassy, A., Louie, G., Mark, W., Matheny, J., McFarland, K., Moore, A. 2019. *Interim Report*, National Security Commission on Artificial Intelligence, Washington D.C., November 4 <https://www.nscai.gov/reports#h.p_via-X-XQewCS>.

Schwab, K. 2015. 'The Fourth Industrial Revolution – what it means and how to respond', *Foreign Affairs*, December 12 <https://www.foreignaffairs.com/articles/2015-12-12/fourth-industrial-revolution>.

Shoham, Y., Perrault, R., Brynjolfsson, E., Clark, J., Manyika, J., Niebles, J., Lyons, T., Etchemendy, J., Grosz, B., Bauer, Z. 2018. *The AI Index 2018 Annual Report*, AI Index Steering Committee, Human-Centered AI Initiative, Stanford University, Stanford, California, December <http://cdn.aiindex.org/2018/AI%20Index%202018%20Annual%20Report.pdf>.

Swanson, A. 2019. 'Trump officials battle over plan to keep technology out of Chinese hands', *The New York Times*, October 24 <https://www.nytimes.com/2019/10/23/business/trump-technology-china-trade.html>.

The Australian Financial Review. 2019. 'China to replace the US as Australia's leading research partner', July 22 <https://www.afr.com/policy/health-and-education/china-to-replace-the-us-as-australia-s-leading-research-partner-20190718-p528e4>.

Thomas, E. 2019. 'Should Australia be partnering with the Chinese tech giants designing a surveillance state?', *ABC News*, May 3 <https://www.abc.net.au/news/2019-05-03/xinjiang-china-surveillance-company-partnership-with-aus-unis/11074122>.

University of Technology Sydney. 2019a. 'UTS CETC review', September 13 <https://www.uts.edu.au/news/media-contacts/uts-cetc-review>.

University of Technology Sydney. 2019b. 'UTS statement to Four Corners', July 12 <https://www.uts.edu.au/news/media-contacts/uts-statement-four-corners>.

University of Technology Sydney. 2019c. 'Statement to Four Corners – 9 October 2019', October 11 <https://www.uts.edu.au/news/media-contacts/statement-four-corners-9-october-2019>.

Web of Science Group. 2019. 'Web of Science journal evaluation process and selection criteria', August 16 <https://clarivate.com/webofsciencegroup/journal-evaluation-process-and-selection-criteria/>.

Webster, G., Creemers, R., Triolo, P., Kania, E. 2017. 'China's plan to 'lead' in AI: purpose, prospects, and problems', New America, August 1 <https://www.newamerica.org/cybersecurity-initiative/blog/chinas-plan-lead-ai-purpose-prospects-and-problems/>.