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COMPARING ARTIFICIAL INTELLIGENCE DEVELOPMENTS OF SUPERPOWERS: CHINA AND THE US

Titu-Marius I. Băjenescu*, ORCID ID: 0000-0002-9371-6766

Swiss Technology Association, Electronics Group Switzerland
*tmbajenesco@gmail.com

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Abstract. The paper deals with the progress in various aspects of Artificial Intelligence (AI) in US and China. There is concern about high-level machine intelligence and super-intelligent AI coming up in a few decades, bringing with it significant risks for humanity. In other quarters, these issues are ignored or considered science fiction. High level machine intelligence will be developed around 2040-2050, rising to a nine in ten chance by 2075. Experts expect that systems will move on to super-intelligence in less than 30 years thereafter. They estimate the chance is about one in three that this development turns out to be 'bad' or 'extremely bad' for humanity.

Keywords: *US policy regarding AI, China policy regarding AI, narrow AI, general AI, artificial general intelligence AGI, US Laying the foundation for an AI strategy, strategies for AI.*

Rezumat. Lucrarea tratează progresul în diferite aspecte ale inteligenței artificiale (IA) în SUA și China. Există îngrijorare cu privire la inteligența mașinilor la nivel înalt și super-inteligența (IA) care poate apărea în câteva decenii, ceea ce aduce riscuri semnificative pentru umanitate. În alte sferturi din societate, aceste probleme sunt ignorate sau considerate "science fiction". Informațiile despre mașini la nivel înalt vor fi dezvoltate în jurul anilor 2040-2050, ajungând la o șansă de nouă din zece până în 2075. Experții se așteaptă ca sistemele să treacă la super-informații în mai puțin de 30 de ani după aceasta. Se estimează că șansa este aproximativ egală cu una din trei ca această dezvoltare să se dovedească a fi „proastă” sau „extrem de proastă” pentru umanitate.

Cuvinte cheie: *politica SUA referitor la IA, politica chineză referitor la IA, IA îngustă, IA generală, inteligența artificială generală AGI, strategii de IA.*

Introduction

In general, an artificial Intelligence attempts to reproduce the human memory, learning processes and a problem-solving oriented behaviour and therefore capture complicated mental processes. The fact the topic "artificial intelligence" has become more and more interesting in recent years, depending on the rapidly improving computing power of today's high-performance processors, which make it possible to achieve large process data volumes quickly and inexpensively [1]. Scientists and experts always define this increasingly

important and omnipresent topic AI versatile and different. A view from mathematicians and computer scientists is, for example, that thinking is calculable and therefore is not necessarily a clearly human characteristic. The artificial intelligence and the necessary hardware would thus be the equivalent of the human mind and brain.

Artificial intelligence (AI) is the collection of computations that at any time make it possible to assist users to perceive, reason, and act. Since it is computations that make up AI, the functions of perceiving, reasoning, and acting can be accomplished under the control of the computational device (e.g., computers or robotics) in question [2]. AI at a minimum includes:

- Representations of "reality," cognition, and information, along with associated methods of representation;
- Machine learning;
- Representations of vision and language;
- Robotics; and
- Virtual reality

A system is called *intelligent* if it can independently and efficiently solve problems. The level of intelligence depends on the degree of autonomy, the degree of complexity of the problem and the degree of efficiency of the problem-solving process. Recent history has pointed out that a variety of intelligent computational techniques, part of which are inspired by human intelligence, may be successfully applied to solve all kinds of practical problems. Examples of such intelligent techniques include machine learning, agent technology, and knowledge representation, and examples of application domains include medicine, economics, and incident management, among many others. This sub-area of AI, which has its main emphasis on applications of intelligent systems to solve real-life problems, is currently known under the term *Applied Intelligence* [3].

Traditionally, AI was developed as a simulation of intelligent human thinking. This definition suffers from the fact that "intelligent human thinking" and "acting" are not defined. Furthermore, made man the measure of intelligence, although evolution has made many organisms with different degrees of "intelligence" has produced. In addition, we have long been surrounded by "intelligent" systems in technology, which, although independent and efficient often control our civilization differently than humans.

Artificial intelligence has long since dominated our lives, without is conscious. Smartphones that talk to us, wristwatches that record our health data, workflows that automatically organizing cars, planes and drones that control themselves, transport and energy systems with autonomous logistics or that to explore distant planets, are technical examples of a networked world of intelligent systems. They show us how our everyday life is determined by AI functions [4].

Like any technology, AI is not an inevitable fate. It can be shaped. Conversely, however, this also means that if we do not help shape it, others will do it for us [5]. The big question is, therefore, what should this future look like? Where do we want to go with learning machines and thinking robots? With the increasing complexity and automation of technology, the robotics is service providers of the industrial society.

Over the last 10 years, researchers have learned that image recognition, driving, and translation may also be framed as prediction problems. As the range of tasks that are recast as prediction problems continues to grow, we believe the scope of new applications will be extraordinary.

An AI system has new intellectual abilities that humans do not have at all. It's impossible to make broad predictions about AI's impact in the coming years and decades.

AI is Science Fiction

AI began as sci-fi fantasy popularized by visionary writers, but AI is here and now. There are many current applications, depending of how you define AI. In the US one of the first examples of AI being used at the edge concerned handwriting recognition of checks [5].

The recent history of artificially intelligent systems is certainly impressive. With neural networks and machine learning, research has taken a decisive step towards more environmentally adapted programming. There is speech, facial and pattern recognition systems of astonishing adaptability, and the expectations and visions of the AI community are correspondingly high. Now the so-called *Artificial General Intelligence* (AGI), a machine with a "healthy, artificial mind" is beginning to shine on the horizon. Broadly speaking, AI is the simulation of human intelligence process using machines. Such intelligence is found in computer systems [6]. AI has some characteristics similar to human intelligence such as planning, problem-solving, knowledge representation, motion, learning, and many other things. There are two main types of AI: *narrow AI*, and *general AI*.

Narrow AI is found in computers. These AIs learn and are taught to how to carry out specific tasks without being programmed explicitly how to do so. An example is the vision-recognition systems in self-driving cars or the AIs that works behind the curtain that delivers advertisement on websites that are relevant to viewers based on their search history and internet activities. These AIs are called *narrow AI* because they can only learn or taught how to do a specific task. Narrow AIs can do many things such as interpreting video feeds from surveillance drones or mundane tasks such as organizing personal and business documents. They are capable of responding to customer's questions and coordinating with other AIs to book a hotel room at the right price and location. They have also been used in advanced applications such as spotting potential cancer tumours in X-rays, detect wear and tear in elevators or flagging inappropriate contents online.

On the other hand, *general AI* is an entirely different entity. It has the same adaptable intelligence found in humans, unlike narrow AI that can only learn to do one thing. This flexibility allows general AIs to build spreadsheets, give you a haircut, and drive without crashing into people. This is the sort of AIs displayed in terminator the movie. So far, though, it does not exist yet and AI experts are still debating whether it will ever be a reality.

Artificial General Intelligence (AGI) would be developed between 2040 or 2050. Even if that is not the case, then the chances are up to 90% by 2075 [7]. The emergence of super-intelligence is also predicted.

USA-CHINA: The Clash of AI Powers

AI research in America is facilitated by openness and speed. Openness refers to the willingness to share information within the community; speed, as a result of technological advancements, allows data to be shared instantly. This is a similar phenomenon in China. In addition, Chinese researchers are voracious readers; and since the English language is a mandatory subject in Chinese public schools, they possess an additional edge over the Americans - the ability to access information from both English and Chinese-speaking AI communities (two of world's biggest). This might be a contributing reason to why China possesses the most data in the world [8].

China would not have undergone a technological revolution without the endorsement from the Chinese leadership. The role of the government cannot be undermined when we analyze factors contributing to China's success in AI. Furthermore, the Chinese government pours in massive investments to fuel growth, justifying "overpaying in the short term" by the monumental long-term upside.

China's biggest advantage is no longer cheap labour, but unparalleled flexibility of the supply chains and armies of skilled industrial engineers.

Chinese companies collect a lot more data, with user consent. Chinese users use a lot more services, digitally. The main problem of these companies was resistance to localization. In order to build a product where "they" (i.e. customers) will come, American companies have to tailor their products to Chinese users' needs; or build them from scratch to meet the market's demands.

Over the past 15 or 20 years, Chinese entrepreneurs have gone from copycat to innovators, those who continue to copy of course get nowhere, as we would expect. However, those, who through copying learn the art of developing products for users, and then they benefited from a large market with a huge amount of data, which was perfect for AI and therein developed the secret recipe for the Chinese internet companies and Chinese AI companies, which benefited from a lot of data.

They came up with new products that were perfect for developing countries, and figured out how to make money, and developed an entirely different business model than Silicon Valley [9]. Rather than developing light-tech companies, Chinese companies have developed very heavy, hard-to-replicate companies - companies built on operational excellence, and built on complicated software and human labour combined... that makes it very difficult to copy.

US are well ahead in the research. Universities in the US are leaps and bounds better than the Chinese universities. However, by and large, professors publish openly, so China has the implementation edge, and the Chinese companies are able to find ways to make money. They have a larger market to build from, and AI gets better with data, and in the age of AI data is the new oil. So with these advantages Chinese implementation and monetization and valuation of the companies have already started to eclipse the US, and probably will have a larger leap unless there is a big breakthrough in the US, which might change the whole equation here.

The American Beginnings

From the time of the first embryonic computer developments in the late 1940s and early 1950s, DOD has encouraged and sponsored AI and human-computer interaction (HCI) R&D in the laboratories of industry, academia, and government. Advancements in AI and HCI have allowed DOD to accelerate work toward its goal of improving national security while reducing the risk faced by individuals in hostile environments [10].

This goal has manifested itself in strong support for and pressure to advance technologies that [11]:

- Permit total replacement of humans in hostile environments by "satisfactory" perceiving, reasoning, and acting mechanical-electronic surrogates;
- Permit combinations of robots and humans to carry out needed functions in hostile environments with minimal or much reduced risk to the human;

- Permit remote control of robots or human-robot systems in hostile environments to substantially reduce the risk to the human;
- Improve dramatically via education and training the capability of humans to perform satisfactorily in hostile environments, principally via simulation, emulation, and modelling processes and procedures; and
- Expedite the design, development, and manufacture of products, systems, and platforms of high quality in a timely manner and at least cost via concurrent engineering, computer-aided design (CAD), computer-aided manufacturing (CAM), flexible computer-integrated manufacturing (FCIM), and other automated design and production technologies.

American Strategy For AI

At the beginning of August 2018, the US Senate approved the 2019 defence budget, making it a point of honour to initiate the formulation of an American strategy for artificial intelligence. The United States intends to develop a more established artificial intelligence strategy and end the vagueness that has prevailed in this area since the Obama presidency. The new legislation includes two sections that take stock of current efforts in the field both domestically and internationally and proposes a series of measures to accelerate research and acquisition of AI technologies by the Department of Defense (DoD).

US Laying the Foundation For An AI Strategy

The Secretary of Defense is requested to develop a strategic plan and coordinate the Department's efforts in this direction. In order for this plan to take shape, the DoD will have to strengthen its links with the research sector among technology firms, the defence industry, academia and thinktanks. The emerging global competition in the field is indirectly taken into account: among the recommendations the training, recruitment and retention on the national territory of the best specialists echo the efforts of China to attract on its soil and in its companies the greatest experts in AI, especially Americans. The Pentagon is called upon to exploit the progress made by the commercial and academic sectors and appeals for the establishment of an ethical and legal framework for the regulation of AI technological applications [12].

The newly created *Joint Artificial Intelligence Center* (JAIC) will now oversee and coordinate the plethora of DoD agencies and organizations in their efforts to research and acquire AI technologies for all projects exceeding \$15 millions.

The *National Defense Authorisation Act* (NDAA) places particular emphasis on the importance of public-private partnerships in developing the Department's capabilities, following the Pentagon's well-established view that the innovative power of technology companies, especially those based in Silicon Valley, can never be matched by the heavy federal bureaucracy.

A *National Security Commission on Artificial Intelligence* (NSCIA) has been established, whose members will be appointed by the Government and Congress. The Commission will report on the progress of AI in the United States by assessing the country's international competitiveness in national security, defence capabilities, private sector integration with government objectives, and investment. Outside the Pentagon, the commission is responsible for ensuring multi-layered coordination of government public policy in support of AI.

This legislation for NDAA 2019 reflects an awareness not only of the importance of AI, but also of the fact that the United States are not alone in its continued development. The emphasis on public-private partnerships and academic integration is reminiscent of the "civil-

military merger" of China's strategy to integrate universities, government and the private sector. China is also spending a lot of energy and money to increase its talent pool, funding AI programmes in national universities and trying to attract American and European researchers. And the United States seems to be following the example of its most serious rival by adopting a similar strategy that is bearing fruits.

We can also look at it another way: Certainly, the federal government wants to strengthen its cooperation with innovative firms in the private sector, its model is very different from that of its Chinese counterpart. Indeed, far from Beijing's strategy, the neo-liberal paradigm is infusing itself into American public policies and has done so more recently than one may think. In recent years, the government has been giving way to the private sector in the implementation and even the very definition of public action. While Beijing regulates, controls and capitalizes on the general dynamics by its technological firms without being dictated to by them.

One of the many revealing signs of the fragility of the American strategy is the "rebellion" of some Google employees against the Pentagon's Maven² project (a program that uses automatic learning to analyze the video streams captured by drones in order to improve their attack capabilities). Beyond the ethical problem, which the Chinese have little to worry about, this episode demonstrates the extreme dependence of the government apparatus - and in this case the American military - on the technological industry [13].

Ultimately, the American AI strategy is an anti-strategy. It is ultimately based on the goodwill of extremely powerful industrial players who, ironically, owe their dazzling success to massive government investment in their direction. If the United States dominates the world scene in the field of technology, it is because the government, and particularly the Pentagon and the intelligence community, have been extraordinarily intrusive, have invested phenomenal sums of money in projects which a priori have no future and demanded, in return, convincing results. The state must remain a driving force; its international influence, power, credibility and even legitimacy in the eyes of its citizens depend on it. And this is not just true only for the United States.

The debate on the place of artificial intelligence in the military field will certainly not be confined to the United States and its companies only.

"If developed, autonomous weapons will be the third revolution in warfare. They will allow fighting to be conducted faster and, on a scale, never before achieved. They could become weapons of terror. Dictators and terrorists could use them against innocent populations, free from any ethical constraints," warn artificial intelligence researchers. This Pandora's box will be difficult to close if it is opened.

China's Strategy

The difficulty of doing business in China stems from the dominant role that the Communist government plays in the economy, including its top-down policies that favour

¹ Project Maven at the Pentagon: Google's AI that breaks the technology vase: Thousands of Google employees oppose its work on the Department of Defense's Project Maven, an AI pilot program that could be used for drone strikes. Thousands of Google employees have signed a petition calling on the company to end its collaboration with the Pentagon on artificial intelligence and image recognition technology because of its possible use for drone strikes. The letter, signed by 3,100 employees, was sent to Google CEO Sundar Pichai. The signatories say they are opposed to Project Maven, a Pentagon pilot program designed to accelerate the use of artificial intelligence technologies within the Department of Defense. "We believe that Google should not intervene in the war business," the employees wrote in the petition. "Therefore, we ask that the Maven project be cancelled, and that Google write, publish and enforce a clear policy that neither Google nor its subcontractors will ever build war technology."

Chinese companies at the expense of foreign investors. There is no level playing field for foreign companies, and global markets are suffering the repercussions. In comparison, the United States' approach, which is more organic and bottom-up, creates a more level playing field and allows more room for innovation. Although China has made progress in recent decades towards market-oriented policies, the government continues to be heavily involved in the economy through a dominant network of state-owned enterprises, its guidelines for channelling investment through state-owned banks, and its opaque regulations that disadvantage foreign firms. For example, under China's "Made in China 2025" industrial policy, the government is directing investment towards high-tech industries with the aim of developing local enterprises at the expense of foreign competitors. As a result of this policy, Chinese companies enjoy an unfair advantage in accessing credit, obtaining business licenses, bidding and acquiring resources. Conversely, the U.S. government does not generally hold shares in major companies and does not discriminate between local and foreign companies. The capital market is efficient and private [14].

While AI presents numerous opportunities, we noted that there are still many challenges, including understanding how AI is being utilized, guarding against adversarial manipulation, assessing risk of bias (fairness), proving the performance of AI systems (safety, security), and building AI that interacts well with human decision makers. Not all AI is the same, and some use cases pose more risk than others. A risk-based, use-case approach to AI governance is needed, she said, and the administration plans to issue a memo on this topic in the near future. Efforts to craft this memo are underway by the *Office of Management and Budget's* (OMB) Office of Information and Regulatory Affairs to provide AI guidance to federal agencies. The guidance will help federal regulatory agencies develop and maintain regulatory and non-regulatory approaches for safe and trustworthy creation and adoption of new AI technologies. A draft guidance memorandum will be published for public comment this summer, and the administration plans to finalize the memorandum later this year. Agencies will then have six months to develop plans to implement the OMB Guidance [15]. China's next-generation AI plan, released in 2017, declared AI as a strategic national priority for the country and showcased the top leadership's vision for a new economic model driven by AI. Unlike the US, the Chinese government is putting this plan into practice. For example, it recently commissioned Baidu to create a national "deep learning laboratory" together with leading universities - and it's investing an undisclosed sum in the effort. The country is already strong in AI. Baidu, Alibaba, and Tencent are among the global AI leaders. Chinese programmers recently won the *ImageNet AI* competition. And its leading ecommerce companies are using highly sophisticated AI in their warehouses and across the business.

International Cooperation

In the area of international cooperation, we noted the administration's active participation in the development of the *Organization for Economic and Cooperative Development's* (OECD) Principles on Artificial Intelligence, issued on May 22, 2019³. The OECD AI Principles provide high-level guidance for responsible stewardship of trustworthy AI, which include inclusive and sustainable growth and well-being, human-centred values and fairness,

³ Organization for Economic Cooperation and Development, "OECD Principles on AI," <https://www.oecd.org/going-digital/ai/principles>.

transparency and explainability, robustness and safety, and accountability. OECD is also establishing an AI Policy Observatory⁴ for next steps in sharing information [16].

Conclusions: The Ethical Scale

On the one hand, even a super-intelligence, would be subject to the laws of logic, mathematics and physics. We therefore need multidisciplinary basic research so that the algorithms do not get out of hand. On the other hand, we demand technology design: Based on past experience, we should recognize the opportunities, but also think carefully about what purpose and use we should develop AI in the future. AI must as a service in society. This is their ethical scale.

Behind the rush to continually improve AI's capacities, there is also a need for guidelines and standards to ensure that the research, development, and use of AI ethical. There is yet another debate surrounding ethical AI. Should it make ethical decisions, or should there be some sort of regulations?

Even a super-intelligence will be subject to the laws of logic, mathematics and physics. We therefore need interdisciplinary basic research, so that the algorithms do not get out of hand. On the other hand, we demand technology design: After the experiences of the past we should recognize the opportunities, but also consider carefully for what purpose and benefit we should develop AI in the future.

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⁴ See: <https://www.whitehouse.gov/presidential-actions/executive-order-maintaining-american-leadership-artificial-intelligence/>