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China embraces AI:
A Close Look and A Long View

A technology revolution is now sweeping the world, and the countries that most effectively seize the opportunities it creates will dominate the 21st century. Nowhere is the revolution more transformative for lives, livelihoods, security and prosperity than in the field of artificial intelligence. AI will shift the balance of power in both the global economy and international relations, because the countries that master AI first will have a crucial strategic advantage in writing the rules for the next global order.

As with any transformative technology, it's hard to cut through the hype. Journalists and subject matter experts can highlight the most important emerging trends and questions, like the potential political impact when AI and AI-driven automation transforms labor markets. After all, even if technological change brings an eventual net gain in the total number of jobs, it will dislocate huge numbers of workers who lack the education and training to advance from old jobs to new ones. That reality will make it more difficult for government to meet the needs of citizens in every country on Earth. But the 36,000 foot view of AI and its implications will blur important distinctions between different types of AI, and the varying approaches that governments will take in adopting it and adapting to its impact. This white paper – a collaboration between Kai-Fu Lee, a world-leading AI researcher and founder of Sinovation Ventures, and Paul Triolo, head of Eurasia Group's Geo-technology practice—represents their bid to capture essential features of this dynamic and fast-changing sector, with a focus on China.

Today's consensus view is that the United States and China have begun a two-way race for AI dominance, making technology a key source of trade friction between the two countries. At a moment when policymakers and legislators are debating the future of the US role in the world, and tensions between the White House and Silicon Valley are growing, China has put the full power of the state behind its drive for AI dominance. China continues to lag the US in cutting-edge hardware and talent, but it has more internet users than the US and Europe combined, an advantage that could give China an unassailable lead in amassing the huge data sets that lie at the heart of AI innovation. But while US-China competition is a central element of their relationship, this is not simply a winner-take-all game. As China races to close the gaps in its AI capabilities, a closer look at the sector also shows more cross-pollination between the superpower and the emerging challenger than the casual observer might expect.

Beyond these two powers, decision-makers in countries large and small are now grappling with the opportunities and anxieties created by the advent of artificial intelligence. While this may lead to rising trade frictions and concerns about the importance of AI to national security in the short term, in the long-run AI, automation, and related technologies will be key to establishing security and prosperity for coming generations of citizens around the world.

— Ian Bremmer, Eurasia Group

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China's Artificial Intelligence Revolution: Understanding Beijing's Structural Advantages

By Dr. Kai-Fu Lee, Sinovation Ventures, and Paul Triolo, Eurasia Group

If 2017 was the year of China AI excitement and hype, 2018 will be the year that China's true competitive position in AI becomes clearer. Much of the media coverage of China's AI rise has focused on the big Chinese Internet companies and their deployment of AI, high-levels of government interest in the technology, and the potential for a US-China "AI race." The latter discussion typically comes with a stiff dose of alarmism about the potential military use of AI, which has arguably been given too much prominence, concerns about killer robots notwithstanding.

These analyses disappoint on many counts. They typically fail to differentiate between the different meanings of AI, how it is already being put to work, and how it will be used to add intelligence to a wide range of software applications. This white paper attempts to address this imbalance, first by offering a more nuanced view of AI in China in its many manifestations, and then by outlining the main sources of China's emerging AI advantages.

Artificial intelligence is not just another product or service. It is a fundamental enabling technology that can be added to existing processes and services to make them smarter, more efficient, more accurate, and more useful. AI is not a monolith. It is best understood as four distinct waves of applications: Internet AI, Business AI, Perception AI, and Autonomous AI. Assessing a country or company's current capabilities and future prospects in AI requires a nuanced understanding of these different AI domains, along with other variables, such as the amount of data, quality of talent, and availability of cutting-edge hardware.

With the above taxonomy, we can make the following predictions for the development of AI in China:

- **A new generation of scientific talent will accelerate China's AI development:** China currently has a deficit in top AI talent, but a huge army of young scientists is amassing. We anticipate this talent deficit will evolve into an advantage over time.
- **AI-ready data will be a key source of advantage:** Huge data sets, and more flexibility to use them in AI applications, will become China's core AI advantage. This single advantage will be insurmountable by other counties.
- **China will become a world leader in three out of four core AI applications:** China's capabilities in Internet AI, Perception AI, and Autonomous AI will not only be very strong, but world-leading or co-leading.
- **Business AI will lag in China:** China's capabilities in Business AI will develop more slowly due to a lack of enterprise software and data warehousing.
- **Chinese AI will continue to benefit from a highly favorable regulatory environment:** Unparalleled government support will significantly accelerate China's AI development.
- **China will become a global AI power:** Beijing will rise to become an AI innovation center at the level of Silicon Valley, overtaking the likes of Toronto, Montreal, and London.

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Key factors in the AI equation

AI is a blanket term for a large set of processes, data analytics, enabling technologies, applications, and software that make an existing process "smarter" with highly optimized results. AI can enable smart game playing (such as AlphaGo), efficient financial applications (such as loan underwriting), super-human perception (such as speech or face recognition), and even advanced decision making (such as autonomous vehicles).

In order for AI to function, four important pre-requisites are needed.

- A sea of data: By far the most important element is the availability of large, labelled data sets (examples include information about people who applied for loans and whether they repaid or defaulted; or people who submitted a customer complaint and whether they are satisfied or dissatisfied). AI uses these large data set as examples to teach its algorithms to optimize.
- Computational power: Huge data sets require significant computing power. This increases as the number of training samples rises from millions to billions, and as the size of each sample grows (video is larger than a still image, which is larger than speech, which is larger than search or e-commerce data). Very large data sets often require parallel processing, as well as specialized hardware, such as graphics processing units, or GPUs.
- Domain-specific focus: Today's AI functions only in clearly defined single domains. It is not capable of generalized intelligence or common sense (AlphaGo does not play chess; AI trained to determine loan underwriting can outperform human in that task, but cannot do any other task).
- Special (human) expertise required: AI algorithms are not yet "platforms" or "frameworks," and cannot be used by ordinary engineers. Despite the availability of openly published academic papers and even open-source software, experts are needed to "tune" AI to work for a given domain and data set. This is likely to remain the case for several more years, until efforts like Google's Tensor Flow become as easy to use as widely-used programming packages for mobile phone operating systems.

The four waves of AI development

AI development is proceeding in four waves. These are happening simultaneously, but with different starting points and velocity:

1. Internet AI – Internet websites and apps are the biggest sources of user-labeled data today – when we click to buy on an e-commerce website, we are giving AI a label to learn from. The Internet giants (Google, Facebook, Amazon, Baidu, Alibaba, Tencent) are the greatest beneficiaries of these large internet-derived data sets. This wave of AI began around 2010, when Google started to adopt deep learning throughout the company.

    a. China's massive data sets and strong venture capital ecosystem, with funding available for tenacious entrepreneurs, means that Chinese startups are poised to lead or co-lead in the areas of Internet AI with the United States.

    b. Alibaba will hold its own against Amazon, while Tencent will probably lead Facebook. Baidu is the Google of China, but lags its US competitor in this area of AI.

2. Business AI – Businesses that have large repositories of data can apply AI to historical or new data to connect to business processes and aid in decision-making . Examples include IBM Watson (US), Layer 6 (Canada), and 4th Paradigm (China) who apply AI to financial data (for predicting commodities and stocks, credit card fraud, and for optimizing client asset allocation). This wave began around 2013 when many AI for business companies were founded.

China will take a while to catch up in Business AI, because Chinese businesses have been slow to adopt data warehousing and enterprise applications. Thus, the cleansing and structuring of data for AI processing will be slower for China.

3. Perception AI – Perception AI involves digitizing the physical world through sensors and smart devices, collecting new data that may have been previously unavailable, and using it to create new applications. For example, Amazon Echo digitizes our audio environment and speech input; China's Face++ collects large amounts of video including people's faces. This phase of AI will require deploying large numbers of internet-connected sensors, new types of multimedia content, and, occasionally, new user interfaces (e.g., by speech and gesture). This wave of AI also includes autonomous stores, which can recognize customer faces and product selections, , understand gestures, and automatically process customer check out and payment. This wave of AI development began in 2015, when these new capabilities began to become pervasive.

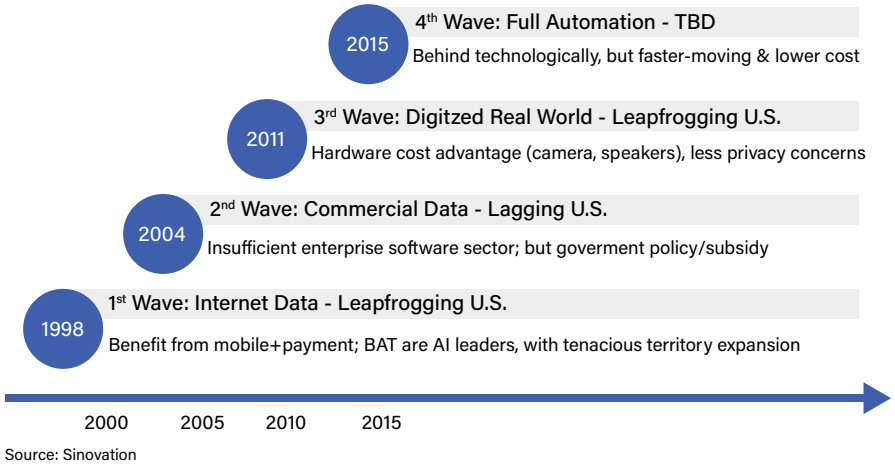
   China will be a leader in this area, because of the huge quantity of available data being collected, and also because Chinese citizens are less concerned about privacy in public spaces (e.g., video cameras in shopping malls recognizing faces and targeting each user with potential offers).

4. Autonomous AI – The previous three waves of AI are largely software driven, but Autonomous AI uses movement and tactile output to make AI into self-driving cars, robots, and connected things. This wave will begin soon, as Level-3 driverless vehicles and factory robots become commonplace.

   a. China has a chance to lead or co-lead in this space. While Chinese technology in this area is about two years behind the US, Chinese entrepreneurs are pushing hard, with government support in policy, subsidies, and a willingness to experiment.

   b. As China is the largest self-contained manufacturing nation in the world, enhanced or brand new robotic production lines needed to enable autonomous AI will move much faster and will be more cost-efficient to deploy in China.

AI products: Who's ahead? China versus US



Source: Sinovation

The big AI players: a US-China comparison

Just as US has three big AI players, so does China.

Google has perhaps 50% of the world's top 100 AI scientists, focused on efforts including Google brain (a kind of new, AI-enabled operating system), Google cloud (analogous to a new kind of power grid), and DeepMind (known for AlphaGo). **Baidu** has been following in Google's footsteps, building up its Duer OS (for speech and language-based OS) and Apollo (the beginnings of an OS for autonomous vehicles). Baidu has the largest number of AI experts in China, despite some recent high-profile departures. Despite the similarities above, the AI talent gap between Google and Baidu remains significant (Google leads any company by a large margin).

Facebook applies AI throughout its properties, because social networks continue to attract huge usage data, which is fuel for AI. Facebook has assembled a top tier central research lab (FAIR) and an applied machine learning (AML) group. **Tencent** is most analogous to Facebook, with a central research organization, and each product group (such as WeChat) fielding its own applied AI group.

Amazon has been a black horse in the AI race. While it was never known for AI research or technology, Amazon AWS, Amazon Echo, Amazon Go, and the Whole Foods acquisition are all AI-related, and catapulted Amazon to a leadership position in applied AI. Amazon Echo and the Alexa API became the core of a speech-driven operating system. Amazon Go and Whole Foods have begun to merge online and offline for the most optimized giant merchant in the world. And AWS is the most popular cloud product, now enhanced with increasing AI capabilities for third parties. **Alibaba** has proceeded with a similar strategy, with Ali Cloud as the leading cloud system with AI added. Alibaba also opened its own brick and mortar stores and demonstrated its autonomous stores, intending to merge online and offline.

To recap: Google and Baidu are similar in their platform/OS ambitions. Amazon and Alibaba are similar in their cloud-plus-AI and online-merge-offline AI ambitions. Facebook and Tencent are similar in their focus on using AI in their most popular consumer applications, without visible platform ambitions to date.

China's vibrant AI start-up scene: from copycat to leapfrog

China's startup scene has transformed dramatically over the past 10 years, from copycat versions of existing applications to true leapfrog innovation. This is largely a result of capital flowing into China, a large pool of determined and hard-working entrepreneurs, and supportive government policies. Even prior to AI, China has leapt ahead of the US in mobile innovations, faster growth, and value creation.

This growth has led to a huge explosion in data, which is the fuel for AI. Startups in each of the four waves are plentiful. Internet companies have built AI capabilities quickly, and leveraged it for their growth. Internet-driven AI companies include Didi (ride sharing), Meituan (food delivery), Toutiao (news aggregator), Meitu (selfie beautification), Kuaishou (live streaming), as well as several fin-tech companies that built Internet apps for personal finance: Qudian, PPdai, and Smart Finance. These companies are valued around $150 billion.

There are also pure-play AI companies in Wave 2 Business AI – typically focused on finance, health, and enterprise services. Examples include 4th Paradigm (AI solutions for banks and financial institutions), Yibot (AI customer service for consumer service providers such as China Mobile, Didi, Ctrip), and iCarbonX (health tracking).

In Wave 3 Perception AI, there are many companies working on smart devices, face recognition, speech recognition, including Face++ and Sensetime (face recognition), Mobvoi (voice assistant), Ainemo and Rokid (smart home assistants). The foremost example is iFlyTek. iFlyTek is China's leading speech recognition company,

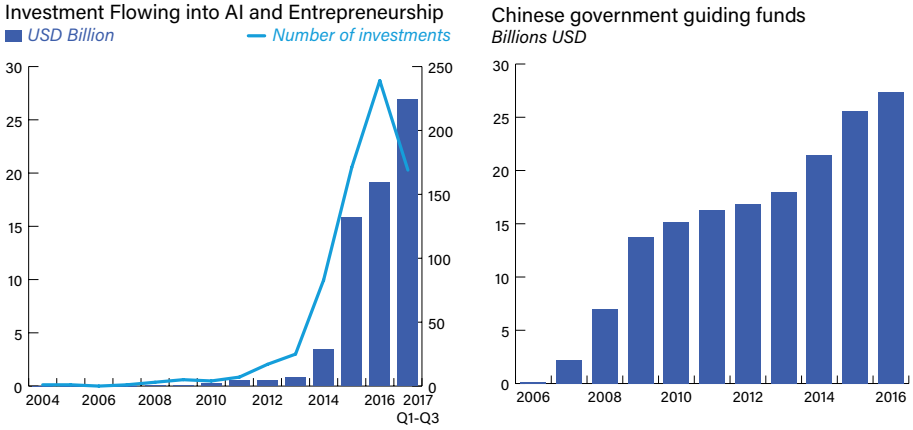
comparable to Nuance in the US. But if we track the two speech recognition players closely, iFlyTek's market cap has surpassed Nuance since 2015; by the end of 2016 it was more than double its main US competitor's.

Some players in Wave 3 digitization are rolling out AI in lifestyle products. Mobike, China's leading bike-sharing company, now deploys smart bicycles across over 200 cities globally. The bikes are equipped with solar-powered GPS, accelerometers, Bluetooth and other sensors. Both NFC (near-field communications) and microphones are activated by smartphone. The various sensors transmit data to a cloud-based server. Each day, tens of millions of cyclists peddling around Chinese megacities generate 20 terabytes of data for Mobike to analyze and optimize with AI — connecting people, bikes, roads and destinations as one of the world's largest "internet of things" networks.

Finally, for Wave 4 Autonomous AI, autonomous vehicles and robotics are also in high-growth mode. UISEE, founded by the former director of Intel Labs China, has begun testing a fully autonomous vehicle in slow-driving scenarios in defined areas. Momenta's technology combines deep-learning-based software in perception, HD semantic mapping, and data-driven path planning as the brain for autonomous driving working with Chinese and international car manufacturers. Meanwhile, in the skies, Shenzhen based DJI has reportedly captured 85% of the consumer drone market with an $8 billion valuation. One key advantage of DJI over American companies that have to travel to the other side of the world to build their products, is that DJI has its own manufacturing facilities in Shenzhen. Its engineers can design and test prototypes in neighboring facilities, allowing for rapid progress from idea-generation to product creation.

AI has quickly become the hottest area for Chinese start-ups. Investors poured US$4.5 billion into over 200 AI companies between 2012 and the third quarter of 2017. Over half of those investments have occurred over the past two years. Face++, a Beijing based facial-recognition startup, announced a C-round investment of $460 million in early November 2017, the biggest-ever AI venture capital fund raising globally. In the same month, the company won first place in 3 computer vision challenges, ahead of teams from Google, Microsoft, Facebook, and Carnegie Mellon University.

Capital is flowing into AI and entrepreneurship



Source: Yiou, Eurasia Group, Tencent, PeData, Zero2 IPO Group

China's greatest asset: Data leadership

More data makes AI smarter. A very good scientist with a ton of data will beat a super scientist with a small amount of data. This is not always well understood, but it is critical to determining which companies – and countries – will take the global lead in AI development.

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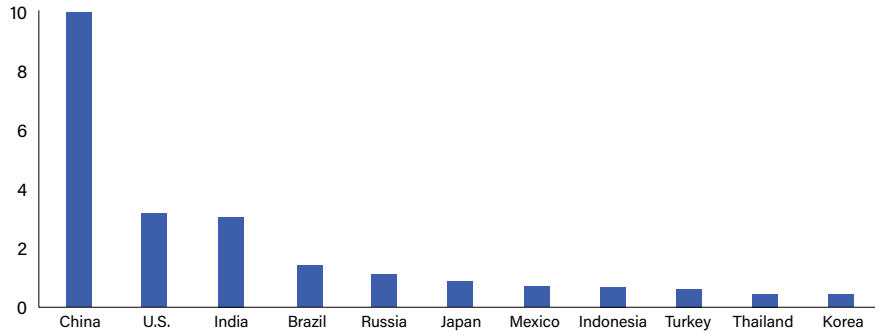
China's AI technology is still behind, but it is catching up quickly as entrepreneurs and investors jump into the sector. The size of available datasets is the most important source of competitive advantage in AI. Most AI algorithms are open-source and well-known. It takes smart people to tweak the algorithms, but when it comes to applying them, it's all about the data: who has it first, and who has more. If you have more data, you have a product that's better trained with AI. That gets you more users, which makes you more money, which you can use to hire more scientists, buy more machines and get more data. This virtuous cycle has been the key success factor behind Facebook, Google and Microsoft and in China, Baidu, Tencent, Alibaba and many others. As computer scientist Robert Mercer says, "there's no data like more data." So, how much data is China generating?

China has the most mobile phones and Internet users in the world: 1.39 billion mobile phone subscriptions as of September and 800 million Internet users (the vast majority using mobile access, 725 million as of August) – about three times more than that in the United States or India. In the mobile connected world, China has the edge. But that's only part of the story.

The gap in internet and mobile usage is much larger than a factor of three. In China, people use their mobile phones to pay for goods 50 times more often than Americans. Food delivery volume in China is 10 times more than that of the United States. And shared bicycle usage is 300 times that of the US. This proliferation of data -- with more people generating far more information than any other country – is the fuel for improving China's AI.

China = The world's largest unified mobile market by 3x

Number of active devices by country (in '000MM)

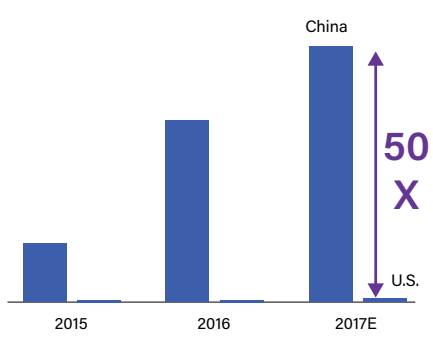


Source: QuestMobile, CNNIC

But the gap is actually much larger than 3x

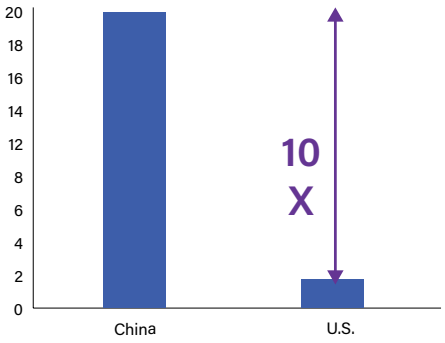
China versus US mobile paymets

Trillion USD



China versus US food delivery orders

Millions



Note: Data as of June 2017

2017 Q1-Q3 China AI industry level distribution of investment

Sector	$ billion RMB
Transportation	9.95
Corporate service	9.07
Healthcare	7.93
Finance	6.59
Real estate	1.58
Advertising and marketing	1.40
Public Security	1.00
Education	1.00
Consumer goods	0.68
Logistics	0.65
Internet service	0.60
Cultural entertainment	0.43
Manufacturing	0.30
E-commerce	0.25
Accomodation	0.17
Gaming	0.01
Sports	0.002
Social network	0.001

Source: Alibaba, Eurasia Group

Closing the talent gap

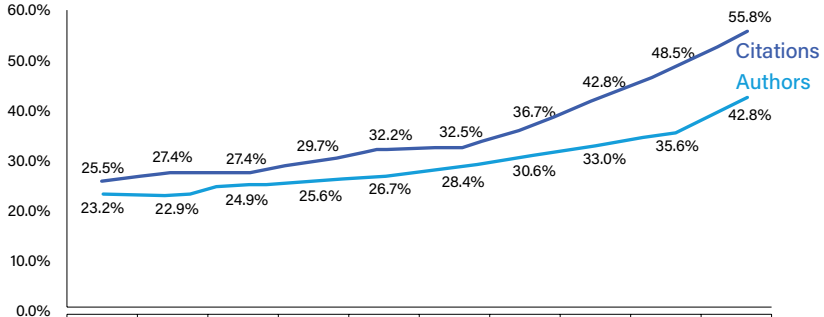
While the world's top elite AI researchers are still mostly Americans, the number of AI researchers in China is growing fast.

China's Microsoft Research Asia (MSRA) (where Kai-fu Lee was part of the founding team) has trained over 5,000 AI professionals, including interns. Many of these 5,000 people have moved on to other companies and universities. For example, some have become CTOs and chief AI scientists of China's biggest companies including Baidu, Alibaba, Tencent and Lenovo. Some have moved on to start-ups (such as Face++ Chief Scientist Sun Jian, Momenta CEO Cao Xu-Dong), while others have moved to Chinese universities and research institutions.

The quality of Chinese research output is also rising. The number of ethnic Chinese authors accounts for 43 percent of the top 100 AI journals and conferences, an indicator of rapid growth in Chinese AI research.

Ethnic Chinese AI research contribution growing to 43%

% Chinese researchers contribution to best 100 AI journals/ conferences 2006-2015



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
% total papers	23.2%	22.9%	24.9%	25.6%	26.7%	28.4%	30.6%	33.0%	35.6%	42.8%
% cited papers	25.5%	27.4%	27.4%	29.7%	32.2%	32.5%	36.7%	42.8%	48.5%	55.8%

Source: Sinovation Ventures AI Institute

Finally, young Chinese students are rushing into AI as the hottest (and highest paid) area. Chinese universities' strong computer science and mathematics programs have created a pipeline of engineering graduates primed for work in the field.

These factors suggest that while China currently has a top-level AI talent deficit, it will likely overcome this in the coming years due to the large number of talented people entering the industry.

Hardware: Robots, automation and AI chips

China is by far the biggest robot market in the world. Data tracked by the International Federation of Robots show the country continues to break records in automation. China's automation drive gained added heft in 2015, when the government announced a national 10-year plan entitled "Made in China 2025." The plan, which aims to turn China into one of the top technological industrial nations, includes strengthening Chinese robot suppliers and further increasing their market shares both at home and abroad. This robotic revolution is creating a robust ecosystem of hardware, Automation AI and associated talent to help China prepare for a fully automated world.

Semiconductors are another key component of China's budding ecosystem. While Chinese firms are still catching up to their US peers in developing AI-optimized hardware, they are making rapid progress on semiconductors designed for AI algorithms such as neural networks for machine language processing and facial recognition. It is unlikely that China's late start will hold back developments in the sector. Chinese companies running

high-end AI applications have access to many options, from leveraging cloud-based AI services running on GPUs or tensor processing units (or TPUs, a type of integrated circuit developed by Google specifically for machine learning) to developing applications that leverage neutral network processors running on smartphones. Leading Chinese telecom equipment maker Huawei has devoted considerable R&D efforts to developing its family of neural network processors for mobile phones, this year debuting the Kirin 970 chip, for example.

A growing number of deep tech startups are pursuing dedicated AI integrated circuit (IC) design and development, including Cambricon, Bitmain, DeepPhi, Vimicro, ChipIntelli, and Horizon Robotics. US companies such as Nvidia, Intel, Xilinx, Altera, and AMD have a major advantage over these Chinese startups in terms of intellectual property, manpower, resources, and industry experience. It is likely that the Chinese government's vast high-tech research apparatus will increasingly contribute intellectual property, manpower, and resources in this endeavor--though it remains unclear where this will make the most difference. In the meantime, Chinese hardware firms that are pursuing dedicated chips for niche applications could break into some markets such as image sensor chips, image processing chips, and semiconductors for autonomous vehicle applications. Mobile phone companies including Huawei and ZTE will also continue to develop AI chips for their smartphones that are on par with leading Western brands.

AI policy in China

Beijing's AI policy priorities are clear. The "Next Generation Artificial Intelligence Development Plan," announced by China's State Council in July 2017, called for China to catch up on AI technology and applications by 2020, and to become a global AI innovation hub by 2030. Chinese President Xi Jinping hammered the point home in his 19th Party Congress speech in October, when he mentioned the development of advanced manufacturing and the promotion of further integration of the Internet, big data and artificial intelligence with the real-world economy. Beijing has placed huge bets on AI for a host of political and economic reasons, from improving governance capacity to improving policy development and surveillance. The plan calls for China to lead the way in developing a regulatory environment to both encourage AI development and to mitigate the potential downsides of AI.

A few months after the national plan's announcement in July, the Ministry of Science and Technology (MOST) designated Baidu to lead the autonomous vehicle platform, Tencent for medical, Alibaba for Smart Cities, and iFlyTek for speech interfaces.

These plans should be taken seriously, as the Chinese government has shown a strong track record in delivering results. For example, Beijing announced in 2010 that China would become the world's leader in adopting high-speed rail (HSR). Today it has 60% of the world's HSR market. In 2014, the Chinese government announced the "Mass Entrepreneurship and Innovation Plan."Today there are business 8000 incubators in China, compared to 1400 in 2014. These plans have teeth, both due to the deadlines and metrics set out at the national level, as well as the local companies that are likely to take these directions as top priorities. We can expect a similar trajectory for China's AI policies.

Historically, the Chinese government has been open-minded towards technology development. When a new technology comes out, the government will give it the benefit of doubt and let it grow, rather than stifle it with policy or endless debates. Also, the environment in China is more conducive to fast launch and iteration. There is a general belief that it is better to launch something and then get it approved later. This allows Chinese businesses to generate real data at scale, which in turn allows technology to improve over a shorter period of time, particularly once AI is introduced into the equation. For example, while in the US, truckers' unions are petitioning the Department of Transportation to delay autonomous truck testing, in China, the Xiong'an New Area, a planned smart city development southwest of Beijing, is being designed from the ground up with full autonomy in mind. Various highway authorities are willing to develop road augmentation, special lanes, or move warehouses near highway exits, all to facilitate faster deployment of autonomous trucks.

We also see major initiatives in cities, following the central government's call to action. Shanghai, Nanjing, Wuhan, and Tianjin are but a few of the cities coming out with their own AI initiatives. As with past policies, much of the resources will be applied at the provincial and city government levels. The types of resources may include subsidies for top talent (especially overseas talent); guidance for top VC funds, with the government playing the role of limited partner (LP) but offering some of its upside to the general partners (GPs) of the funds; special programs for top AI companies and start-ups (free rent, subsidy for local hiring, housing and private school for top talents); and technical awards for companies and individuals.

Finally, the US, EU, and China will also compete to be out in front on developing a regulatory regime around AI technologies and applications. The National Plan's explicit recognition of the need for regulatory, legal, and ethical principles for AI development and use represents an uncommonly foresighted approach. Of course, the government's approach to AI regulation, ethics, and economic adjustment will reflect Beijing's broader model of governance and ideology. Given its preference for a state-centric approach to international issues, for example, it is possible China will launch an initiative via the UN to establish first an automation/AI-related "code of conduct," or basic regulatory approach, followed by a special committee on the topic and eventually an oversight body operating within a UN framework. Such an initiative would put China at the forefront of developing a global approach to these issues. Beijing has attempted a similar approach on cybersecurity issues, which it argues have a global impact and require a global regulatory response.

A long view: Future duopoly of AI

To sum up, AI in China is on the rise, propelled by several structural advantages for AI development: huge data sets, a young army of talent, aggressive entrepreneurism, and a strong and pragmatic government AI policy.

- These advantages will accelerate development across all four waves of AI: Internet AI, Business AI, Perception AI, and Autonomous AI.
- The big players in China are competing fiercely with US counterparts, but currently lag on research and scientific expertise as well as global platform experience.
- The vibrancy of the Chinese technology startup ecosystem and huge expansion of technical and engineering talent is closing the talent gap.
- China's sea of data, robots and computation proficiency are growing, with the size and availability of massive data sets set to become a key advantage for China's AI development.
- A supportive regulatory environment and turbo charged government ambitions for AI will ensure the country is uniquely placed to compete for AI dominance.

The pro-tech, pro-experimentation, and pro-speed attributes put China in position to become a strong AI power. In this age of rapid innovation, the US-China AI duopoly is not only inevitable. It has already arrived.

China next generation AI development plan goals

Year	Focus	Core industry revenue (billion RMB)	AI related industry revenue (billion RMB)
2020	Big data intelligence, autonomous intelligence systems, cross-medium intelligence, swarm intelligence, hybrid enhanced intelligence, AI foundational theories	150	1,000
2025	Intelligent manufacturing, intelligent medicine, intelligent city, intelligent agriculture, national defense construction, AI laws and regulations, AI security assessment and control capabilities	400	5,000
2030	Social governance, national defense construction, industrial value chain	1,000	10,000

Source: State Council, Eurasia Group

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Major Chinese national and local government strategy and policy documents related to AI and automation (2015-2017)

Name	Issuer	Date	Focus
Made in China 2025	State Council, MIIT lead	May 2015	Bolstering smart manufacturing, robotics, semiconductors
Internet+ Action Plan	State Council, NDRC, MIIT, MOST, CAC leads	Jul 2015	"Developing Internet access for industry, and leverage AI to create new services and applications, mentions fostering AI backbone enterprises"
Internet+ and AI Three-Year Action Plan	NRDC	May 2016	"Developing basic AI ecosystem and producing world-class AI enterprises"
"A Next Generation Artificial Intelligence Development Plan"	State Council, MOST, MOE lead	Jul 2017	Lays out roadmap for China to dominate AI sector globally by 2030
Application Guidelines for 2017 Projects on Key Topics, such as Intelligent Robotics	MOST	Jul 2017	Announces key performance targets for 2017 projects involving sectors such as AI drive robots
AI Innovation and Development Megaproject Application Requirements	NDRC	Oct 2017	Details project requirements for 2018 in AI areas, including facial recognition, AI semiconductors
Implementing Opinions on Shanghai's Promotion of the New Generation AI Development	Shanghai Municipal Government	Nov 2017	Details city focus on smart cars, robots, software platforms, AI semiconductors, smart sensors
Some Policies for Promoting Development of the AI Industry	Wuhan Donghu High-tech Development Zone	Nov 2017	Establishes special fund wto provide 200 million RMB/ year for talent recruitment, innovation
New Generation AI Development Plan Implementation Kickoff Meeting	MOST, 15 ministries, commissions	Nov 2017	Announces AI Strategic Advisory Commission, AI Development Planning Office
Establishment of China AI Industry Development Alliance	NDRC	Nov 2017	Establishes leadership team that includes Baidu, Unicom, ZTE, iFlytek, AIspeech, Sysware, Haier, Huawei
New guidelines for AI industry development	NDRC, MIIT	December 2017 or January 2018	Will issue new guidelines based on the National AI Strategy

Source: State Council, Eurasia Group

Key Chinese AI startups and domestic and foreign investors

	English name	Chinese name	Emphasis	Digital economy sector	Chinese investors	Foreign investors
Level 1	Roobo	ROOBO 智能管家	Basic research level	AI system solutions for household electric appliances, automobiles, robots	iFlytek, Seven Seas Partners	
	Cambricon	寒武纪	Basic research level	Smart chips, AI processors, autonomous vehicles	Alibaba, CAS Investment Management Co., Lenovo	
	Terminus	特斯联科技	Basic research level	iCloud service, smart hardware, smart cities, smart transportation		IDG Capital
	Superpix Micro Technology Co.	思比科微电子	Basic research level	Image sensor chips, image processor chips		
	Ainemo Inc	小鱼在家	Basic research level	AI for household electric appliances: video chat, home monitoring	Baidu, Sinovation Ventures	
	Slamtec	思岚科技	Basic research level	Smart robot management, evelopment		
	Hesai Photonics Technology Co.	禾赛光电科技	Basic research level	Autonomous vehicles	Pagoda Investment	
	Zongmu Tech	纵目科技	Basic research level	Autonomous vehicles		
	4Paradigm	第四范式	Basic research level	Fintech & BI	Sinovation Ventures	Sequoia Capital

Level 2	SenseTime Co	商汤科技	Technology level	Visual computing, facial recognition, smart surveillance	Wanda	IDG Capital
	Megvii Technology	旷视科技	Technology level	Facial recognition, visual computing, public security	Alibaba, Sinovation Ventures, Foxconn	Russian sovereign wealth fund
	Ubtech	优必选科技	Technology level	Smart robots		
	CloudMinds	达闼科技	Technology level	Smart robots controlled via cloud	Foxconn	Softbank
	Baifendian Corp	百分点科技	Technology level	Big data applications	Tencent	IDG Capital
	Social Touch	时趣互动	Technology level	AI commerce	Lenovo	
	Yitu Inc	依图科技	Technology level	Visual computing, facial recognition	Zhen Fund	Sequoia Capital
	Orion Star Technology	猎户星空	Technology level	Voice recognition		
	Unisound	云知声	Technology level	Smart appliances, voice recognition, IoT	Tencent, Jing Dong	
	Tusimple	图森未来	Technology level	Autonomous vehicles	Sino Wei Capital	Nvidia
	Horizon Robotics	地平线	Technology level	AI Chip Processing	Sinovation Ventures, Hillhouse Capital, Morningside Venture Capital, GSR Ventures, Linear Venture, Zhen Fund	Sequoia Capital, Intel
	Bitmain	比特大陆	Technology level	AI Chip Processing	Sinovation Ventures	IDG Capital, Sequoia Capital
	Cloudwalk	云从科技	Technology level	Image recognition	Chinese Academy of Sciences, Shunwei Capital, Oriza Holdings, Puhua Capital, Yuexiu Fund, Qianhai Xingwang Investment	
	Sensing Tech	深醒科技	Technology level	Image recognition	Kinzon Capital, Matrix Partners China, Zero2IPO Venture	
	IntelliFusion	云天励飞	Technology level	Image recognition	Zhen Fund, Shanshui Congrong Media Investment, Green Pine Capital, Shenzhen Investment Holdings, Donghai International, Hongxiu Yingxin	
	Infervision	推想科技	Technology level	Image recognition	GF Securities, Innovation Angel Fund, PowerCloud VC Qiming VC, Genesis Capital	
	Deephi Tech	深鉴科技	Technology level	AI Chip Processing	Ant Financial, Banyan Capital, GSR Ventures, MediaTek, Th Holdings, Sigma Square Capital	Samsung, Xilinx
Level 3	NEXTEV	蔚来汽车	Application level	Autonomous vehicles, electric vehicles	Tencent, Baidu, Jing Dong, Lenovo	
	Beijing Genomics Institute	华大基因	Application level	Biotechnology		
	Mobvoi, Inc	出门问问	Application level	Consumer products: wearables, voice recognition	Zhen Fund	Google, Volkswagen, Sequoia Capital
	CHJAutomotive	车和家	Application level	Autonomous vehicles		
	iCarbonX	碳云智能	Application level	Healthcare	Tencent	

Level 3 (cont.)	CAS Dinfo	中科鼎富科技	Application level	Big data: natural language processing		
	Quant Group	量化派	Application level	Finance		
	iPinYou	品友互动	Application level	Digital marketing		
	Yongqianbao	用钱宝	Application level	Personal finance	Sinovation Ventures	
	UISEE	驭势	Application level	Autonomous vehicles	Sinovation Ventures, Zhen Fund, GYANNHILL CAPITAL, Casstar, DeepGlint	
	Momenta	初速度	Application level	Autonomous vehicles	Zhen Fund, Sinovation Ventures, BlueLake Capital, Shunwei Capital, NIO Capital	Daimler AG, Cathay Capital
	LinkDoc	零氪科技	Application level	Big Data Platform	Cenova Ventures, ABG, CBC Capital	NEA
	Yibot	追一科技	Application level	NLP, intelligent customer service	Sinovation Ventures, Morningside Venture, Banyan Capital	GGV Capital
	DJI	大疆科技	Application level	Drone systems	Maison Capital, Aeternam Stella, Lighthouse Capital, New China Life Insurance, New Horizon Capital	
	ehang	亿航	Application level	Drone systems	Zhen Fund, LeBox Capital, PreAngel, GP Capital, Oriental Fortune Capital	IDG Capital, GGV Capital
	XAIRCRAFT	极飞	Application level	Drone systems	Chengwei Capital	
	ZeroTech	零度智控	Application level	Drone systems	Rapoo, Cinda Asset Management, 名航资本	Samsung, Qualcomm
	Yuneec	昊翔				Intel
	Ninebot	纳恩博	Application level	Intelligent robots	Xiaomi	Sequoia Capital, Intel, GIC
	Makeblock		Application level	Intelligent robots	Northern Light VC, Cloud Angel Fund, Shenzhen Venture Capital	HAXLR8R Sequoia Capital EMC
	Rokid		Application level	Intelligent robots	Linear Venture, Walden International, Visionplus Capital, Advantech Capital	SIG, IDG
	Quicktron	快仓	Application level	Intelligent robots, warehousing management	Cainiao, SBCVC, BestExpress	
	Geek+	极智嘉	Application level	Intelligent robots	Alog, Volcanics Venture, Banyan Capital	Vertex Ventures
	Jingchi	景驰科技	Application level	Autonomous vehicles	China Growth Capital, Qiming VC	Nvidia
	Aispeech	思必驰	Application level	Voice recognition	Alibaba, DMC, Lenovo, Tus Holdings	

Sources: Alibaba Research Institute, Eurasia Group, Sinovation

Dr. Kai-Fu Lee is the founder and CEO of Sinovation Ventures, and president of Sinovation Ventures Artificial Intelligence Institute.

Paul Triolo is the Practice Head, Geo-technology at Eurasia Group, Ltd. who has long tracked China's tech innovation.