Artificial Intelligence:

the Future of the United States

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Abstract

Since the Industrial Revolution, the United States has prided itself on being the leading innovator in technology. Currently, however, the United States is running the risk of falling behind other nations in terms of relevance and applicability of the technology it produces. Specifically, the United States is not properly allocating the resources to the research and development of artificial intelligence (AI). While nations such as China have strong national initiatives to promote AI development, the United States' policy is loose and uncoordinated. To make sure the U.S. remains competitive in AI technology, it is vital that the government allocates the proper amount of resources and creates an environment where individuals want to research AI within the United States.

Introduction

Artificial intelligence (AI) is the future. Already, it is present everywhere: on our phones, our televisions, and even our cars. Very few Americans, however, actually understand what artificial intelligence is and its potential positive and negative effects on American society. Artificial intelligence is one of the most rapidly developing technologies of our era, and it is vital that our citizens understand it and are able to implement it.

The United States is currently a leading innovator in AI development, but it could potentially fall behind other nations. China, for example, has a coordinated national effort to make China the forerunner in AI, and is allocating billions of dollars towards this industry. The United States, on the other hand, has only released executive orders and reports regarding artificial intelligence, without taking any tangible steps to forward its development. In order to not fall behind technologically, it is vital the United States government accelerates its efforts in developing and implementing artificial intelligence by providing funding and resources, while also creating infrastructure to mitigate the potential harms of artificial intelligence.

What is Artificial Intelligence?

Artificial intelligence is a computer program "with the ability to think for [itself] and embrace different types of machine learning."[1] In machine learning, AI systems learn from data and then use this knowledge to make predictions, such as when a computer uses facial recognition to tell if a image includes a cat or a human.

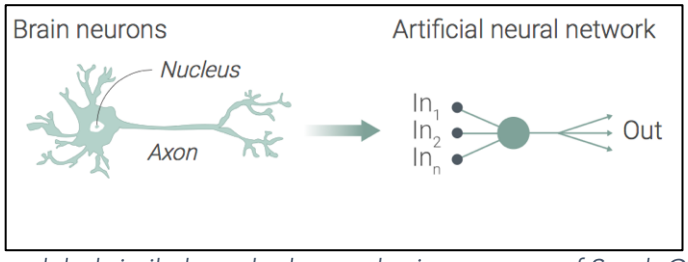

Figure 1 shows how AI is modeled similarly to the human brain, courtesy of South China Morning Post

Currently, AI is "narrow": it is very good at accomplishing a very specific task and no other, such as driving a car or playing a game.[2] AI can even surpass human ability in its given task, such as when Deep Mind's AlphaGo beat reigning champion Lee Sedol in three different games of Go in 2016, a game which was thought to be too complicated for a computer to ever learn to play.[3] Some image recognition AI's are even better than humans in detecting tumors and other abnormalities from X-Ray images.[4] AI is currently used to steer airplanes and is slowly creeping onto the ground transportation market as well.[5] This trend will continue as AI learns to complete more and more tasks.

History of Artificial Intelligence

Mathematician Alan Turing first devised the concept of intelligent machines in 1950 with his paper, "Computing Machinery and Intelligence," in which he described how to build intelligent machinery and how to test its intelligence.[6] The test he created, called the Turing Test, is fairly straightforward: a human must determine if it's interacting with a machine or another human. If the human cannot tell a difference, then the machine has achieved human-level intelligence.[7]

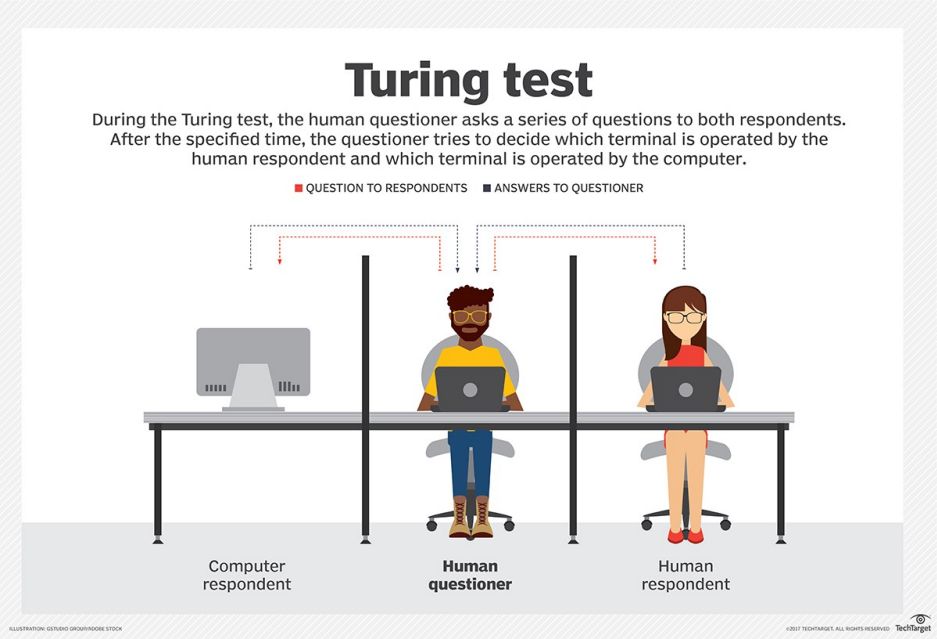

Figure 2 Depicts the Turing Test, Courtesy of Head Tale

Scientists first came together to discuss artificial intelligence at the Dartmouth Conference on Artificial Intelligence in 1956. At this conference, the consensus among researchers was that artificial intelligence was indeed achievable.[8] Ever since this conference, artificial intelligence research has expanded. However, it was not until the 1990s great strides in artificial intelligence development were achieved. Previously, computers were extremely limited in their memory and speed. In the past few decades, computing power has doubled every couple years according to Moore's law. Thus, hardware is now powerful enough to build artificial intelligence systems.[9] In the past twenty years, search engines such as Google have greatly expanded the amount of data available that researchers can use to "train" artificial intelligence, also contributing to its recent growth.[10]

Future Applications of Artificial Intelligence

The expansion of artificial intelligence is being dubbed by digital visionaries such as Kevin Kelly as the "second Industrial Revolution." Kelly describes this new industrial revolution as very similar to the one we experienced in the nineteenth and twentieth centuries. In the first Industrial Revolution, artificial power was added to human power, such as humans operating steam engines. In this new industrial revolution, however, we are going to add artificial intelligence to human intelligence, and work together to solve problems, such as a doctor and AI working together to create a treatment plan for a patient.[11] According to MIT research, humans and robots working together are more efficient than humans or robots working by themselves, with robots reducing human idle time by 85 percent.[12] Together, humans and AI will increase efficiency and productivity.

Artificial Intelligence and Economic Growth

One of the greatest concerns with artificial intelligence is the impact it will have on job availability, especially on types of work that can be automated or done by a computer program. According to the McKinsey Institute "About half the activities people are paid to do globally could theoretically be automated. [However], very few occupations-less than 5 percent- consistent of activities that can fully be automated. In about 60 percent of occupations, at least one-third of the constituent activities could be automated."[13] Work that is repetitive in nature will be automated, and demand for blue-color work will decrease. The demand for workers with digital skills, however, will rise significantly from 40 percent to over 50 percent. Also, AI will increase global economic activity, with a potential 1.2 percent GDP growth solely due to AI technologies.[14]

This economic growth will not be evenly distributed, however. Companies that implement AI technology or have already implemented AI technology will receive a disproportionate amount of this economic growth, with some doubling their cash flow by 2030. Nations that lead in AI adoption will also receive much more of this economic growth than developing countries, gaining 20 to 50 percent in economic benefits compared to only 5 to 15 percent for developing countries.[15]

This type of inequality driven by new innovation, however, has already occurred in history during the Industrial Revolution. New innovations such as the spinning jenny and scientific farming reduced the demand for textile workers and farmers during nineteenth century, dramatically decreasing work opportunities for the lower classes while increasing the income of the upper classes. Overtime, however, these innovations allowed the price of foods and goods to decrease, improving the quality of life for most humans.[16]

In this same way, artificial intelligence will displace many people in the workforce. However, it will allow people to work in fields that are currently understaffed and cannot be automated, such as child and elder care.[17] People will always be in demand; the only thing that changes with time is the kind of skills the work force deems are valuable. According to the McKinsey Institute, across all industries the "demand for higher cognitive, social and emotional, and technological skills should grow."[18] In the words of visionary Kevin Kelly, AI is "going to create whole new categories, a whole new slew of tasks that we didn't know we wanted to do before. They're going to actually engender new kinds of jobs, new kinds of tasks that we want done, just as automation made up a whole bunch of new things that we didn't know we needed before. We're going to be working with these AIs, and I think you'll be paid in the future by how well you work with these bots."[19] The United States should not let the fear of how automation will affect the average worker hold it back for developing AI. Rather, it should teach people how to harness it for productivity.

Artificial Intelligence in China

If the United States does not invest heavily in AI innovations, it has the risk of falling behind other nations, particularly China. According to Kai-Fu Lee, author of AI Superpowers: China, Silicon Valley, and the New World Order, "If you measure by research — basic research papers published, excellence of research — U.S. is and will be ahead for the next decade. But if you measure by value created, how much market capitalization, how many users, how much revenue, China probably is already ahead."[20] Since 2005, China has been publishing more research papers about AI than the United States. Although historically Chinese publications are not as influential as American publications, and sometimes are even found to be fraudulent, the Chinese are currently approaching the United States in terms of how much esteem their publications receive. If these trends continue, by as soon as 2020 these two nations will share the same amount of top AI research publications.

Part of the reason why China has an advantage over the United States is the lack of privacy of its citizens. WeChat, a popular mobile application in China, tracks many aspects of Chinese civilians lives, including what they purchase and the type of public services they use.[21] The Chinese government has fewer privacy regulations than the United States, which gives companies much larger data sets with extensive depth to use when developing artificial intelligence systems.[22]

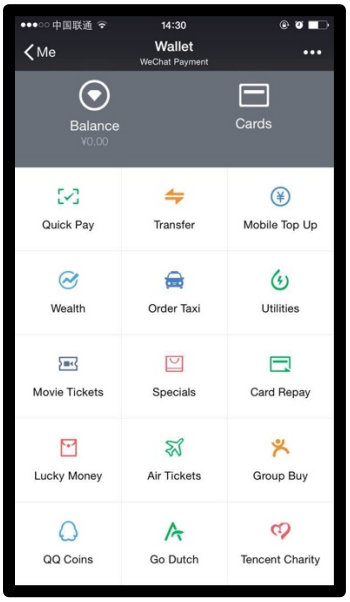

Figure 3 Shows a Screenshot of the WeChat app and all the data it collects from its users, Courtesy of BankNXT.

China currently has a national plan to become the leading nation in AI research with three benchmarks: "Keep pace with AI technologies by 2020, achieve AI breakthroughs by 2025, and to actually be the world leader in AI by 2030."[23] China may already be outspending the United States in terms of AI development. China has a plan to build a 2.1 billion technology park in the suburbs of Beijing, but as of 2016 the United States has only spent 1.2 billion on unclassified artificial intelligence development programs.[24] According to analysis from think tanks such as the Center for a New American Security, Americans should see China's AI ambitions as serious and effective, as lofty as they may seem. Furthermore, China's military is heavily involved in AI development, setting up new research facilities in Beijing dedicated to just AI development.[25]

Current Artificial Intelligence Policy of the United States

On February 11, 2019, President Donald Trump released the "Executive Order on Maintaining American Leadership in Artificial Intelligence." In this order, Trump outlined a five-principle plan to promote American leadership in the development and implementation of artificial intelligence systems. The principles are as follows:

- ◊ America should be driving AI technological breakthroughs.
- ◊ The U.S. government should reduce barriers to the safe testing and deployment of AI.
- ◊ The U.S. should train Americans to use AI technology.
- ◊ The U.S. should foster the public's trust in AI and make sure it is applied safely.
- ◊ The U.S. should "promote an international environment" while also ensuring that it protects its technological advantage.[26]

This report is "well-intentioned but low in specifics."[27] It does not have a direct course of action to accomplish its goals, but it does establish the National Science and Technology Council (NSTC) Select Committee on Artificial Intelligence to lead this initiative. Additionally, instead of directly allocating funds to the research and development of AI, the executive order calls federal agencies to reallocate their budgets to prioritize AI, and thus fails to allocate large resources to this effort as China currently is.[28]

Recommendation 1: Allocate Money Directly in the Federal Budget for AI Research and Development.

If the United States wants to remain competitive with China, it needs to show Americans that AI development is truly a priority by allocating a significant budget for its research and development. According to Ian Buck, executive of the chipmaking company Nvidia, "There's simply no replacement for the federal government significantly increasing support for fundamental research to bolster university research. Funding drives research. Research, in turn, drives innovation, from startups to multinationals."[29]

Recommendation 2: Emphasize Computer Science in the K-12 Curriculum

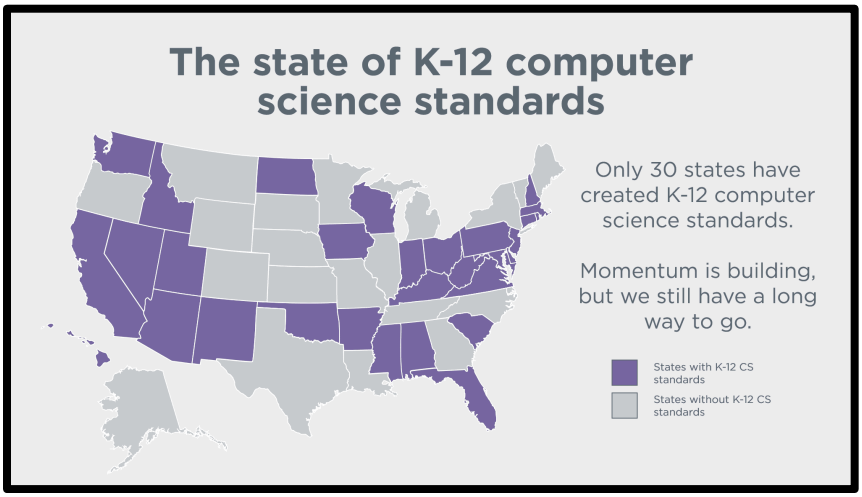

Figure 4 Shows the Status of Computer Science in the United States, Courtesy of Computer Science Week

It is important that we teach young students the skillsets that are needed for AI development as Trump calls for in his executive order. Currently, the K-12 system ill prepares students for jobs requiring technical skills, with only one in four schools teaching computer programming. In 22 states, computer science classes don't count toward math or science high school graduation requirements.[30] As skills such as programming will be especially valuable compared to other trades in the future economy, it is vital that schools start teaching these concepts to students as a core part of the curriculum rather than as an elective course.

Recommendation 3: Attract Talent from Other Nations

Many critics said Trump's executive order fell short in terms of promoting immigration to the United States for leaders in AI development. Many top AI researchers in the United States such as Andrew Ng, Yoav Freund, and Yann LeCun are immigrants. Additionally, many graduate students researching artificial intelligence in the United States are from other nations. Donald Trump's current policies, however, discourage these individuals from immigrating to the United States. Some technical talent is going so far as to leaving the United States for Canada instead.[31] While it is admirable that Donald Trump wants to put American students first, it is also important the United States is attractive to tech talent from all corners of the world in order to remain competitive. The United States should make it easier for people that can

contribute to technical development, especially that of AI, to immigrate to the United States.

Recommendation 4: Make Data Readily Available to Companies

In his executive order, Donald Trump declared the United States government will make large data sets available to companies and researchers. Data is vital to AI development, because it allows researchers and developers to train AI. China is ahead in many respects because it is easier for Chinese tech companies to get access to large amounts of data. While the United approaches privacy and civil rights much differently than China as a democracy, it is also important that we do not let American innovation stagnate. Thus, United States companies should be given access to the government's data sets. However, there must be a way to anonymize this data so American's rights are not violated.

Recommendation 5: Protect American Workers

The fear of automation is oftentimes a barrier to American citizens' trust and enthusiasm for AI. According to the McKinsey Institute, job turnover will increase as AI is further deployed, and people may need to acquire new skills midcareer.[32] The United States government must restructure its unemployment system to accommodate a workforce that will be constantly changing due to artificial intelligence, which includes providing job retraining. While the bureaucratic nature of the United States government many times causes things to move slowly, an exception needs to be made for accommodating those that are unemployed in order to ensure that these people do not remain stagnate for long. Instead of the government providing job retraining, an alternative approach would be to offer tax incentives to companies that retrain their employees. This would benefit the government, the company, and the worker, because the government does not have to create the job retraining infrastructure themselves, companies do not have to rehire, and employees do not have to find new employers[33]

Conclusion

Artificial intelligence is changing the landscape of our world, and the U.S. needs to prepare itself for the rapid change that will be occurring in the near future. It is vital that humans can interact with AI in order to increase productivity and efficiency. Nations such as China have national initiatives solely dedicated to supporting the research and development of AI and are pouring billions of dollars into this initiative. President Donald Trump's recent executive order calls for national support of AI, but it fails to list out any tangible plans to ensure America's competitiveness in AI development. In order to ensure America is a leading innovator in AI, the U.S. needs to

directly allocate funds to AI development, encourage teaching computer science at the K-12 level, attract talent from other nations, and make data readily available for companies to use to develop AI. Additionally, it is important that the United States government provides support for workers that are displaced through AI, by providing job retraining itself or by incentivizing companies to do so. The future is here. The United States needs to ensure we don't let it pass us by.

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