

An artificial race for intelligence

AI researchers in China are keen to keep the global sharing culture of AI alive, despite obstacles, including an ongoing trade war with the United States.

BY SARAH O'MEARA

GEOFFROY DE CRÉCY

In 2010, computer scientist Jie Tang was given a rather unusual task by his bosses at Tsinghua University in Beijing. He was asked to go to the United States and befriend a world-renowned artificial-intelligence researcher.

“The leadership team wanted a Turing Award-winning scientist to evaluate our department to help us become a world-class team, not just top in China. They’d heard of John Hopcroft at Cornell University. But no one knew him personally,” Tang says.

Tang’s department thought that his research into how users behave on social networks made him an ideal candidate to approach Hopcroft, who worked in a similar

area, and so Tang and his colleague, Shiqiang Yang, headed to Cornell in Ithaca, New York, to invite Hopcroft to Beijing.

“He was very friendly and invited us to his home for dinner,” says Tang. Months later, Hopcroft and a team of scientists from all over the world began advising Tsinghua’s computer scientists on how to move up the rankings. And in 2011, Tang returned to Cornell as a visiting scholar to collaborate with Hopcroft.

It’s the kind of story that’s much less likely to happen now. Nine years on, Tsinghua’s computer-science department is no longer an academic outlier in need of assistance. It was ranked first by the US News Best

Global Universities for Computer Science in 2019 and produced the largest share (see go.nature.com/2pvdka7) of the top 1% most highly cited papers in maths and computing of any university in the world between 2013 and 2016.

China’s publication of AI-related papers now ranks second only to Europe in the world, having overtaken the United States in 2006. Between 2007 and 2017, the number of AI-related papers published in China tripled from 5,995 to 15,199.

“I don’t think Chinese scientists from other lower-ranked institutes would have had the same opportunity as me, back then,” says Tang. “To go out and form an international ►

► collaboration. But now the country is more open. All universities have international offices and seek out ways to work with other countries.”

THEY CAME FROM THE WEST

China’s AI research environment has been supported by overseas specialists since the late 1990s when US computer company Microsoft opened Microsoft Research Asia and recruited local computer scientists. Top executives at the Chinese e-commerce giant Alibaba, telecommunications company Huawei and Asia’s largest technology firm Tencent all began their careers at Microsoft Research Asia. Kai-Fu Lee, who founded the lab in 1998, went on to become the president of Google China during its brief operational period as a search engine (the company’s search engine was blocked in China in 2014 after a dispute over censorship, although Google maintains a presence in the country), before leaving in 2009 to set up his own venture-capital firm.

Despite this background, China’s AI research has become a divisive political issue between nations. In 2017, China announced a plan to become a world leader in AI by 2030 — a goal that has fuelled the fear of politicians, particularly in the United States, over China’s potential for technological supremacy.

The announcement came at a time of concern for leaders of high-tech economies, who said that China was already endangering international relations by demanding companies hand over intellectual property in exchange for access to Chinese markets.

In 2018, a trade war began in earnest when US President Donald Trump placed tariffs on 818 Chinese goods, including lab equipment and reagents. The US government has since placed obstacles in the path of Chinese scientists working in sensitive fields, such as AI, shortening the length of study visas for graduates for example, and US institutes

have restricted collaborations with Chinese companies, such as Huawei.

On a daily basis, Chinese computer scientists are frustrated by the impact of the trade war on their research. Visa applications are frequently delayed or denied, says Zhi-Hua Zhou, dean of the School of AI at Nanjing University. At the Association for the Advancement of AI’s 2019 conference held in Hawaii in February, “lots of China researchers were not able to get a US visa in time”, he says. “That meant their colleagues, including those from the US, lost the opportunity to see the presentation of their recent development and inventions.”

AI RESEARCH IS ABOUT OPENNESS AND SPEED. IF YOU DON’T SHARE YOUR WORK, IT’S MEANINGLESS.

Yunji Chen, a researcher at the Institute of Computing Technology in Beijing, notes that the culture of AI research contrasts sharply with the current political climate.

“AI research is about openness and speed. If you don’t share your work, it’s meaningless because your success is measured by how many people across the world download your algorithm or code and are using it. Also, you need to publish immediately, or someone else will have got there first and claim that moment.”

He points out that AI researchers publish

their algorithms, codes, data and results in real time and to an international readership on open web platforms such as arXiv and GitHub, where others can find and use the research. “I think collaboration is more important than competition and would advocate for more. I think there’s no real gap between the Chinese, US and European AI communities. We talk to each other and discuss cutting-edge improvements. It benefits all sides.”

In 2016, Chen’s research was spun out into Cambricon, a Beijing-based manufacturer of advanced semiconductor chips that speed up AI-powered applications in devices such as mobile phones and servers. The company is currently valued at US\$3 billion, according to Chen.

Chen remains an academic and stresses his commitment to the open culture of AI research. He uses the story of Tsinghua graduate Yangqing Jia who developed Caffe, an open-source deep-learning framework, during his PhD at the Berkeley Artificial Intelligence Research (BAIR) lab at the University of California, Berkeley, as an example of how research is shared across borders. Caffe didn’t sit in a national database or behind a paywall, Chen is quick to point out. Instead, it lives on GitHub.

“This is very important work. It’s been downloaded from GitHub tens of thousands of times. Both Chinese and US researchers will write their deep-learning applications based on this framework,” says Chen. “This is how AI research works.”

WHERE DO RESEARCHERS COLLABORATE?

AI professors are adept at finding informal ways to collaborate face to face, as well as online. Although it’s extremely rare to find research that’s jointly funded by the Chinese and an overseas government, there are a variety of channels that ensure researchers can work together. These collaborations are the source of a growing number of papers by Chinese and overseas researchers.

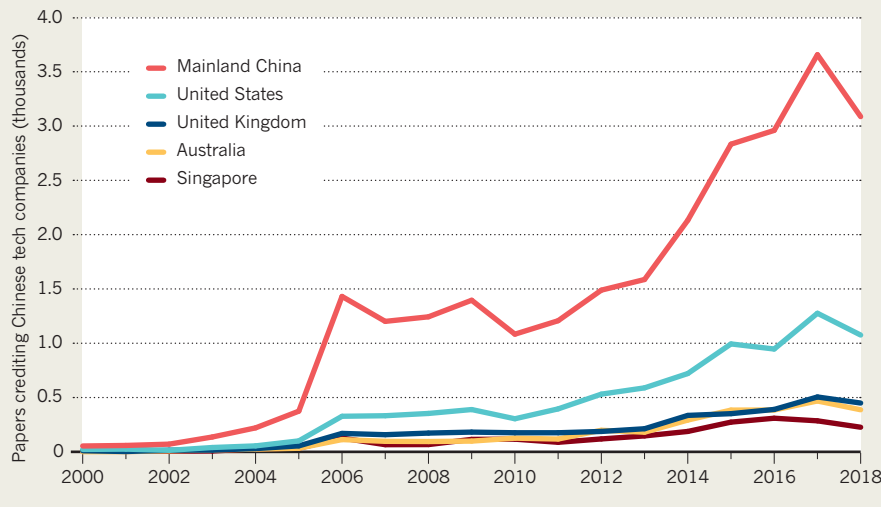
Xi’an Jiaotong University’s Institute of Artificial Intelligence and Robotics is one of China’s oldest AI research teams. Established in 1986, it has formed research partnerships with institutes in countries such as Japan, the United States, the United Kingdom, Germany and France over the years, and former president Nanning Zheng says the university uses a range of collaboration tools: from holding conferences with international speakers and employing well-known foreign scholars as adjunct professors, to sending young faculty members and PhD students to conduct cooperative research abroad.

“AI blurs the boundaries between physical reality, data and individuals. It creates complex moral, legal, ethical and security issues. Dealing with these issues is a global problem,” says Zheng. “We need to strengthen international cooperation.”

The easiest way to bring scientists together is in a conference setting. But until a decade

TECH SUPPORT

The number of research papers crediting the Chinese technology companies Alibaba, Tencent, Baidu and Huawei has increased in recent years, both in China and internationally.



SOURCE: SCOPUS

ago, Chinese scientists were not present at major gatherings. Now, they attend top-level meetings and have started inviting overseas researchers back home.

In 2017, Chen arranged for the 22nd conference on Architectural Support for Programming Languages and Operating Systems to be held in Xi'an. Computer science conferences have tended to be held in the United States or Europe, says Chen. "Ten years ago it would have been hard to convince organizers to do it here. But now there are so many Chinese names on the programme list that they agreed. We had the highest numbers of attendees and submissions in its history."

PHD++

In 2006, Tang launched Aminer, a platform for searching academic publications that offers similar services to Google Scholar, from Tsinghua University. Today, its code hosts an algorithm developed by AI researcher Michalis Vazirgiannis and his team.

Tang met Vazirgiannis, who runs the Data Science and Mining group at the École Polytechnique in Paris, at a conference in 2012. Since then, Vazirgiannis has visited Tang's laboratory frequently and one of his postdocs spent several weeks in China deploying an algorithm to compute a new metric that has improved the effectiveness of Aminer's services.

Many AI papers with international co-authors are also the result of this kind of swap. Faculty members regularly send PhD students and junior researchers to other labs to enable collaborations.

Computer scientist Ling Shao's research career had taken him to four institutions in the United Kingdom: the University of Oxford, the University of Sheffield, Northumbria University and the University of East Anglia. As a result, he has the fourth-highest citation rate for papers co-authored by researchers from the United Kingdom and China over the past decade.

"As a professor, you always have to attract PhD students, that's a major part of the work," he says. "And since I was from China and have many connections with top Chinese universities, I recruited students from there, such as Peking University, the University of Science and Technology of China, Zhejiang University and Xi'an Jiaotong University."

In early 2018, Shao founded the Inception Institute of Artificial Intelligence in Abu Dhabi, and is its chief executive and chief scientist. His decision to move to the United Arab Emirates was inadvertently prompted by his past connections with top-level talent. "I had two former PhD students working in the UAE and they started telling me about the growing AI science scene. I decided to find out more."

FUNDING FROM THE EAST

The rise of influential tech companies in China has increased the volume of AI research and opportunities for researchers. Academics all over the world now work on research projects

funded by Chinese Internet behemoths (see 'Tech support').

Vazirgiannis, for example, has been working with Tencent, which owns WeChat, a sophisticated messaging app with more than 1 billion users, on machine-learning projects. "They send us the data, and with it, we do the research and can publish papers. But we can't release the data itself. That's proprietary."

At NeurIPS 2018, a machine-learning and computational-neuroscience conference, Tencent was the fifth-largest contributor of published papers, behind Google, Microsoft, Facebook and IBM.

Han Xiao works as an engineering lead at Tencent's AI lab in Shenzhen, and also runs the non-profit organization the German-Chinese Association of Artificial Intelligence, which is dedicated to promoting collaborations between China and Germany, where he did his degree. "We are really serious on sharing work with the public," he says. "Most of Tencent's research is published either at top-tier AI conferences or an open-publication model, such as arXiv."

SHARING AT AN IMPASSE?

Wu Fei, the vice-dean of Zhejiang University in Hangzhou, has been involved in formulating China's AI development plans, including the New Generation Artificial Intelligence Development Plan released in 2017, which outlined China's strategy to build a domestic AI industry worth nearly \$150 billion and become a leader in AI by 2030.

The plan calls for more international cooperation. "If you want to study one algorithm or method, then it can be done by one professor. But if we want to study the interdisciplinary research between AI, neuroscience, mathematics, for example, then that's good motivation to set up strong international cooperations," he says.

Wu also thinks that the ethical and security dilemmas posed by AI must be solved multilaterally. "The challenges faced by AI cannot be worked out by one country. For example, international cooperation can be used to jointly agree that an AI weapon cannot be used in a large-scale war."

Although Wu is aware that tensions between China and the United States stand in the way of joint initiatives, he would like to see joint funding programmes between national governments so that researchers can work together, as well as jointly funded research institutes. He points out that AI, could become a "terrible force" without international cooperation.

"The most urgent task is to collaborate. We cannot say that in order to prevent competition, we will not cooperate. Ultimately that would damage the interests of all mankind." ■

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