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Essay: Reframing the U.S.- China AI “Arms Race”

Why This Framing is Not Only Wrong, But
Dangerous for American Policymaking

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Introduction

China is going to develop superior artificial intelligence and take over the world, it seems—at least if one listens to what many commentators have been shouting from the rooftops. Indeed, over the past year, American security analysts, policymakers, and journalists alike have increasingly used a Cold War-era analogy to describe issues around the development of artificial intelligence (AI)—specifically characterizing the state of U.S.-China technological competition as an “AI arms race,”¹ whereby the United States and China are presumably locked in competition for artificial intelligence hegemony.² “Ultimately, we will win the race for AI,” President Trump’s Deputy Assistant for Technology Policy Michael Kratsios recently wrote.³ Talk of U.S.-China “algorithm battles” even made it into a 2018 U.S. National Security Council memo.⁴

Here, the framing is clearly winner-takes-all: One nation will reap the benefits of artificial intelligence, in fashions as wide-ranging as accelerated economic growth and enhanced military capability, while the other loses out and faces defeat. But this framing of artificial intelligence is not only wrong, it’s dangerous, and it seriously hampers the ways in which American policymakers approach the management of China’s technological rise and the development of artificial intelligence within our country. The United States needs to quickly address China’s growing AI development; artificial intelligence will have important influence over the balance of international power⁵ and the future world order⁶—but, as this report will address, a winner-takes-all arms race framing is not the appropriate lens through which to view this strategic threat.

The first chapter argues why this winner-takes-all arms race framing treats AI development as if it occurs in vacuums within the United States and China. By ignoring the interconnection and interdependence of the sectors between the two countries, this framing causes American policymakers to overlook the many mutual benefits that could arise from the furthering of global artificial intelligence capabilities. As a result, policymakers in the United States risk causing damage to AI development, missing opportunities, and mishandling AI risks—when they should focus on engaging with China on AI projects without giving up critical expertise or technologies that could potentially enhance harmful applications of artificial intelligence.

The second chapter argues why this framing incorrectly treats artificial intelligence like one technology, rather than a catch-all term that alludes to a variety of technologies. This is blatantly wrong and overlooks the varying speeds and mechanisms of AI’s development in different application areas. Once again, American policymakers may mishandle AI risks and miss out on AI upsides as a result.

A winner-takes-all arms race framing is not the appropriate lens through which to view this strategic threat.

The third chapter explains why AI competition between the United States and China is critically important, even if the winner-takes-all arms race framing is wrong. Artificial intelligence is an increasingly major factor in state power—primarily economic growth and military capability. In an era of great power competition between the United States and China, AI will therefore play an important role in the balance of international power and the future world order. Further, the country with superior implementations of AI will set important global norms around the use of AI in society writ large, which could influence governance in a number of countries.

Finally, I will offer options for reframing AI competition—away from an arms race metaphor—in a fashion which maximizes AI development in the United States while avoiding potentially problematic outcomes and hopefully limiting the contributions of AI to Chinese power.

Problem 1: “Arms Race” Framing is Winner-Takes-All

Interpreting U.S.-China AI development as an “arms race” or a winner-takes-all competition fundamentally misunderstands the transnational nature of AI development and technological interdependence. Policy prescriptions drawn from this “race” concept will thus be ill-fit to the goals they attempt to serve. This bad fit could result in, among other undesirable outcomes, damage to AI development, missed opportunities for AI development, and mishandling of real AI risks.

Yoshua Bengio, an early pioneer of modern AI techniques, has publicly disapproved of framing AI development as a race. “We could collectively participate in a race,” he told *MIT Technology Review*, “but as a scientist and somebody who wants to think about the common good, I think we’re better off thinking about how to build smarter machines and make sure AI is used for the well-being of as many people as possible.”⁷ Possible idealism aside, his point strikes at a fundamental flaw with this arms race analogy: AI is developed by a vast community of scientists, developers, and researchers who are not isolated within their respective countries. As such, the development of AI is not siloed within Chinese or American borders, and the benefits of artificial intelligence are not exclusive to either of those nations. Public and private entities in both countries can benefit from developments of artificial intelligence in areas that have wide reach between nations and positive impacts on economic growth and public well-being (e.g., skin cancer detection). In other words, the development of artificial intelligence is not winner-takes-all. And contrary to what some commentators seem to believe (or at least constantly and singularly discuss), not every significant application of AI will be a weapon.

Graham Webster eloquently provides context on this fact through his analysis of winner-takes-all U.S.-China rhetoric. “Unlike the US and USSR, in which science and technology developed on largely independent tracks, the US and China are part of a globally intertwined ecosystem,” he explains. As a result, “companies and innovators in both countries would suffer if international research, development, and manufacturing were to shut down,” and “even if the US and China cut off trade with each other, both countries would still have to worry about security risks from components, since risks along the supply chain exist everywhere.”⁸ There is far more interconnection and interdependence than may otherwise be apparent in an “arms race” framing.

American firms rely heavily on Chinese manufacturing technologies (e.g., in Shenzhen),⁹ and that reliance is likely to grow as artificial intelligence applications made in the United States are increasingly deployed in drones, robots, and the like which may depend upon Chinese-made hardware. Trade and supply-chain links aid both countries in further developing artificial intelligence.

¹⁰ China is a major market for U.S. AI hardware, and researchers from around the world—including between China and the United States—might work on similar AI problems, share data used to develop AI systems, or coauthor research papers.

¹¹ All of these factors further bolster the interconnections between the two countries' AI sectors.

As is perhaps expected, money, too, has an impact. In 2013, Chinese investment in Silicon Valley was at \$1.17 billion. By 2015, it was \$11.52 billion.¹² From 2012 to 2016, American firms had invested \$2.6 billion in the other direction.¹³ While Chinese venture capitalists have invested heavily in U.S. tech companies like Uber and Airbnb,¹⁴ Tencent and Alibaba—both tech giants in China—are themselves multinational public corporations with significant ownership by international stakeholders.¹⁵ Worth noting is that both companies have extensive ties to the Communist Party of China (CCP) and the Chinese government, and are currently subject to Chinese laws mandating information-sharing with the government (e.g., via the 2017 Cybersecurity Law).¹⁶ But even this considered, there is notable economic interconnection and interdependence between AI development in the two states.

Interconnections and interdependencies between AI development in the United States and AI development in China don't end there. China's Tsinghua University opened an Institute for Artificial Intelligence in June 2018, for which Google's AI Chief Jeff Dean is an advisor.¹⁷ Alibaba, another Chinese tech giant, has multiple research labs located in the United States as part of its global AI research efforts.¹⁸ China's largest retailer has a research partnership with Stanford University's Artificial Intelligence Lab to fund such research areas as computer vision, robotics, machine learning, forecasting, and natural language processing.¹⁹ Kai-Fu Lee, former head of Google's operations in China, runs an AI training institution in the country that leverages the expertise of Chinese government personnel and some of North America's "leading" computer scientists.²⁰ And Baidu, the Chinese search company, belongs to the U.S.-based Partnership for AI, which aims to develop best practices for AI technology.²¹ It is worth noting potential risks associated with these kinds of relationships, including the Chinese government's intentions to bring Western technology talent from the United States into its own country²² and previous instances of intellectual property theft. But that still doesn't change the existence of collaborative relationships and the value garnered from at least some of them. The United States and China have many interconnections and interdependencies between their AI sectors—and so the key is in managing the risks that result therefrom, not denying the interconnectivity and interdependence in the first place.

The "AI arms race" framing implies isolated competition between two global powers, which is clearly inaccurate when it comes to the United States and China; their AI development is anything but isolated from one another. Ideally, the "openness that is so integral to American innovation should be sustained and

safeguarded”²³ rather than building walls between American and Chinese AI development.²⁴ But as a result of this winner-takes-all framing, a growing emphasis on a winner-takes-all race threatens to push the two countries’ tech sectors apart, potentially damaging AI development in ways we can’t foresee. It doesn’t matter what exactly initialized this way of thinking—for instance, some would argue this is a reaction to China’s aggressive push for AI supremacy in many areas²⁵—because this is the reality.

This bad fit could result in, among other undesirable outcomes, damage to AI development, missed opportunities for AI development, and mishandling of real AI risks.

As a result of this winner-takes-all view of AI development, mutually damaging U.S. policies towards China—like reckless trade policies or trying to hamper all collaboration on AI whatsoever—may very well hurt American AI development,²⁶ not to mention play into Beijing’s vision of “science as a tool of national greatness and scientists as servants to the state.”²⁷ The Trump administration’s recent talk of limiting the “export of artificial intelligence”²⁸ is just one recent example. This winner-takes-all, race-to-the-bottom approach, which Remco Zwetsloot, Helen Toner, and Jeffrey Ding argue is guided heavily by fear and speculation,²⁹ could further compromise the likelihood of developing sound policies that can advance mutual interests—while not lending too much advantage to Chinese AI capabilities.³⁰

In addition to crafting hurtful policies and missing opportunities to advance mutual interests, United States policymakers, as a result of the AI arms race framing, may mishandle AI risks. An increasingly common refrain, for instance, is that any privacy regulation in the United States is going to doom AI development because Chinese competitors face no restrictions on their data collection. This argument risks exploiting individuals’ information, by which American data privacy legislation—which is desperately needed—is guided by what the Chinese government has or has not done in the same vein.³¹ American companies can still remain competitive in the AI sector while working under the guidance of some form of national privacy regulation.

Even generally, total disengagement with China on issues of AI ethics is not preferable either. It is well known and oft-discussed that Chinese society has different views than American society on such issues as data privacy.³² According to the executive director at Partnership for AI, “we cannot have a comprehensive and global conversation on AI development unless China has a seat at the table.”³³ But with the AI arms race framing, U.S. policymakers may very well damage American AI development, miss opportunities for bolstering it, and dismiss or ignore ethical issues that need addressing under the belief of winner-takes-all AI competition.

Problem 2: "Arms Race" Framing Treats AI as a Single Technology

Relatedly, the arms race framing often prompts discussion of artificial intelligence as a single technology—but this, too, is inaccurate and could lead to bad policymaking. There is no true consensus definition of artificial intelligence, even among experts, but it's clear that AI is not one technology. Instead, artificial intelligence is “a catch-call concept alluding to a range of techniques with varied applications in enabling new capabilities,”³⁴ from image recognition to disease prediction. However, thinking of AI as a single thing threatens to guide policymakers to mishandle AI risks and miss out on upsides.

To provide context on the topic, much of what today's commentators refer to as “AI” is just machine learning. While the term is often used without definition, the premise is relatively simple: Computers can identify patterns from data and use that pattern analysis to make decisions on their own.³⁵ For instance, a computer that receives labeled images of cats and dogs can, with the right algorithm, learn to distinguish between the two classes of images. Researchers would feed labeled images of the two animals, perhaps hundreds or thousands at a time, to the model. As this occurs, the model begins to make observations about what characterizes each type of image, as well as what distinguishes one type from the other (e.g., through various statistical techniques often unknown to the programmer). Eventually, this so-called training process will be complete, at which point the human programmers would feed the machine unlabeled photos of cats and dogs, hoping it can now identify which is which. The computer's skills on these tests provide success benchmarks from which further improvements can be made.³⁶

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This is precisely why AI should not be used in reference to one technology: The process for teaching a computer to identify pictures of household pets is different than the process for teaching it to comprehend human language. Similarly, machine learning models for facial recognition are designed differently than machine learning models used to generate risk scores on convicts or estimate

someone's likelihood of defaulting on a loan. Depending on the task, the code itself—the machine learning model and/or its specific properties—will differ between AI implementations. The same goes for the dataset, which is often specifically tailored to single use cases. Even within a single application area of AI like image recognition, detecting enemy combatants' faces would require a notably different dataset than the one used for a cat-versus-dog image classifier.

Discussing a single arms race, though, makes the development of AI sound as if it's focused on one technology.³⁷ Commentators, in turn, talk of China “beating” the United States in AI³⁸ without any particular understanding of what that means—the winning, or what it means for China to do it. Will Chinese tech giant Tencent develop a more accurate facial recognition system than the FBI? Will Chinese company Baidu minimize the bias³⁹ of its AI systems compared to bias in systems built by Amazon? Will China's military drones be able to fly faster than ours, or its intelligence service's natural language processors better spy on phone calls than an American private security firm?

In reality, it's difficult to decipher the answers to these questions since the underlying logic behind a single AI arms race, with a clear winner and clear loser, is flawed.⁴⁰ Further, referring to China as a single entity—albeit considering the government's relative control of industry compared to the United States—still loses much important nuance. This could have many potentially damaging effects. As the U.S. government still needs to develop a cohesive national AI strategy, putting many forms of AI in a single bucket may yield disastrous risk management. Skin cancer predictors yield different economic, legal, social, political, and ethical risks than do facial recognition systems deployed in poor urban centers. Relatedly, some forms of artificial intelligence—like a system that's world-class at playing games like Dota 2 or Go—could make for grabby news headlines, but likely have much less strategic value in U.S.-China great power competition than, say, an AI system in a lethal autonomous weapon.

Artificial intelligence is not a single technology, and policymakers must recognize that AI is instead a catch-all term that refers to many unique technologies, many of which that have their own distinctive development methods and timelines. Different applications of AI will develop at different speeds and with different levels of accuracy and effectiveness. Other factors, such as the computing power needed to run particular functionalities or the data used to test a given system, will also vary. For policymakers to better invest government resources in AI development—and to better coordinate non-governmental efforts—it's essential that artificial intelligence's many forms are not thrown into a single bucket and treated in the same fashion. As just iterated, doing so will almost certainly result in U.S. policymakers mishandling AI risks while missing out on critical AI upsides. Treating AI as one thing greatly oversimplifies AI development at the peril of the United States' economic, technological, and strategic leadership.

Why U.S.-China AI Competition Matters

Competing AI development in the United States and China needs to be reframed from the AI arms race rhetoric, but that doesn't mean AI development itself doesn't matter. In fact, the opposite is true. We are in an era of great power competition, and U.S. policymakers must pay greater attention to artificial intelligence development domestically and in China, primarily for two reasons. First, artificial intelligence will have a profound impact on state power, mainly through economic growth and enhanced military capability. Second, global leaders in AI will set norms around its use—and around the use of technology in society writ large—which will have important influence on other “undecided” states and the future international order. This is why American policymakers should focus on engaging with China on AI projects without giving up critical expertise or technologies that could potentially enhance harmful applications of artificial intelligence, whether they are in governance, business, or the military.

An Era of Great Power Competition

We are entering an era of great power competition, characterized by “struggle, change, competition, the use of force, and the organization of national resources to enhance state power.” Industrial productivity, science, and technology are critical in this struggle as well, notes international relations scholar Paul Kennedy.⁴¹ Indeed, that seems to be the case. Amidst a heap of articles on the death of the liberal world order,⁴² there is also much concern in the American national security arena around China, Russia, Iran, and North Korea—what political scientist Amy Zegart refers to as the “big four” due to their various elements of state power and the threat vectors they present (nuclear risks, cyber risks, territorial aggression against U.S. allies, and disruption of the international order).⁴³ The great power competition that Paul Kennedy identified from the twentieth century is back in full force.⁴⁴

“Great power competition returned,” declared President Trump’s National Security Strategy in 2017.⁴⁵ While the strategy isn’t without its flaws—one historian notes how “the grim worldview at [the strategy’s] core threatens to undermine the strategies that have long made U.S. global leadership work”⁴⁶—the document isn’t wrong in its premise: We are in an era of great power competition. The U.S. defense establishment similarly recognized this fact in its 2018 National Defense Strategy, asserting that

“The central challenge to U.S. prosperity and security is the reemergence of long-term, strategic competition by what the National Security Strategy classifies as revisionist powers. It is increasingly clear that China and Russia want to shape a

world consistent with their authoritarian model—gaining veto authority over other nations’ economic, diplomatic, and security decisions.”

Alongside the ongoing weakening of the post-World War II international order, the strategy notes, “China is leveraging military modernization, influence operations, and predatory economics to coerce neighboring countries to reorder the Indo-Pacific region to their advantage.” Further, “As China continues its economic and military ascendance, asserting power through an all-of-nation long-term strategy, it will continue to pursue a military modernization program that seeks Indo-Pacific regional hegemony in the near-term and displacement of the United States to achieve global preeminence in the future.”⁴⁷ This is undoubtedly great power competition between China and the United States, as then-Secretary of Defense Jim Mattis further emphasized when presenting the strategy document.⁴⁸

In this great power competition, artificial intelligence is of vital importance and will become even more important for state power in the coming decades, particularly as AI accelerates economic growth and enhances military capabilities. As China enhances its state power through both of these dimensions, the United States must pay close attention and work to maximize its own gains in these respects.

Artificial Intelligence and State Power

Artificial intelligence is poised to contribute greatly to bolstering a developed nation’s economy. Accenture Research and Frontier Economics predict, based on research in 12 developed countries, that AI could “double annual economic growth rates” in 2035 while also increasing labor productivity by up to 40 percent.⁴⁹ McKinsey Global Institute predicts AI may deliver \$13 trillion in global economic activity by 2030.⁵⁰ PricewaterhouseCoopers puts that figure even higher at up to \$15.7 trillion in global GDP growth by 2030, much of which will be due to productivity increases.⁵¹

These estimates are varied, but they all rightfully predict enormous economic growth due to an explosion in AI uses worldwide.⁵² However, these gains will not be evenly spread. As research from McKinsey Global Institute articulates, “leaders of AI adoption (mostly in developed countries) could increase their lead over developing countries,” and “leading AI countries could capture an additional 20 to 25 percent in net economic benefits, compared with today, while developing countries might capture only about 5 to 15 percent.”⁵³ With the United States and China already representing the largest economies in the world, maximizing uses of AI within either nation could lead to massive gains in state power and influence on the global stage. “After all,” writes political scientist Michael Horowitz, “countries cannot maintain military superiority over the medium to long term without an underlying economic basis for that power.”⁵⁴

Further, there is in part a question of pure economic power: If Chinese companies don't just *develop* better but *also use* that AI more profitably than American firms, China benefits economically and by extension has more resources to build state power generally. That the United States currently has significant AI talent does not mean an American edge in AI development is decisive and everlasting.

Militarily speaking, artificial intelligence is also revolutionary for state military power. The People's Liberation Army (PLA) in China views AI as a revolutionary factor in military power and civil-military fusion,⁵⁵ just as the U.S. Department of Defense has similarly recognized how advances in artificial intelligence "will change society and, ultimately, the character of war."⁵⁶ China is investing in this future. The PLA has already funded a number of AI military projects as part of its 13th Five-Year Plan, spanning command decision-making, equipment systems, robotics, autonomous operating guidance and control systems, advanced computing, and intelligent unmanned weapon systems.⁵⁷ In 2017, President Xi Jinping called for the military to accelerate AI research in preparation for the future of war.⁵⁸ There has even been a report of the Beijing Institute of Technology recruiting high-talent teenagers for a new AI weapons development program.⁵⁹ The Chinese government is undoubtedly preparing to maximize its AI development in the service of maximizing its military power.

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The United States has started to do the same, in some respects: It has established a Defense Innovation Board for ethics of AI in war,⁶⁰ as well as a Joint Artificial Intelligence Center to develop "standards....tools, shared data, reusable technology, processes, and expertise" in coordination with industry, academia, and American allies.⁶¹ DARPA, the Defense Advanced Research Projects Agency, currently has 25 programs in place focused on artificial intelligence research, and in September 2018, its director announced a plan to spend up to \$2 billion over the next five years on more AI work.⁶² But there is still much to be done, as I'll address in the last section.

Even within the U.S. military's approaches to artificial intelligence, as one West Point scholar notes, "the military is facing some hard questions about how it will

adapt its culture and institutions to exploit new technologies—and civilians face a tough job ensuring they answer them effectively.”⁶³ There are certainly military leaders aware of this fact—in announcing the \$2 billion in AI funding, DARPA’s director depicted it “as a new effort to make such systems more trusted and accepted by military commanders”⁶⁴—yet the road ahead will have its challenges. In general, the U.S. defense apparatus’ willingness to engage in cultural and operational shifts will greatly influence how successfully AI is integrated into the United States military.

It’s also important to note that China’s government and its private companies will likely be less constrained by ethical and legal norms when developing AI than will their American counterparts.⁶⁵ Faster deployment of and greater experimentation with AI may result, even though this may lead to perhaps chaotic or more unpredictable deployments of artificial intelligence—or, perhaps, plainly unethical uses of AI. This leads into the second main reason why U.S.-China AI competition still matters.

Artificial Intelligence and Global Technology Norms

Artificial intelligence is increasingly enabling authoritarian governance around the world. Many commentators have referred to this as “digital authoritarianism,”⁶⁶ by which technologies like AI—deployed at scale to, say, bolster citywide facial recognition—enable or enhance authoritarian principles of state governance. Chinese companies have been complicit—and at times instrumental—in the diffusion of the technology and practices that enable this authoritarian governance. While Western companies sometimes export surveillance technology to dictators as well, most democratic governments take steps to prevent it through export controls, such as those established in the Wassenaar Arrangement.⁶⁷

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Chinese firms have exported facial recognition systems to governments in Singapore, the United Arab Emirates, Zimbabwe, and Malaysia. Broader categories of surveillance technology—from national identity cards to biometric sensors, internet monitoring software, and more—are also exported by Chinese companies to governments in Ethiopia, Ecuador, South Africa, Bolivia, Egypt,

Rwanda, and Saudi Arabia.⁶⁸ In addition to enabling insidious social control and large-scale human rights abuses, such spread of surveillance technology—which includes AI—consolidates power in the hands of governments that are hostile, or typically align with powers hostile, to American interests.⁶⁹ Democracy is under attack around the world,⁷⁰ and authoritarian uses of AI further harm democratic norms and the state of democracy globally. This is especially true for the many countries who remain undecided in their use and regulation of technologies like artificial intelligence.

This is an obvious strategic problem for U.S. policymakers, especially as Beijing has already sought to become a global leader in technology norms through an assortment of proposals at the likes of the United Nations⁷¹ and through channels such as IEEE.⁷² Unsurprisingly, this interest has already been reflected with respect to artificial intelligence. The China Electronics Standardization Institute, involved in standard-setting under China’s Ministry of Industry and Information Technology, released a white paper in January 2018 on a framework for AI standardization.⁷³ In April 2018, Chinese organizations hosted a major international AI standards meeting in Beijing.⁷⁴ Similar to how China is proactive in trying to set global norms around the internet, it is also intent on setting global standards and norms around artificial intelligence and its use in society.⁷⁵

As Jeffrey Ding, Paul Triolo, and Samm Sacks explain, “realizing that China’s many large companies are increasingly global players, and Chinese-developed AI algorithms will have effects on users outside of China, China’s government aims to advance global efforts to set standards around ethical and social issues related to AI algorithm deployment. Should Chinese officials and experts succeed in influencing such standards and related AI governance discussions, the policy landscape may skew toward the interests of government-driven technical organizations, attenuating the voices of independent civil society actors that inform the debate in North America and Europe.”⁷⁶ This may very well become a greater trend—as China’s government and private industry develop increasingly sophisticated AI applications—that lends even further global influence to China alongside bigger economic advantage.

It’s not just through diplomats, trade negotiators, and military officers that the Chinese or American government will exercise influence in areas of competition between the two countries (most obviously Southeast Asia, Africa, and Latin America). Without a clear, viable model of digital governance to oppose digital authoritarianism, the United States stands to lose political influence over a number of countries in these areas. This, too, will significantly impact great power competition, potentially in ways that diminish the relative importance of military power.

The Chinese government, in this larger process of global norm-setting on uses of contemporary technologies, is attempting to remake the world in its image. This

is why U.S. policymakers desperately need to reframe their thinking on AI competition.

Reframing AI Competition & Conclusion

We are in an era of great power competition, and the United States and China are undoubtedly in competition with respect to artificial intelligence. AI, which is a catch-all term for a number of technologies, will impact state power—primarily via economic growth and military capability—and allow global norm-setting on AI and technology writ large in fashions that impact the future world order. In short, artificial intelligence is a vital element of U.S.-China great power competition. But the winner-takes-all arms race view of this competition is wrong and dangerous for American policymaking, which is why it must be reframed.

Understanding Interconnection and Interdependence

First, U.S. policymakers need to understand the interdependence and interconnection of AI development between the United States and China. Competition is a fine way to put it, but an arms race sounds as if AI development is siloed within each country. This leads to impractical statements about export controls on artificial intelligence writ large—which anyone aware of AI research’s open source nature would certainly dismiss as impractical.

Some experts have agreed on the value of paying attention to China potentially exploiting U.S. policy gaps to undermine American technological advantages, which the export controls in some sense address. But others point out that top universities and businesses alike are concerned about “possibly throttling a vital source of research” due to proposed blocks on industry collaboration.⁷⁷ And it isn’t just about research collaboration. Important funding and resources for American AI research could also be blocked as a result. The Center for Data Innovation, for instance, writes that export restrictions on AI technologies could “substantially reduce” opportunities for American firms to sell their AI products and services, thereby harming U.S. AI competitiveness.⁷⁸ Jack Clark, head of policy at OpenAI, holds that “the number of cases where exports can be sufficiently controlled are very, very, very small, and the chance of making an error is quite large.” Further, MIT’s R. David Edelman notes, trying to distinguish in export control policies between what is military versus civilian use of AI “may be impossible.”⁷⁹ In short, overlooking U.S.-China interconnection and interdependence in AI development may very well lead to policies that try to sever connections between AI sectors and thereby harm AI development in the process.

Rather than try to blindly and broadly apply export controls to AI under the myth of winner-takes-all AI development, American policymakers should focus on ways in which China is actually aided in a winner-takes-all fashion by American ideas or resources—like through its theft of American intellectual property.⁸⁰

In September 2015, President Obama and President Xi announced at a White House press conference: “We’ve agreed that neither the U.S. or the Chinese government will conduct or knowingly support cyber-enabled theft of intellectual property, including trade secrets or other confidential business information for commercial advantage.”⁸¹ This seemed to work initially, and Chinese hacking of American companies notably dropped for a brief period, though this didn’t directly translate to increased U.S.-Chinese cooperation on other cyberspace issues.⁸² (For evidence of this since 2015, see the aforementioned work my colleague and I have done to document China’s proposals for cyber codes of conduct in the UN and other international bodies, which the United States and its allies have resisted due to fundamental disagreements over issues of internet governance and so-called cyber sovereignty.)

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It’s clear, however, that this no-IP-theft agreement has fallen apart since President Trump took office,⁸³ despite initial proclamations that the Trump administration would stick with the agreement.⁸⁴ The volume of hacking in this vein is back up. By the estimation of one independent commission, China now accounts for 50 to 80 percent of the annual \$300 billion in American economic losses from thefts of intellectual property.⁸⁵ A March 2018 report from the Office of the U.S. Trade Representative reached similar conclusions: “Beijing’s cyber espionage against U.S. companies persists and continues to evolve,” as “Chinese state-sponsored cyber operators continue to support Beijing’s strategic development goals, including its S&T advancement, military modernization, and economic development.”⁸⁶ Without getting too much into the nuance of the Obama-Xi agreement⁸⁷ and the changes in Chinese hacking that resulted therefrom, the point is that American AI development is necessarily harmed by China’s industrial espionage, both online and offline.

The same goes for the potential security risks of Chinese investments in American AI companies; a January 2017 report to the president warned, for instance, about China’s challenge to American leadership in semiconductors—

which make the microchips in many advanced technologies—via investment in U.S. firms.⁸⁸ But between these problems and broad, sweeping plans for limiting industry collaboration on AI, the U.S. government cannot effectively combat China’s technological rise without recognition of the interconnection and interdependence of American and Chinese AI development.

Addressing the Many Technologies at Hand

Second, U.S. policymakers cannot approach artificial intelligence as if it’s one technology. Doing so treats all AI implementations as the same, which is wrong—and leads to narrow thinking about how to bolster AI development. To see this in practice, look no further than U.S. policymakers’ intense focus on AI’s military applications at the cost of neglecting its non-military ones (perhaps another result of calling it an arms race).

Particularly for national security professionals who speak vaguely (and widely speculatively) of a world with automated fighting and a changed character of battle and war, military applications of AI—such as autonomous surveillance drones or intelligently automated command and control systems—are a stereotypical answer for how AI will impact state power. This answer is not wrong. China, as already discussed, well recognizes this fact, as does the United States and other countries like Russia⁸⁹ who have invested in defense-focused AI applications.

But many other non-military applications of AI are particularly important for state power in the ways they could boost the economy, and they too must be a part of policymakers’ thinking on the technologies captured in the term artificial intelligence. Healthcare, for instance, is a particularly promising area for AI’s impact on economic growth. Cancer detection, eye health, coma treatments, and depression prediction are just some of the varied ways in which AI implementations are already revolutionizing medicine around the world.⁹⁰ Disease prediction in particular has received much research attention, insofar as AI systems may combat such issues as doctors’ decision fatigue.

This is not to overstate the ability of modern machine learning algorithms to identify cancers or predict epidemics; many legal and ethical issues plague AI in healthcare (e.g., data privacy, AI bias) and other challenges such as data labeling, data sampling, and clinical integration will put additional limits on how, and how quickly, AI implementations will impact the American and global healthcare systems.⁹¹ But this is to say that the U.S. government should not only focus on military applications of AI. This entirely ignores potential AI application areas with promise to improve quality of life and greatly boost American economic power in the process.

Moreover, in either case, AI is still not one technology: Facial recognition systems deployed in military drones are different than natural language processors used to spy on phone calls, and image recognition algorithms to detect brain tumors are different than intelligent systems that manage hospital supply chains. Yet all could fall under the banner of AI, and all can have important impacts on state power via the military and the economy.

U.S. policymakers must therefore prioritize investments in AI, and policies towards AI development, that attempt to maximize state power in both military and economic dimensions—all while understanding that Congress and other bodies must address the legal and ethical issues raised by the various forms these AI implementations may take.

Bolstering American AI Capabilities

Without a doubt, the U.S. government needs to invest more in developing artificial intelligence within its borders. Congress must work to advance standard development for safe artificial intelligence⁹² and explore regulating certain public uses of AI that disproportionately harm minorities and other already disadvantaged groups, such as racially biased facial recognition in urban centers.⁹³ Both of these policy actions would help integrate AI into American society in ways better aligned with democratic principles. This would further help to promote global norms around democratic uses of AI.⁹⁴

More broadly, the United States needs a whole-of-government approach to artificial intelligence that its Chinese counterparts have already begun to execute. The United States must focus on deciphering the investments and policies most important to maximizing military and economic gains, while still working carefully to promote and ensure democratic uses of AI domestically. For instance, Congress should work to support collaborative health research related to AI while still working to legally protect the privacy of patient information. The National Institute of Standards and Technology (NIST) should work with industry trade organizations like the Institute of Electrical and Electronics Engineers to help set standards for ethical uses of AI facial recognition, while the American defense apparatus should do similar, parallel work in the military vein. A multi-pronged and multi-stakeholder approach is needed for AI development. This is especially true given China's multi-pronged and multi-stakeholder investment in AI.

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Chinese business and government entities have poured billions of dollars (USD) into artificial intelligence development over the last decade.⁹⁵ The Chinese government has also released a variety of plans and held a number of dialogues on further developing AI, which spans the founding of AI-specific educational institutes, creating AI majors at universities, and communicating and coordinating AI research among research institutes, universities, enterprises, and military industry.⁹⁶ It remains to be seen how well these plans will be executed upon,⁹⁷ but their construction nonetheless reflects government effort to bolster AI development within Chinese borders—clearly, acknowledging AI’s many forms.

In sum, the Chinese government’s actions are “a clear indication of governmental commitment to this agenda at the highest levels,”⁹⁸ while the United States, meanwhile, has yet to implement a cohesive, national AI strategy.⁹⁹ The U.S. Treasury Secretary said back in 2017 that AI worker displacement was “not even on [their] radar screen.”¹⁰⁰ (This is only further evidence of U.S. policymakers focusing, at the highest levels, too much on AI’s military applications and not enough on its potential applications in, say, healthcare.) While the United States has strong advantages in developing various forms of artificial intelligence—such as a talented workforce¹⁰¹ and highly influential research coming from its scholars and practitioners¹⁰²—the country still needs whole-of-government investment in developing artificial intelligence. The likes of a Defense Innovation Board for ethics of AI in war,¹⁰³ a Joint Artificial Intelligence Center,¹⁰⁴ and a new Congressional AI commission,¹⁰⁵ while valuable steps, are not enough.¹⁰⁶

U.S. federal agencies should all be strategizing about the research, development, and implementation of AI in their organizations, and this should be happening with top-down direction from the White House. Congress should simultaneously be exploring regulatory data privacy frameworks that seek to maintain AI competitiveness in the military, government, and industry while still protecting

consumers' and citizens' information. But these lofty goals must start with a few tangible policy steps.

- **Stop with the AI arms race rhetoric.** American policymakers must acknowledge that AI development is not winner-takes-all and that AI is not a single technology—and then ditch the arms race framing. Journalists, too, should take greater care in reporting on AI development in ways that don't imply a winner-takes-all competition. Alongside this, the national security establishment—spanning think tanks, academia, and high-level U.S. policy offices—should, alongside writing and strategizing about AI's impact on military capability, take care to put similar focus on AI's impact on economic power. The U.S. government in particular should explicitly include the influence of AI on economic power in national security and defense strategies, paying far more attention to non-military AI applications.
- **Develop a national AI strategy.** The White House needs to develop a cohesive, national AI strategy document highlighting the importance of AI for bolstering economic and military power, as well as the importance of working to promote democratic uses of AI domestically and around the world. From China to France, other countries have done so—yet the United States has not, despite vague term-dropping of “artificial intelligence” in such documents as the 2017 National Security Strategy¹⁰⁷ or the 2019 National Intelligence Strategy.¹⁰⁸ Individual agency strategies or reports on artificial intelligence, such as that from the Director of National Intelligence,¹⁰⁹ are not enough either, and the February 11 Executive Order on maintaining American leadership in AI¹¹⁰ is still not a cohesive, national strategy that compares to what China has developed. In spite of the Trump administration's unprecedented vacancies in the White House Office of Science & Technology Policy,¹¹¹ the White House should also hire, and consult with, artificial intelligence experts in the design of this strategy.
- **Bolster diplomatic cyber capacity.** Especially after the closing of the Office of Coordinator for Cyber Issues at the U.S. State Department—amid broader State Department cutbacks and the retraction of American diplomatic arms—the U.S. federal government needs to devote more diplomatic capacity¹¹² to fighting the model of digital authoritarianism that China currently champions. This involves such policy actions as helping smaller countries build diplomatic cyber capacity; building international norms that champion the value of a global and open internet and ethical uses of ethical AI; and emphasizing the value of democratic uses of AI for economic growth. Major agreements and dialogues around cyberspace and AI are occurring in international forums, yet the United

States isn't nearly active enough in delivering a clear, cohesive message that opposes digital authoritarianism. The State Department has announced the creation of a new cybersecurity bureau,¹¹³ but this should be further supplemented by greater diplomatic focus on AI—on formal agreements, standard-setting, and global norms and practices around AI's use and regulation in society.

- **Tighten controls on selling AI surveillance products to dictators.** American policymakers must also evaluate how some of its own private companies slip through the cracks of existing export controls and sell surveillance technology to authoritarians like Saudi Arabia.¹¹⁴ Such practices make the United States look hypocritical and serve to further justify China's narrative around undemocratic uses of AI for social control and "national security." From the 2013 multilateral arms-control Wassenaar Arrangement, for instance, the United States has not implemented the "IP network communications surveillance systems" control, unlike the entire E.U. bloc and most other Wassenaar participants.
- **Address Chinese intellectual property theft.** While many research collaborations between American and Chinese AI sectors undoubtedly hold benefits for both countries, the United States is losing massive technological advantages in a number of sectors due to China's widespread IP theft; and this certainly includes AI. It's likely that the widely publicized 2015 U.S. indictments of Chinese hackers influenced the subsequent Obama-Xi agreement, so the Department of Justice should make it a clear priority today to indict Chinese hackers for stealing American IP. Among other policy changes, this would be helped by bolstering incentives for the FBI to prosecute cybercrime cases, increasing interagency cooperation, and bolstering diplomatic cyber capacity.¹¹⁵ Borrowing from Lorand Laskai and Adam Segal at the Council on Foreign Relations, the U.S. government should also combine indictments for Chinese IP theft with targeted sanctions against the entities from which thefts occur, and work with potential American targets to strengthen their cybersecurity.¹¹⁶
- **Enact national data privacy legislation.** The United States must develop a stance on data governance that contrasts with China's model of pervasive government surveillance, while still upholding democratic norms around consumer protection. To think that any and all privacy laws will massively hinder American AI development is not only quite speculative, but follows a dangerous narrative whereby ethical considerations around AI should be cast aside in the service of trying to bolster national AI power. Not only does this narrative seek to serve major

American technology companies which desire minimal regulation,¹¹⁷ but it also ignores the importance of the United States and its allies upholding democratic norms around AI—which includes addressing such issues as AI bias and data privacy—in order to promote a less authoritarian global order.

While the United States needs to worry about China's AI ambitions, an arms race framing is not the right approach. Before any true policy changes can be made to aid the United States in this great power competition with China, American policymakers at the highest levels—as well as American academics, journalists, and national security analysts writ large—must ditch the AI arms race metaphor.

Notes

- 1 Among many other examples: Uri Friedman, “The Trump Administration Debates a Cold War With China,” *The Atlantic*, November 30, 2018, <https://www.theatlantic.com/international/archive/2018/11/trump-xi-meet-g20-new-cold-war/577045/>; Michael Auslin, “Can the Pentagon Win the AI Arms Race?” *Foreign Affairs*, October 19, 2018, <https://www.foreignaffairs.com/articles/united-states/2018-10-19/can-pentagon-win-ai-arms-race>; Rajeswari Pillai Rajagopalan, “The Trouble With China’s Edge in the AI Arms Race,” *The Diplomat*, August 10, 2018, <https://thediplomat.com/2018/08/the-trouble-with-chinas-edge-in-the-ai-arms-race/>; Julian E. Barnes and Josh Chin, “The New Arms Race in AI,” *The Wall Street Journal*, March 2, 2018, <https://www.wsj.com/articles/the-new-arms-race-in-ai-1520009261>; Joe Pappalardo, “‘Fake News’ Is Sparking an AI Arms Race,” *Popular Mechanics*, September 18, 2018, <https://www.popularmechanics.com/technology/a23286956/fake-news-ai-arms-race/>; and Clay Chandler, “Why China Has An Edge In the A.I. Arms Race,” *Fortune*, June 25, 2018, <http://fortune.com/2018/06/25/artificial-intelligence-in-china/>.
- 2 For related, interesting reading on China’s aspirations for hegemony in quantum technology, see: Elsa B. Kania and John Costello, “Quantum Hegemony? China’s Ambitions and the Challenge to U.S. Leadership,” Center for a New American Security, September 12, 2018, <https://www.cnas.org/publications/reports/quantum-hegemony>.
- 3 Michael Kratsios, “Why the US Needs a Strategy for AI,” *WIRED*, February 11, 2019, <https://www.wired.com/story/a-national-strategy-for-ai/>.
- 4 In January 2018, Axios reported that a U.S. National Security Council memo warned of China “slowly winning the AI ‘algorithm battles.’” See: Jonathan Swan, David McCabe, Ina Fried, and Kim Hart, “Scoop: Trump team considers nationalizing 5G network,” Axios, January 28, 2018, <https://www.axios.com/trump-team-debates-nationalizing-5g-network-f1e92a49-60f2-4e3e-acd4-f3eb03d910ff.html>.
- 5 Michael C. Horowitz, “Artificial Intelligence, International Competition, and the Balance of Power,” *Texas National Security Review* (Vol. 1: Issue 3), May 2018, <https://tnsr.org/2018/05/artificial-intelligence-international-competition-and-the-balance-of-power/>.
- 6 Nicholas Wright, “How Artificial Intelligence Will Reshape the Global Order,” *Foreign Affairs*, July 10, 2018, <https://www.foreignaffairs.com/articles/world/2018-07-10/how-artificial-intelligence-will-reshape-global-order>.
- 7 Will Knight, “One of the fathers of AI is worried about its future,” *MIT Technology Review*, November 17, 2018, <https://www.technologyreview.com/s/612434/one-of-the-fathers-of-ai-is-worried-about-its-future/>.
- 8 Graham Webster, “The US and China aren’t in a ‘cold war,’ so stop calling it that,” *MIT Technology Review*, December 19, 2018, <https://www.technologyreview.com/s/612602/the-us-and-china-arent-in-a-cold-war-so-stop-calling-it-that/>.
- 9 Matt Sheehan, “Does Chinese Venture Capital in Silicon Valley Threaten US Tech Advantage,” MacroPolo.org, April 26, 2018, <https://macropolo.org/chinese-vc-silicon-valley-threaten-us-tech-advantage/>.
- 10 Jack Zhang, Graham Webster, Elsa Kania, Rush Doshi, Yukon Huang, and Paul Triolo, “Should the U.S. Start a Trade War with China over Tech?” *ChinaFile*, June 26, 2018, <http://www.chinafile.com/conversation/should-us-start-trade-war-china-over-tech>.
- 11 Jeffrey Ding, “Deciphering China’s AI Dream,” Future of Humanity Institute, March 2018, https://www.fhi.ox.ac.uk/wp-content/uploads/Deciphering_Chinas_AI-Dream.pdf. Page 28.

12 Matt Sheehan, “Does Chinese Venture Capital in Silicon Valley Threaten US Tech Advantage,” MacroPolo.org, April 26, 2018, <https://macropolo.org/chinese-vc-silicon-valley-threaten-us-tech-advantage/>.

13 According to the Wuzhen Institute, a think tank. See: The Economist, “China may match or beat America in AI,” *The Economist*, July 15, 2017, <https://www.economist.com/business/2017/07/15/china-may-match-or-beat-america-in-ai>.

14 Cory Bennett and Bryan Bender, “How China acquires ‘the crown jewels’ of US technology,” *Politico*, May 22, 2018, <https://www.politico.eu/article/china-investment-uber-apple-us-tech-how-china-acquires-the-crown-jewels/>.

15 Jeffrey Ding, “Deciphering China’s AI Dream,” Future of Humanity Institute, March 2018, https://www.fhi.ox.ac.uk/wp-content/uploads/Deciphering_Chinas_AI-Dream.pdf. Page 28.

16 Erica Pandey, “Caged giants: Why China’s Big Tech can’t escape the Communist Party,” *Axios*, June 8, 2018, <https://www.axios.com/china-big-tech-alibaba-tencent-communist-party-xi-jinping-c9de0516-1315-41e8-9daa-932c57f7faec.html>.

17 Synced, “Tsinghua University Launches Institute for AI; Hires Google’s Jeff Dean As Advisor,” *Synced*, June 28, 2018, <https://medium.com/syncedreview/tsinghua-university-launches-institute-for-ai-hires-googles-jeff-dean-as-advisor-e2875fc0847f>.

18 Saheli Roy Choudhury, “Alibaba says it will invest more than \$15 billion over three years in global research program,” *CNBC*, October 11, 2017, <https://www.cnbc.com/2017/10/11/alibaba-says-will-pour-15-billion-into-global-research-program.html>; and “Laboratory,” DAMO Academy, Alibaba, accessed January 9, 2019, <https://damo.alibaba.com/labs/>.

19 “Stanford Artificial Intelligence Laboratory,” Stanford University, accessed January 9, 2019, <http://ai.stanford.edu/>.

20 Tom Simonite, “Ex-Google Executive Opens a School for AI, with China’s Help,” *WIRED*, April 5, 2018, <https://www.wired.com/story/ex-google-executive-opens-a-school-for-ai-with-chinas-help/>.

21 James Vincent, “US consortium for safe AI development welcomes Baidu as first Chinese member,” *The Verge*, October 17, 2018, <https://www.theverge.com/2018/10/17/17988582/partnership-on-ai-pai-welcomes-first-china-baidu-member>.

22 Alex Keown, “China’s ‘Thousand Scientists Plan’ Recruits Western Scientists and Researchers,” *BioSpace*, November 19, 2018, <https://www.biospace.com/article/china-s-thousand-talents-plan-recruits-western-scientists-and-researchers/>.

23 Jack Zhang, Graham Webster, Elsa Kania, Rush Doshi, Yukon Huang, and Paul Triolo, “Should the U.S. Start a Trade War with China over Tech?” *ChinaFile*, June 26, 2018, <http://www.chinafile.com/conversation/should-us-start-trade-war-china-over-tech>.

24 Anja Manuel, “Chinese Tech Isn’t the Enemy,” *The Atlantic*, August 1, 2018, <https://www.theatlantic.com/international/archive/2018/08/america-needs-china-in-tech/566516/>.

25 Gregory C. Allen, “China’s Artificial Intelligence Strategy Poses a Credible Threat to U.S. Tech Leadership,” Council on Foreign Relations, December 4, 2017, <https://www.cfr.org/blog/chinas-artificial-intelligence-strategy-poses-credible-threat-us-tech-leadership>.

26 It’s worth noting this winner-takes-all view of U.S.-China relations is a problem in general. President Obama attempted to move away from this view during his presidency, but it has returned under the presidency of Donald Trump. See: Robert G. Patman and Timothy G. Ferner, “Paul Kennedy’s Conception of Great Power Rivalry and US-China Relations in the Obama Era” in *The Changing East Asian Security Landscape*, Wiesbaden: Springer

Vieweg (2017), edited by Stefan Fröhlich and Howard Loewen, https://link.springer.com/chapter/10.1007/978-3-658-18894-8_5; and Rachel Esplin Odell, “Chinese Regime Insecurity, Domestic Authoritarianism, and Foreign Policy” in “AI, China, Russia, and the Global Order: Technological, Political, Global, and Creative Perspectives,” Strategic Multilayer Assessment Publication, December 2018, http://static1.1.sqspcdn.com/static/f/1399691/28061274/1547846008013/AI+China+Russia+Global+WP_FINAL.pdf?token=UV%2BjFj79ouGsUfUyB%2Bmu4WH7LwE%3D.

27 A longer, pulled quote on the issue: “The United States may feel it’s only playing defense in a global cold war over tech. In reality, these policies play into Beijing’s preferred vision of the world. China sees science as a tool of national greatness and scientists as servants to the state. This parochial vision discounts the individual agency and ethical obligations of scientists and runs contrary to the cosmopolitan ideal of science. The United States must uphold those ideals, not create new boundaries.” See: Yangyang Cheng, “Don’t Close the Door on Chinese Scientists Like Me,” *Foreign Policy*, June 4, 2018, <https://foreignpolicy.com/2018/06/04/dont-close-the-door-on-chinese-scientists-like-me/>.

28 Tony Romm, “Trump administration proposal could target exports of the tech behind Siri, self-driving cars and supercomputers,” *The Washington Post*, November 19, 2018, <https://www.washingtonpost.com/technology/2018/11/19/trump-administration-proposal-could-target-exports-tech-behind-siri-self-driving-cars-supercomputers/>.

29 Remco Zwetsloot, Helen Toner, and Jeffrey Ding, “Beyond the AI Arms Race,” *Foreign Affairs*, November 26, 2018, <https://www.foreignaffairs.com/reviews/review-essay/2018-11-16/beyond-ai-arms-race>.

30 As Lorand Laskai and Samm Sacks have written, “Any attempt to separate the two technology sectors by force would prove counterproductive at best and

devastating at worst. This simultaneously competitive and interdependent relationship warrants a completely different strategy—one that exploits the benefits of collaboration while strengthening the United States’ ability to compete.” See: Lorand Laskai and Samm Sacks, “The Right Way to Protect America’s Innovation Advantage,” *Foreign Affairs*, October 23, 2018, <https://www.foreignaffairs.com/articles/2018-10-23/right-way-protect-americas-innovation-advantage>.

31 Graham Webster and Scarlet Kim, “The Data Arms Race Is No Excuse for Abandoning Privacy,” *Foreign Policy*, August 14, 2018, <https://foreignpolicy.com/2018/08/14/the-data-arms-race-is-no-excuse-for-abandoning-privacy/>.

32 This is underscored by, for instance, the fact that Chinese and American businesspeople alike consistently point out, in recent years, a lack of data privacy protections in China: Greg Williams, “Why China will win the global race for complete AI dominance,” *WIRED*, April 16, 2018, <https://www.wired.co.uk/article/why-china-will-win-the-global-battle-for-ai-dominance>; and Natasha Lomas, “Zuckerberg urges privacy carve outs to compete with China,” *TechCrunch*, April 10, 2018, <https://techcrunch.com/2018/04/10/zuckerberg-urges-privacy-carve-outs-to-compete-with-china/>. But some American analysts’ misconceptions—or perhaps generalizations—about views and policies in China around surveillance and data privacy are changing, as aided by some recent work. See: Samm Sacks, “New China Data Privacy Standard Looks More Far-Reaching than GDPR,” Center for Strategic & International Studies, January 29, 2018, <https://www.csis.org/analysis/new-china-data-privacy-standard-looks-more-far-reaching-gdpr>; Samm Sacks, “China’s Emerging Data Privacy System and GDPR,” Center for Strategic & International Studies, March 9, 2018, <https://www.csis.org/analysis/chinas-emerging-data-privacy-system-and-gdpr>; Jeffrey Ding, “Deciphering China’s AI Dream,” Future of Humanity Institute, March 2018, <https://www.fhi.ox.ac.uk/wp-content/uploads/>

Deciphering_Chinas_AI-Dream.pdf; and Samm Sacks and Lorand Laskai, “China’s Privacy Conundrum,” *Slate*, February 7, 2019, <https://slate.com/technology/2019/02/china-consumer-data-protection-privacy-surveillance.html>. Also see: Evelyn Cheng, “Data privacy issues may be capturing more attention in China,” *CNBC*, December 4, 2018, <https://www.cnbc.com/2018/12/05/data-privacy-issues-may-be-capturing-more-attention-in-china.html>.

33 James Vincent, “US consortium for safe AI development welcomes Baidu as first Chinese member,” *The Verge*, October 17, 2018, <https://www.theverge.com/2018/10/17/17988582/partnership-on-ai-pai-welcomes-first-china-baidu-member>.

34 Elsa B. Kania, “The Pursuit of AI Is More Than an Arms Race,” *Defense One*, April 19, 2018, <https://www.defenseone.com/ideas/2018/04/pursuit-ai-more-arms-race/147579/>.

35 For more on this, see: Robert D. Hof, “Deep Learning,” *MIT Technology Review*, n.d., <https://www.technologyreview.com/s/513696/deep-learning/>; and Karen Hao, “What is machine learning? We drew you another flowchart,” *MIT Technology Review*, November 17, 2018, <https://www.technologyreview.com/s/612437/what-is-machine-learning-we-drew-you-another-flowchart/>.

36 This is a deliberate oversimplification. Once again, see the previous endnote for a more detailed primer on some machine learning basics.

37 Political scientist Michael Horowitz argues that “[t]here will not be one exclusively military AI arms race” but instead “many AI arms races, as countries (and, sometimes, violent nonstate actors) develop new algorithms or apply private sector algorithms to help them accomplish particular tasks.” Again, the concept of an “arms race” is perhaps too constraining and too winner-takes-all, yet his point about multiple, overlapping, intersecting AI development tracks stands true. See: Michael C. Horowitz, “The Algorithms of August,” *Foreign Policy*, September 12,

2018, <https://foreignpolicy.com/2018/09/12/will-the-united-states-lose-the-artificial-intelligence-arms-race/>.

38 See previous references on the permeation of the winner-takes-all “arms race” rhetoric in commentary from journalists, policymakers, and analysts. Also, it’s worth noting that even in some interviews where artificial intelligence experts bring out more nuance in the conversation, headlines reframe the conversation in the context of a winner-takes-all AI “arms race.” See, for instance: Phred Dvorak, “Which Country Is Winning the AI Race—the U.S. or China?” *The Wall Street Journal*, November 12, 2018, <https://www.wsj.com/articles/which-country-is-winning-the-ai-racethe-u-s-or-china-1542039357>.

39 While trying to remain relatively high-level, it’s still worth noting that understandings of “bias” take many forms. For just some discussion of different fairness definitions, see: Cynthia Dwork, Moritz Hardt, Toniann Pitassi, Omer Reingold, and Richard Zemel, “Fairness Through Awareness,” *arxiv.org*, November 29, 2011, <https://arxiv.org/pdf/1104.3913.pdf>; Moritz Hardt, Eric Price, and Nathan Srebro, “Equality of Opportunity in Supervised Learning,” *arxiv.org*, October 7, 2016, <https://arxiv.org/pdf/1610.02413.pdf>; Jon Kleinberg, Sendhil Mullainathan, and Manish Raghavan, “Inherent Trade-Offs in the Fair Determination of Risk Scores,” *arxiv.org*, November 17, 2016, <https://arxiv.org/pdf/1609.05807.pdf>; Matt Kusner, Joshua Loftus, Chris Russell, and Ricardo Silva, “Counterfactual Fairness,” 31st Conference on Neural Information Processing Systems, 2017, <https://papers.nips.cc/paper/6995-counterfactual-fairness.pdf>; and Niki Kilbertus, Mateo Rojas-Carulla, Giambattista Parascandolo, Moritz Hardt, Dominik Janzing, and Bernhard Schölkopf, “Avoiding Discrimination through Causal Reasoning,” *arxiv.org*, January 21, 2018, <https://arxiv.org/pdf/1706.02744.pdf>. These are pulled from a syllabus developed by Duke University’s Ashwin Machanavajjhala.

40 This framing is flawed for the aforementioned reasons, but also because technological “superiority is not synonymous with security.” When it comes to technologies like artificial intelligence, “the most reasonable expectation is that the introduction of complex, opaque, novel, and interactive technologies will produce accidents, emergent effects, and sabotage” that will cause “the American national security establishment [to] lose control of what it creates.” See: Richard Danzig, “Technology Roulette: Managing Loss of Control as Many Militaries Pursue Technological Superiority,” Center for a New American Security, May 30, 2018, <https://www.cnas.org/publications/reports/technology-roulette>. Page 2.

41 Paul Kennedy, *The Rise and Fall of the Great Powers*, Unwin Hyman Limited: Great Britain (1988). Page 196.

42 Among many others, see: Thomas Wright, “The Return to Great-Power Rivalry Was Inevitable,” *The Atlantic*, September 12, 2018, <https://www.theatlantic.com/international/archive/2018/09/liberal-international-order-free-world-trump-authoritarianism/569881/>; Robert Kagan, “The World America Made—and Trump Wants to Unmake,” *Politico*, September 28, 2018, <https://www.politico.com/magazine/story/2018/09/28/donald-trump-unga-liberal-world-order-220738>; and Judy Dempsey, “Judy Asks: Is the Crisis of the Liberal Order Exaggerated?” Carnegie Europe, February 18, 2017, <https://carnegieeurope.eu/strategieurope/68041>.

43 Amy Zegart, “The President’s National Security In-Box,” Stanford University, October 11, 2016, http://web.stanford.edu/dept/politicalscience/cgi-bin/wordpress/wp-content/uploads/2016/10/Zegart_Oct.11.pdf.

44 This is not to necessarily equate or directly compare China with Russia, North Korea, or Iran in its state power; I do not believe that to be the case at all. China also poses a much greater long-term threat to the United States and democracy writ large than do Russia, North Korea, or Iran. For instance, see:

Ryan Browne, “Top US general: China will be ‘greatest threat’ to US by 2025,” CNN, September 27, 2017, <https://www.cnn.com/2017/09/26/politics/dunford-us-china-greatest-threat/index.html>; and The Economist, “How China could dominate science,” *The Economist*, January 12, 2019, <https://www.economist.com/leaders/2019/01/12/how-china-could-dominate-science>.

45 White House, “National Security Strategy of the United States of America,” White House, December 2017, <https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905-2.pdf>. Page 27.

46 Melvyn P. Leffler, “Trump’s Delusional National Security Strategy,” *Foreign Affairs*, December 21, 2017, <https://www.foreignaffairs.com/articles/2017-12-21/trumps-delusional-national-security-strategy>. Another scholar notes that “While the document is short on specifics, it reflects schizophrenia in the executive branch that cries out for treatment.” See: Benn Steil, “How to Win a Great-Power Competition,” *Foreign Affairs*, February 9, 2018, <https://www.foreignaffairs.com/articles/2018-02-09/how-win-great-power-competition>.

47 U.S. Department of Defense, “Summary of the 2018 National Defense Strategy of the United States of America,” U.S. Department of Defense, 2018, <https://dod.defense.gov/Portals/1/Documents/pubs/2018-National-Defense-Strategy-Summary.pdf>.

48 Idrees Ali, “U.S. military puts ‘great power competition’ at heart of strategy: Mattis,” Reuters, January 19, 2018, <https://www.reuters.com/article/us-usa-military-china-russia/u-s-military-puts-great-power-competition-at-heart-of-strategy-mattis-idUSKBN1F81TR>.

49 See: Accenture, “Artificial Intelligence and the Future of Growth,” Accenture, accessed January 25, 2019, <https://www.accenture.com/us-en/insight-artificial-intelligence-future-growth>; and Mark Purdy and Paul Daugherty, “How AI Boosts Industry Profits and Innovation,” Accenture, June 22, 2017, <https://>

www.accenture.com/t20170620T055506__w___/usen/_acnmedia/Accenture/next-gen-5/insight-ai-industry-growth/pdf/Accenture-AI-Industry-Growth-Full-Report.pdf?la=en.

50 Jacques Bughin, Jeongmin Seong, James Manyika, Michael Chui, and Raoul Joshi, “Notes from the AI frontier: Modeling the impact of AI on the world economy,” McKinsey Global Institute, September 2018, <https://www.mckinsey.com/featured-insights/artificial-intelligence/notes-from-the-ai-frontier-modeling-the-impact-of-ai-on-the-world-economy>.

51 PricewaterhouseCoopers, “The macroeconomic impact of artificial intelligence,” PricewaterhouseCoopers, February 2018, <https://www.pwc.co.uk/economic-services/assets/macro-economic-impact-of-ai-technical-report-feb-18.pdf>. Page 3.

52 For some interesting discussion of implications of AI on economic growth depending on its use, see: Philippe Aghion, Benjamin F. Jones, and Charles I. Jones, “Artificial Intelligence and Economic Growth,” Stanford University, October 10, 2017, <https://web.stanford.edu/~chadj/AI.pdf>.

53 Jacques Bughin, Jeongmin Seong, James Manyika, Michael Chui, and Raoul Joshi, “Notes from the AI frontier: Modeling the impact of AI on the world economy,” McKinsey Global Institute, September 2018, <https://www.mckinsey.com/featured-insights/artificial-intelligence/notes-from-the-ai-frontier-modeling-the-impact-of-ai-on-the-world-economy>.

54 Michael C. Horowitz, “Artificial Intelligence, International Competition, and the Balance of Power,” *Texas National Security Review* (Vol. 1: Issue 3), May 2018, <https://tnsr.org/2018/05/artificial-intelligence-international-competition-and-the-balance-of-power/>.

55 Elsa B. Kania, “Battlefield Singularity: Artificial Intelligence, Military Revolution, and China’s Future

Military Power,” Center for a New American Security, November 2017, <https://s3.amazonaws.com/files.cnas.org/documents/Battlefield-Singularity-November-2017.pdf>. Page 12.

56 U.S. Deputy Secretary of Defense, “Memorandum: Establishment of the Joint Artificial Intelligence Center,” U.S. Department of Defense, June 27, 2018, https://admin.govexec.com/media/establishment_of_the_joint_artificial_intelligence_center_osd008412-18_r....pdf.

57 Elsa B. Kania, “Battlefield Singularity: Artificial Intelligence, Military Revolution, and China’s Future Military Power,” Center for a New American Security, November 2017, <https://s3.amazonaws.com/files.cnas.org/documents/Battlefield-Singularity-November-2017.pdf>. Pages 12-14.

58 James Johnson, “China and the US Are Racing to Develop AI Weapons,” June 20, 2016, *The Conversation*, <https://theconversation.com/china-and-the-us-are-racing-to-develop-ai-weapons-97427>.

59 Stephen Chen, “China’s brightest children are being recruited to develop AI ‘killer bots,’” *South China Morning Post*, November 8, 2018, <https://www.scmp.com/news/china/science/article/2172141/chinas-brightest-children-are-being-recruited-develop-ai-killer>.

60 Aaron Boyd, “Defense Innovation Board to Explore the Ethics of AI in War,” *Nextgov*, October 11, 2018, <https://www.nextgov.com/emerging-tech/2018/10/defense-innovation-board-explore-ethics-ai-war/151957/>.

61 Sydney J. Freedberg, “Joint Artificial Intelligence Center Created Under DoD CIO,” *Breaking Defense*, June 29, 2018, <https://breakingdefense.com/2018/06/joint-artificial-intelligence-center-created-under-dod-cio/>.

62 Zachary Fryer-Briggs, “The Pentagon plans to spend \$2 billion to put more artificial intelligence into its weaponry,” *The Verge*, September 8, 2018, <https://>

www.theverge.com/2018/9/8/17833160/pentagon-darpa-artificial-intelligence-ai-investment.

63 Risa Brooks, "Technology and Future War Will Test U.S. Civil-Military Relations," *War on the Rocks*, November 26, 2018, <https://warontherocks.com/2018/11/technology-and-future-war-will-test-u-s-civil-military-relations/>.

64 Zachary Fryer-Briggs, "The Pentagon plans to spend \$2 billion to put more artificial intelligence into its weaponry," *The Verge*, September 8, 2018, <https://www.theverge.com/2018/9/8/17833160/pentagon-darpa-artificial-intelligence-ai-investment>.

65 China defense scholar Elsa Kania argues this for the PLA's deployment of AI in particular, but I would hold this also applies to Chinese government entities and private industry in general. See: Elsa B. Kania, "Battlefield Singularity: Artificial Intelligence, Military Revolution, and China's Future Military Power," Center for a New American Security, November 2017, <https://s3.amazonaws.com/files.cnas.org/documents/Battlefield-Singularity-November-2017.pdf>. Page 6.

66 This term has notably appeared, among other places, in: Nicholas Wright, "How Artificial Intelligence Will Reshape the Global Order," *Foreign Affairs*, July 10, 2018, <https://www.foreignaffairs.com/articles/world/2018-07-10/how-artificial-intelligence-will-reshape-global-order>; Freedom House, "Freedom on the Net: The Rise of Digital Authoritarianism," Freedom House, November 2018, <https://freedomhouse.org/report/freedom-net/freedom-net-2018>; and Michael Abramowitz and Michael Chertoff, "The global threat of China's digital authoritarianism," *The Washington Post*, November 1, 2018, https://www.washingtonpost.com/opinions/the-global-threat-of-chinas-digital-authoritarianism/2018/11/01/46d6d99c-dd40-11e8-b3f0-62607289efee_story.html.

67 Robert Morgus and Justin Sherman, "How U.S. surveillance technology is propping up authoritarian

regimes," *The Washington Post*, January 17, 2019, <https://www.washingtonpost.com/outlook/2019/01/17/how-us-surveillance-technology-is-propping-up-authoritarian-regimes/>.

68 Justin Sherman and Robert Morgus, "Authoritarians Are Exporting Surveillance Tech, and With it Their Vision for the Internet," Council on Foreign Relations, December 5, 2018, <https://www.cfr.org/blog/authoritarians-are-exporting-surveillance-tech-and-it-their-vision-internet>.

69 Robert Morgus and Justin Sherman, "How U.S. surveillance technology is propping up authoritarian regimes," *The Washington Post*, January 17, 2019, <https://www.washingtonpost.com/outlook/2019/01/17/how-us-surveillance-technology-is-propping-up-authoritarian-regimes/>.

70 See, among many other sources: Freedom House, "Freedom on the Net 2018," Freedom House, 2018, <https://freedomhouse.org/report/freedom-net/freedom-net-2018>; The Economist, "After decades of triumph, democracy is losing ground," *The Economist*, June 14, 2018, <https://www.economist.com/international/2018/06/14/after-decades-of-triumph-democracy-is-losing-ground>; The Economist, "The retreat of global democracy stopped in 2018," *The Economist*, January 8, 2019, <https://www.economist.com/graphic-detail/2019/01/08/the-retreat-of-global-democracy-stopped-in-2018>; and Viola Gienger, "In 2019, Will the Global March of Authoritarianism Turn Into a Stampede ... or a Slog?," January 14, 2019, *Just Security*, <https://www.justsecurity.org/62231/2019-global-march-authoritarianism-turn-stampede-slog/>.

71 Justin Sherman and Robert Morgus, "Five Things You Need to Know About France's New Cyber Norm Proposal," *New America*, November 13, 2018, <https://www.newamerica.org/cybersecurity-initiative/c2b/c2b-log/five-things-you-need-to-know-about-frances-new-cyber-norm-proposal/>.

72 Dan Breznitz and Michael Murphree, "The Rise of China in Technology Standards: New Norms in Old

Institutions,” U.S.-China Economic and Security Review Commission, January 16, 2013, <https://www.uscc.gov/sites/default/files/Research/RiseofChinaInTechnologyStandards.pdf>.

73 Yan Luo, Ashwin Kaja, and Theodore J. Karch, “China’s Framework of AI Standards Moves Ahead,” *National Law Review*, July 16, 2018, <https://www.natlawreview.com/article/china-s-framework-ai-standards-moves-ahead>.

74 Will Knight, “China wants to shape the global future of artificial intelligence,” *MIT Technology Review*, March 16, 2018, <https://www.technologyreview.com/s/610546/china-wants-to-shape-the-global-future-of-artificial-intelligence/>.

75 This also goes for standard-setting around other technologies, such as high-speed rail. See: Andrew Polk, “China Is Quietly Setting Global Standards,” *Bloomberg*, May 6, 2018, <https://www.bloomberg.com/opinion/articles/2018-05-06/china-is-quietly-setting-global-standards>.

76 Jeffrey Ding, Paul Triolo, and Samm Sacks, “Chinese Interests Take a Big Seat at the AI Governance Table,” *New America*, June 20, 2018, <https://www.newamerica.org/cybersecurity-initiative/digichina/blog/chinese-interests-take-big-seat-ai-governance-table/>.

77 Kaveh Waddell, “Trump administration’s proposed export controls could hinder tech research,” *Axios*, November 28, 2018, <https://www.axios.com/trump-export-controls-harm-tech-research-national-security-9561b8a4-7f74-45dd-8162-2807fa7d8ed1.html>.

78 Daniel Castro and Joshua New, “Memorandum to Matthew S. Borman, Deputy Assistant Secretary for Export Administration: Review of controls for certain emerging technologies,” *Center for Data Innovation*, December 6, 2018, <http://www2.datainnovation.org/2018-BIS-export-control.pdf>.

79 Cade Metz, “Curbs on A.I. Exports? Silicon Valley Fears Losing Its Edge,” *The New York Times*, January 1, 2019, <https://www.nytimes.com/2019/01/01/technology/artificial-intelligence-export-restrictions.html>.

80 Alyza Sebenius and Nico Grant, “China Violating Cyber Agreement With U.S., NSA Official Says,” *Bloomberg*, November 8, 2018, <https://www.bloomberg.com/news/articles/2018-11-08/china-violating-cyber-agreement-with-u-s-nsa-official-says>; and Lorand Laskai and Adam Segal, “A New Old Threat: Countering the Return of Chinese Industrial Cyber Espionage,” *Council on Foreign Relations*, December 6, 2018, <https://www.cfr.org/report/threat-chinese-espionage>.

81 White House Office of the Press Secretary, “Remarks by President Obama and President Xi of the People’s Republic of China in Joint Press Conference,” *White House*, September 25, 2018, <https://obamawhitehouse.archives.gov/the-press-office/2015/09/25/remarks-president-obama-and-president-xi-peoples-republic-china-joint>.

82 Adam Segal, “The U.S.-China Cyber Espionage Deal One Year Later,” *Council on Foreign Relations*, September 28, 2016, <https://www.cfr.org/blog/us-china-cyber-espionage-deal-one-year-later>.

83 Alyza Sebenius and Nico Grant, “China Violating Cyber Agreement With U.S., NSA Official Says,” *Bloomberg*, November 8, 2018, <https://www.bloomberg.com/news/articles/2018-11-08/china-violating-cyber-agreement-with-u-s-nsa-official-says>; and Lorand Laskai and Adam Segal, “A New Old Threat: Countering the Return of Chinese Industrial Cyber Espionage,” *Council on Foreign Relations*, December 6, 2018, <https://www.cfr.org/report/threat-chinese-espionage>.

84 Cory Bennett, “Why Trump is sticking with Obama’s China hacking deal,” *Politico*, November 8, 2017, <https://www.politico.com/story/2017/11/08/trump-obama-china-hacking-deal-244658>.

85 Adam Segal, “The U.S.-China Cyber Espionage Deal One Year Later,” Council on Foreign Relations, September 28, 2016, <https://www.cfr.org/blog/us-china-cyber-espionage-deal-one-year-later>.

86 Office of the United States Trade Representative, “Findings of the Investigation into China’s Acts, Policies, and Practices Related to Technology Transfer, Intellectual Property, and Innovation Under Section 301 of the Trade Act of 1974,” Executive Office of the President, March 22, 2018, <https://ustr.gov/sites/default/files/Section%20301%20FINAL.PDF>. Page 168.

87 Stanford University’s Herb Lin, for instance, has good discussion on just how intellectual property theft and espionage were defined: Herb Lin, “What the National Counterintelligence and Security Center Really Said About Chinese Economic Espionage,” *Lawfare*, July 31, 2018, <https://www.lawfareblog.com/what-national-counterintelligence-and-security-center-really-said-about-chinese-economic-espionage>.

88 President’s Council of Advisors on Science and Technology, “Ensuring Long-Term U.S. Leadership in Semiconductors,” Executive Office of the President, January 2017, https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/PCAST/pcast_ensuring_long-term_us_leadership_in_semiconductors.pdf. Relatedly, also see: Paul Triolo and Graham Webster, “China’s Efforts to Build the Semiconductors at AI’s Core,” *New America*, December 7, 2018, <https://www.newamerica.org/cybersecurity-initiative/digichina/blog/chinas-efforts-to-build-the-semiconductors-at-ais-core/>.

89 Vladimir Putin famously said in 2017 that “whoever leads in AI will rule the world,” and in that vein, the country is indeed taking steps to invest in AI’s military applications. See: Russia Today, “‘Whoever leads in AI will rule the world’: Putin to Russian children on Knowledge Day,” *Russia Today*, September 1, 2017, [https://www.rt.com/news/401731-](https://www.rt.com/news/401731-ai-rule-world-putin/)

[ai-rule-world-putin/](https://www.rt.com/news/401731-ai-rule-world-putin/); and Alina Polyakova, “Weapons of the weak: Russia and AI-driven asymmetric warfare,” Brookings Institution, November 15, 2018, <https://www.brookings.edu/research/weapons-of-the-weak-russia-and-ai-driven-asymmetric-warfare/>.

90 Alex Gray, “7 amazing ways artificial intelligence is used in healthcare,” World Economic Forum, September 20, 2018, <https://www.weforum.org/agenda/2018/09/7-amazing-ways-artificial-intelligence-is-used-in-healthcare/>.

91 Choong Ho Lee and Hyung-Jin Yoon, “Medical big data: promise and challenges,” *Kidney Research and Clinical Practice* (Vol. 36: Issue 1), March 2017, 3-11, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5331970/>.

92 Elsa B. Kania, “Challenges of technological innovation and competition in the new year,” *The Hill*, December 29, 2018, <https://thehill.com/opinion/technology/423066-challenges-of-technology-innovation-and-competition-in-the-new-year>.

93 Among other arguments, findings, and recommendations: Julia Angwin, Jeff Larson, Surya Mattu, and Lauren Kirchner, “Machine Bias,” *ProPublica*, May 23, 2016, <https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing>; Justin Sherman, “AI and machine learning bias has dangerous implications,” *Opensource.com*, January 11, 2018, <https://opensource.com/article/18/1/how-open-source-can-fight-algorithmic-bias>; Karl M. Manheim and Lyric Kaplan, “Artificial Intelligence: Risks to Privacy and Democracy,” Social Science Research Network, October 26, 2018, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3273016; AI Now Institute, “AI Now Report 2018,” AI Now Institute, 2018, https://ainowinstitute.org/AI_Now_2018_Report.pdf; Justin Sherman, “Need a resolution? How about ‘Guard your online presence,’” *Richmond Times-Dispatch*, December 31, 2018, https://www.richmond.com/opinion/their-opinion/guest-columnists/justin-sherman-column-need-a-resolution-how-about-guard-your/article_f1052795-3ba7-52fc-862a-

cfa1e7b40609.html; Ross Barkan, “New York should regulate law enforcement use of facial recognition technology,” *City & State NY*, January 7, 2019, <https://www.cityandstateny.com/articles/opinion/commentary/new-york-should-regulate-law-enforcement-use-of-facial-recognition>; and Sophie Haigney, “Not All Surveillance is Created Equal,” *Pacific Standard*, January 7, 2019, <https://psmag.com/magazine/not-all-surveillance-is-created-equal>.

94 For discussion of some issues in this vein, see: Steven Feldstein, “The Road to Digital Unfreedom: How Artificial Intelligence is Reshaping Repression,” *Journal of Democracy* (Vol. 30: Issue 1), January 2019, 40-52, <http://muse.jhu.edu/article/713721>.

95 Vikram Barhat, “China is determined to steal A.I. crown from US and nothing, not even a trade war, will stop it,” CNBC, May 4, 2018, <https://www.cnbc.com/2018/05/04/china-aims-to-steal-us-a-i-crown-and-not-even-trade-war-will-stop-it.html>; Alison DeNisco Rayome, “Chinese AI startups raised \$5B in VC funding last year, outpacing the US,” *TechRepublic*, August 27, 2018, <https://www.techrepublic.com/article/chinese-ai-startups-raised-5b-in-vc-funding-last-year-outpacing-the-us/>; and Jeffrey Ding, “Deciphering China’s AI Dream,” Future of Humanity Institute, March 2018, https://www.fhi.ox.ac.uk/wp-content/uploads/Deciphering_Chinas_AI-Dream.pdf. Pages 7, 16, and 17.

96 Graham Webster, Rogier Creemers, Paul Triolo, and Elsa Kania, “China’s Plan to ‘Lead’ in AI: Purpose, Prospects, and Problems,” *New America*, August 1, 2017, <https://www.newamerica.org/cybersecurity-initiative/blog/chinas-plan-lead-ai-purpose-prospects-and-problems/>; Elsa Kania and Rogier Creemers, “Xi Jinping Calls for ‘Healthy Development’ of AI (Translation),” *New America*, November 5, 2018, <https://www.newamerica.org/cybersecurity-initiative/digichina/blog/xi-jinping-calls-for-healthy-development-of-ai-translation/>; Cameron Hickert and Jeffrey Ding, “Read What Top Chinese Officials Are Hearing About AI Competition

and Policy,” *New America*, November 29, 2018, <https://www.newamerica.org/cybersecurity-initiative/digichina/blog/read-what-top-chinese-officials-are-hearing-about-ai-competition-and-policy/>; and Jeffrey Ding, Paul Triolo, and Samm Sacks, “Chinese Interests Take a Big Seat at the AI Governance Table,” *New America* June 20, 2018, <https://www.newamerica.org/cybersecurity-initiative/digichina/blog/chinese-interests-take-big-seat-ai-governance-table/>.

97 Graham Webster, Rogier Creemers, Paul Triolo, and Elsa Kania, “China’s Plan to ‘Lead’ in AI: Purpose, Prospects, and Problems,” *New America*, August 1, 2017, <https://www.newamerica.org/cybersecurity-initiative/blog/chinas-plan-lead-ai-purpose-prospects-and-problems/>.

98 Gregory C. Allen and Elsa B. Kania, “China is Using America’s Own Plan to Dominate the Future of Artificial Intelligence,” *Foreign Policy*, September 8, 2017, <https://foreignpolicy.com/2017/09/08/china-is-using-americas-own-plan-to-dominate-the-future-of-artificial-intelligence/>.

99 Joshua New, “Why It’s Time for the United States to Develop a National AI Strategy,” Center for Data Innovation, December 4, 2018, <https://www.datainnovation.org/2018/12/it-is-time-for-the-united-states-to-develop-a-national-ai-strategy/>.

100 Shannon Vavra, “Mnuchin: Losing human jobs to AI ‘not even on our radar screen,’” *Axios*, March 24, 2017, <https://www.axios.com/mnuchin-losing-human-jobs-to-ai-not-even-on-our-radar-screen-1513301151-318eabc3-fb43-4642-aebb-26ce673374e5.html>.

101 Iris Deng, “China’s AI industry gets the most funding, but lags the US in key talent, says Tsinghua,” *South China Morning Post*, July 17, 2018, <https://www.scmp.com/tech/china-tech/article/2155600/chinas-ai-industry-gets-most-funding-lags-us-key-talent-says>.

102 Dominic Barton, Jonathan Woetzel, Jeongmin Seong, and Qinzhen Tian, “Artificial Intelligence: Implications for China,” McKinsey Global Institute, April 2017, <https://www.mckinsey.com/featured-insights/china/artificial-intelligence-implications-for-china>. Page 5.

103 Aaron Boyd, “Defense Innovation Board to Explore the Ethics of AI in War,” *Nextgov*, October 11, 2018, <https://www.nextgov.com/emerging-tech/2018/10/defense-innovation-board-explore-ethics-ai-war/151957/>.

104 Sydney J. Freedberg, “Joint Artificial Intelligence Center Created Under DoD CIO,” *Breaking Defense*, June 29, 2018, <https://breakingdefense.com/2018/06/joint-artificial-intelligence-center-created-under-dod-cio/>.

105 Paul Scharre and Michael C. Horowitz, “Congress Can Help the United States Lead in Artificial Intelligence,” *Foreign Policy*, December 10, 2018, <https://foreignpolicy.com/2018/12/10/congress-can-help-the-united-states-lead-in-artificial-intelligence/>.

106 For examples of other U.S. steps to bolster AI development, see: “AI Policy – United States,” Future of Life Institute, accessed on January 10, 2019, <https://futureoflife.org/ai-policy-united-states/>.

107 White House, “National Security Strategy of the United States of America,” White House, December 2017, <https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905-2.pdf>. Pages 20 and 34.

108 Office of the Director of National Intelligence, “National Intelligence Strategy of the United States of America,” Office of the Director of National Intelligence, 2019, https://www.dni.gov/files/ODNI/documents/National_Intelligence_Strategy_2019.pdf.

109 Public-Private Analytic Exchange Program, “AI: Using Standards to Mitigate Risks,” U.S. Department of Homeland Security, 2018, <https://www.dni.gov/>

[files/PE/Documents/2018_AEP-AI.pdf](https://www.dni.gov/files/ODNI/documents/PE/Documents/2018_AEP-AI.pdf); and Office of the Director of National Intelligence, “The AIM Initiative: A Strategy for Augmenting Intelligence Using Machines,” Office of the Director of National Intelligence, 2018, <https://www.dni.gov/files/ODNI/documents/AIM-Strategy.pdf>.

110 White House, Executive Order on Maintaining American Leadership in Artificial Intelligence, White House, February 11, 2019, <https://www.whitehouse.gov/presidential-actions/executive-order-maintaining-american-leadership-artificial-intelligence/>.

111 Ben Guarino, “Trump desperately needs a science adviser, experts say. He just doubled the record for time without one,” *The Washington Post*, July 27, 2018, <https://www.washingtonpost.com/news/speaking-of-science/wp/2018/07/27/trump-just-doubled-the-record-for-time-without-a-science-and-technology-adviser/>.

112 Justin Sherman, “To Preserve a Global and Open Internet, We Need to Invest in Cyber Diplomacy,” *New America*, December 11, 2018, <https://www.newamerica.org/cybersecurity-initiative/c2b/c2b-log/preserve-global-and-open-internet-we-need-invest-cyber-diplomacy/>; and Justin Sherman and Robert Morgus, “Four Opportunities for State’s New Cyber Bureau,” *New America*, February 11, 2019, <https://www.newamerica.org/cybersecurity-initiative/c2b/c2b-log/four-opportunities-for-states-new-cyber-bureau/>.

113 Robbie Gramer and Elias Groll, “Can State’s New Cyber Bureau Hack It?” *Foreign Policy*, January 18, 2019, <https://foreignpolicy.com/2019/01/18/state-department-cyber-security-cyber-threats-russia-china-diplomacy-capitol-hill-lawmakers-pompeo/>.

114 Robert Morgus and Justin Sherman, “How U.S. surveillance technology is propping up authoritarian regimes,” *The Washington Post*, January 17, 2019, <https://www.washingtonpost.com/outlook/2019/01/17/how-us-surveillance-technology-is-propping-up-authoritarian-regimes/>.

115 Mieke Eoyang, Allison Peters, Ishan Mehta, and Brandon Gaskew, “To Catch a Hacker: Toward a comprehensive strategy to identify, pursue, and punish malicious cyber actors,” ThirdWay, October 29, 2018, <https://www.thirdway.org/report/to-catch-a-hacker-toward-a-comprehensive-strategy-to-identify-pursue-and-punish-malicious-cyber-actors>.

116 Lorand Laskai and Adam Segal, “A New Old Threat: Countering the Return of Chinese Industrial Cyber Espionage,” Council on Foreign Relations, December 6, 2018, <https://www.cfr.org/report/threat-chinese-espionage>.

117 Graham Webster and Scarlet Kim, “The Data Arms Race Is No Excuse for Abandoning Privacy,” *Foreign Policy*, August 14, 2018, <https://foreignpolicy.com/2018/08/14/the-data-arms-race-is-no-excuse-for-abandoning-privacy/>.



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