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The New Luddite Scare: The Impact of Artificial Intelligence on Labor, Capital and Business Competition between US and China

ABSTRACT

Objective: The main aim of the article is to send a message to the general public that Artificial Intelligence (AI) is no different than any inventions disruptive for the mode of production discovered before. In the past, Luddites looked with fear at steam-powered industry and mechanized looms; today we look at Artificial Intelligence (AI) with equal anxiety and fear of the unknown.

Methodology: We analyze the world literature on this subject and compare the main economic actors: the USA and China. We also use some historic analogies like discoveries of Thomas Edison and Nicola Tesla.

Findings: AI is a ground-breaking technology which will fundamentally change human relations to the outside world. It will disrupt all known paradigms or production, medicine, shopping and, generally, the exploration of human environment, blurring the barrier between virtual and real.

Value Added: The luddite-type fears are unfounded. AI will enhance the concentration power, polarize societies between winners and losers, capital and labor and enhance the gaps which were on rise with the industrial revolution. We are at the outset of another revolution which will give humans a better command of nature. The negative effects of the revolution should be addressed and resolved in the future.

Recommendations: AI was created by people and can be ultimately governed by the people who set it in motion. Perhaps AI will provide answers how to control ourselves from a runaway deep or general AI. But this is a subject of another paper.

Key words: artificial intelligence, industrial revolution, free trade, labor, employment

JEL codes: F10, F16, J23, J24

Narrow and General Artificial Intelligence

Typically, new technologies are only truly understood by the elite and feared by most people. Artificial Intelligence (AI) is no different than any inventions disruptive for the mode of production discovered before. In the past, Luddites looked with fear at steam-powered industry and mechanized looms; today we look at Artificial Intelligence (AI) with equal anxiety and fear of the unknown.

AI computers are machines capable of making better predictions than any top skilled humans, by a factor of thousands. For example, today's standard computers use digital data fed into their memories and algorithms written by programmers. AI machines will make a quantum leap from there because they are self-programming in real time with data which to humans

seem completely unrelated. AI computer predictions will look like miracles of a super intelligence (Hawking, 2016).

Let us use a simple example. The best radiologist can predict, say, 96 percent of breast cancers, based on seeing thousands of x-rays and MRI scans. Let us now employ the AI machine to help the doctors to save more lives by achieving an earlier detection of the cancer cells. All the knowledge of the best radiologists can be digitized and fed into the algorithm of the AI machine. These data will be collected from dozens of years of education, training and experience of thousands of doctors. The AI will look at the 4 percent of the undetected cases from thousands of radiologists and analyze what they missed, not only by the scans, but from all available information about the patients to find possible correlations. From the practical point of view this is an impossible task for the doctors because their experience and learning are not scalable. Doctors have to sleep, eat and rest. The AI machines are scalable, they have no limitation, the only limitation is the amount of energy they use and the amount of heat they produce. They can use all the electrical power of the hospital, the city and the country to make their prediction job better than the best of humans. One may say, the doctors can learn from the AI machines and reach the same level of predictability. However, the doctors will come to a limit of human possibilities when AI will continue learning to bring predictability level beyond human bench mark. Machines never stop. You may say, the computers do not have human intuition, but intuition is also based on the judgement of the probability of a positive outcome. So even, the intuition of 100 or 1000 best radiologists can be digitized for new AI data. AI will decide where and how to use the data because of the Internet of things or general connectivity. The lives of the patients will be also digitized, so to say.

The concept of AI has been around since the 1960's but the technology to process the vast amount of data was not there. In 1988 programmers adopted the "neural networks model" (Hidden Markov model) to create the world's first independent program speech recognition. Neural networks were matched in 1990's with new computing power, which lets the program

parse examples at high speed. The neural networks were rebranded as "deep learning". The researchers and the CEO have saw the potential of the field to decipher human speech, faces, self-driving cars, predict consumer behavior, identify fraud, and even make lending decisions. The new "deep learning" algorithms could autonomously search for correlations which were "invisible" or irrelevant to human observers to make better decisions than a human could. Deep learning is also known as "narrow AI" – the intelligence that takes data from specific domain and applies it to optimizing specific outcome (Bostrom, 2016). It is very useful in performing narrow optimizations. It is still a far cry from "general AI" or all-purpose technology that can do everything the humans can (Agrawal, Gans, & Goldfarb, 2018).

The significance of general AI in 2019 is not that it has been discovered but that AI entered the stage of implementation which is drawing investors in the search engines, epic amounts of money spent by the Chinese government, talented entrepreneurs, engineers and product managers. To use a historical analogy, the discoveries of Thomas Edison and Nicola Tesla became revolutionary only when people started cooking food, lighting their houses, powering industrial equipment with it. This is the stage AI is now: the age of implementation.

Here are some key facts about AI:

• Prediction skill is the yardstick by which humans measure their own intelligence, so if the AI machines can predict better than the best of us, the AI machines are intelligent,

• The AI machines will always be better prediction machines than humans

• Humans are multifunctional machines, we have 5 senses which feed us with data for 75 or more years, we walk and talk, interact, communicate, learn. The AI machines are scalable, that is, they can be given more sensors and functions on different levels. Basically, it is possible to build humanoid AI machines and they will be more intelligent than humans,

- The AI machines can process millions of terabits of information and the processing speed will only increase. Today, the amount of data produced is so large that no humans will ever to be able to process it to find correlations unless we are aided with self-learning machines (Hawkings, Russel et al., 2014),
- There is no area of life or business that will be insulated or protected against intrusion of AI, we must learn how to cohabit with AI.

These conclusions may be regarded as speculative because we cannot have rigid, quantitative studies of the future, however, they are based on the logic of the past disruptive technologies.

The Impact of narrow AI on Labor

Let us make a mental experiment and assume that all the AI machines are put on the AI island populated by only by the AI robots. The advanced robots will be producing goods for the people living on the continent. The continental people will be producing and consuming as well as they do now. Over a short period of time the AI island would become extremely productive and efficient and the cost of production would be very low. The logic of comparative advantage will lead the continent to trade with AI Island. The AI Island will export cheaper and better goods and services. The continent will be exporting engineers. The living standard and quality of life on the continent will rise. Withdrawing from trade would be a suboptimal choice.

The AI Island will have shown comparative advantage in industries where predictability of outcome, based on massive data, will give it special advantage over the continent. The import competition will first affect highly skilled sector where learning from data is the core business. For example, medicine, drug research, weather forecasting, stock trading, facial recognition, financial services, population control, self-driving cars.

Let us use an analogy. Bank teller jobs have almost disappeared because of the ATM machines, the next will be loan officers who have judgement related

jobs. Ultimately, the loan officer's role will be to sign the contracts without looking at their content. The task of supervision of the malfeasance by the few unethical loan officers giving themselves multi-million high risk loans will be given to AI security subcontractor. The nature of AI Island – human continent trade will be not elimination of the low-cost manufacturing in the continent but ever skilled layers of labor.

Robots work faster than people, AI will make them better programmers, and the managers will be replaced by AI. Only the owners of capital will be left. Elon Musk who was the first one to use AI to streamline the production of Model 3 decided in January of 2019 to lay off 7 percent of the factory workers while increasing car production. Maybe that is why he said that AI represents one of the most serious threats for humans in the years to come.

What do the trade theorems tell us about the impact of AI on labor?

1) The standard Ricardian comparative advantage implies that trade (exchange) between superb AI automorphic Island and less productive continental humans will be beneficial for both. The distribution of benefits from trade will depend on the **terms of trade** or the way the benefits are shared. Since the AI Island does not have people but just machines we can assume that they their utility function of trade is zero and they will work for no reward (without revolting!). So, the continental humans will be the big winners.

2) The more advanced theories of based on the analysis of the factors of productions, such as Heckscher-Olin or Stopler-Samuelson provide more insight into labor losses and benefits. The continental humans will specialize in selecting brain intensive services as improvement of AI or expansion of the AI on different set of services. The reward for such specialized L-intensive goods will rise. The reward (wages) for traditional L-intensive goods will decrease since productivity in the AI – Island will

outpace the productivity of the humans. AI will increase the value added to education because the wage rises of AI developers and labor working alongside AI machines will be exponential (Gerber, 2017).

3) The factor-based trade theories also talk about short-term losses in import-competing industries. Since such losses may come suddenly in many sectors there will be a need for welfare and retraining policy to avoid large throwback from the high end, educated labor.

4) Countries which have open markets to trade with AI and follow rules-based trade will be better off in the long run. Protectionism against AI will be a suboptimal solution and cooperation, trade, exchange between specialized humans and AI is going to be beneficial for people in general.

Here is a very important caveat: as in all free trade cases the dilemma is not whether there will be a positive welfare effect. The problem always comes to Terms of Trade, that is, *the distribution of benefits*: Who benefits from free trade? Is it the corporation which underpays the workers and raises prices, is the profit captured by the exporter or the importer, the owner of capital or the owner of labor (workers), is this the stockholder or the stakeholder? All the above is going to apply to AI, who owns it, who applies it first and who is the stakeholder? This leads us to the next step of the analysis: The impact of AI on capital.

The impact of narrow AI on capital

Capital is factor of production which works in tandem with human labor. The K/L rise over time in physical categories and as cost adjusted for inflation. Over time, humans employ more units of capital per worker and the cost of capital is rising faster than the cost of labor. This has been the basis of the trade theories by Stapler-Samuelson and Heckscher-Olinand confirmed by a monumental study by Thomas Piketty, *Capital in the Twenty First Century* (Piketty, 2014). If the capital or machines share continues to increase, then the workers' income will fall, while the return to owners of AI will rise. The workers,

in all historical studies were relatively worse off and the owners of capital better off in relative and absolute terms. Moreover, according to Thomas Piketty historic trend analysis, r – return to capital was 2 percent higher than q - the return to labor. This trend is very concerning because it has led to increased inequality. The critical question here is whether AI will reinforce this trend or mitigate it. AI is a new form of exceptionally productive capital, so it is logic to conclude, that the economic growth will take place because of capital owners and elite labor owners. AI is likely to enhance this effect in favor of capital. The owners of capital will be able to accrue more wealth shorter periods of time and capital will be concentrated even more. That is why Bill Gates has proposed to impose the tax on AI in anticipation of capital gains by the few.

Here is the dilemma. Tax on capital will make AI robots more expensive and slow -down its use lowering general rise of wealth of the population. Just like applying tariff on trade between AI Island and the human continent the workers' losses would be twofold: they would lose jobs to offshoring and at home access to cheaper imported consumption.

Let us look closer to the capita K. AI is likely to enhance two diverse trends concentration and dispersion of capital.

Let us use this example. There are large search engines which sell goods or work for the sellers of goods: Google, Facebook, and eBay, Amazon or Uber. AI is already a game changer. Marketing is all about finding a customer, selling larger volume, direct sales and lower prices. If producers, sellers and advertisers are all ethical, do not break the safety standards, the volume of and production, sales and consumption will rise. The AI marketing uses big data to create individual, personalized, customized ads. That is what you find daily on Facebook, Twitter and Google accounts. The ads are targeting narrower and narrower class of customers based on the self-programming algorithm. Beyond the question of annoyance, the ads yield happier cus-tomers and larger volume of sales per dollar spend on ads. The personal ads target 100 thousand, then 20 thousand and end will narrowly select 500 customers with, say 75 percent probability of sales. Today, Facebook and

Google do not make money by the volume of ads but by better-selling ads which are monitored by the buyers of the ads. AI can reverse the trend of ever-increasing marketing cost so, at least in theory, products are cheaper, and the consumers are happier. In a macroeconomic sense capital is allocated more efficiently, ROI is higher, interests are lower. The capital is more productive and more dispersed if there are more buyers of the ads.

There are many positive assumptions in the above. First, the markets are not perfect and that is why historical returns to capital are higher than return to labor. Second, capital markets pass information faster and capital is almost perfectly mobile, and, third, labor movement globally is separated by borders and cannot sell its skills to the highest bidder. The conclusion is the AI will enhance the return to capital and enhance the negative effect on imperfect labor markets. The return to K will be higher unless people can migrate freely around the world which is not likely to happen. The conclusion from the above is also that the big countries will benefit more than smaller countries because they will have a larger pool of data to create better algorithms. The low labor cost countries have very small chance to be "AI Tigers" like the "Asian Tigers" had in the last 30 years or so. AI is likely to move production close to home, because of labor-lean production. In conclusion, AI will pull out the **low-cost ladder** from small countries to climb to become industrial nations like South Korea or Singapore. The question which we are facing today is how to predict (!) the likely winners in the AI race.

A new Bipolar world: The narrow field for AI winners and losers

The AI analysis brings us to geopolitics and system analysis. The author will narrow this analysis to the most likely finalists in the AI race: the USA and China. What does it take to win the race in the AI implementation race? Which country will become an AI superpower or simply ***the superpower*** because it will have a potential to win in production, trade, cold war and even an unthinkable

hot war (Lee, 2018; Chin, 2019). We will not be able to predict the AI implementation race winner, but we can describe what it takes to win in this race.

AI will create a new kind of bipolarity. Cold War bipolarity was based on the stockpile of Intercontinental Ballistic Missiles carrying multiple nuclear warheads. The USA and Russia were the key players. In practical terms the arms race was contained by impossibility of outcomes called: Mutually Assured Destruction.

In the new bipolar world there will be two different players: the USA and China. The finalist will keep enormous lead over all others. Let us outline the fundamental characteristics of the AI players:

• The players must generate massive amount of data. Only countries which are large, 5G connected, centralized or with dominant search engines will be in the game. The countries which centralize different domains will have more data, better algorithms and faster AI implementation.

• The players must have large numbers of engineers who are at the top of newest research, enjoy scientific environment, institutional support, receive government or corporate funding. The advancements in AI are not inspired by the Newtonian apples falling from the trees but are incremental due to massive resources and creative, well-funded AI ecosystem.

• The AI implementation players must be able to mature from "business incubators" and "startup" culture on a mission to make the world a better place to extremely competitive, lean, ruthless, hungry for-profit business environment. There is much more economy of scale in AI than it has ever been during industrial revolution or mass manufacturing age.

• The bad news is that countries can score better in AI development if the players circumvent law, discard the norms of the business culture, and where the government's protection of the privacy rules of their citizens are weak. This statement needs further explanation. In the post WWII rules-based international system the trading nations were expected to respect intellectual property rights, be punished for stealing the lines of the code, create the copycats of the search engines and copycats' sales sites. In

democratic countries the law guarantees the privacy of data. The scale of reverse engineering and violation of the security of the data will be higher in the AI implementation stage because the rewards will be higher. Moreover, there will be less consumer push back because the stolen lines of code are easier to hide then a knockoff Prada. In simple terms, the AI players will get unfair advantage from being villains (Tegmark, 2017).

At this point we can compare the two players: the USA and China. We will present them in three comparative areas: *data collection, computing power and the business environment.*

Table 1. Comparison between USA and China

THE DATA COLLECTION (USA 2018)	THE DATA COLLECTION (CHINA 2018)
4/7 of the largest corporate data collectors in the world. The data is collected by separate corporate ecosystems: Amazon, Facebook, eBay, Uber.	3/7 of the largest data collectors in the world. The corporate giants serve as a utility and provide the data to the government: Baidu, Alibaba and Tencent (BAT).
The US Internet giants have most of the data for the first two out of four stages needed in the future implementations of AI: • Internet AI data, • Business AI data, • Perception AI data, • Autonomous AI data.	The "online-to-offline" services picked up faster than in the US and produce more data. (food delivery, ride hailing, haircut etc.,) The US government banned Huawei from providing 5G infrastructure access to the US market. Legal access the US data ecosystem will be limited. The EU and Australia are likely to follow the US lead in cutting off from Huawei infrastructure dominance.
Internal data are based on the click of the consumer and have strong correlations.	Largest connectivity pool in the world. China has more phone Internet users than the US and Europe combined.
Business data relate the clicks to the sales data which are very well reported in the US due to complex accounting, tax system and the third-party consulting business	On WeChat, the community forum, the AI community coalesced in a giant group chats and multimedia platforms, which share AI implementation. The US AI implementation is contained to competing firms.

The perception data is, for example, facial recognition, Internet of things data, and breaking of the barrier between virtual and real.	There are no restrictions in the data collections in China which may give them an advantage in the more advanced use of AI in the perception data and autonomous data.
Autonomous data are generated by machines interacting with real world and making decision outside human intervention. The use and realty data are limited by the moral and ethical issues of the choices which must be made by the computer during the imminent accidents and the liability of the humans versus machines.	
THE COMPUTING POWER, ALGORITHMS (USA 2018)	THE COMPUTING POWER, ALGORITHMS (CHINA 2018)
Computing power: the US relies on Intel and Qualcomm semiconductors which currently are the best in the world. The four American AI leaders have become airtight and secretive in publishing true AI advances.	Computing power: the Chinese government has funded production of semiconductors at NVidia with 20 times more processing power by 2020 than US best. China has new semiconductors producers: Horizon Robotics, Bitman, and Cambricorn Technologies (Knight, 2017a, b).
The US government will step actions to eliminate Chinese access to the US data. The restriction on the Huawei infrastructure marks the beginning of the technology protectionism in the USA.	The US government will step actions to eliminate Chinese access to the US data. The restriction on the Huawei infrastructure marks the beginning of the technology protectionism in the USA.
The US government will step actions to eliminate Chinese access to the US data. The restriction on the Huawei infrastructure marks the beginning of the technology protectionism in the USA.	Funding: billions of dollars are available under "Made in China 2025" program. The Communist Party has "techno-utilitarian" and "venture socialism" attitude to AI. The aim is more important than low profitability or potential missteps in funding. No restriction in the use of the facial recognition or job losses in self-driving transportation.
AI engineers: The US dominates in the quality. The US has produced most of the top inventors and research in AI. The US hosts and hosts the Association for Advancement of AI Conferences.	AI engineers: China dominates in the quantity. Microsoft Research China, an institution founded in 1998, trained until 2017 five thousand AI researchers, including the top executives at Baidu, Alibaba, Tencent, Lenovo, and Huawei. Tsinghua University has more citation in AI then Stanford University.

On the academic side there is open research model. The US journals produced majority of the research papers in the world. The US has also DARPA the largest military spending in the world. Funding of the newest military technologies including AI has historically been very effective as a first step toward commercialization. Little data is available on the military funding for AI.	The Chinese researchers who were involved in Google's Deep Mind and created the AlphaGo Zero (the self-taught AI computer) founded also Chinse startup Face++ which turned quickly into a world leader in face and image recognition technology.
	Face++ beats top teams from Google, Microsoft, and Facebook in 2017 face recognition COCO competition in three out of four categories The Chinese government contract for face recognition followed.
THE BUSINESS ENVIRONMENT (USA 2018)	THE BUSINESS ENVIRONMENT (CHINA 2018)
Google, eBay, Facebook, Amazon are four out of seven world leaders in AI which failed to keep their business in China due to copying of the interfaces and stealing of the lines of code, poor understanding of the Internet market and government restrictions in China.	The Chinese AI leaders are BAT: Baidu (search engine), Alibaba (online seller and payment system Alipay), and Tencent (social network + communicator WeChat). All have research centers in the US and are led by the US-trained engineers.
The best AI Silicon Valley startups have missionary attitude and lack external funding. The NSF and the politicians are reluctant to fund small businesses after the Solantra failure and are concerned about the privacy issues in development of the facial recognition technology.	In 2015 Chinese government opened 6,600 AI incubators and startups. Many of them are defunct, some which deliver product get large funding from the government.
	The Chinese local governors compete to get the high-profile AI project to get advancement in the Party ranks.

Sources: *Wall Street Journal, The Economist*, and *MIT Technology Review* 2017–2018.

The scoring in each of the above 3 categories presented here: data collection, the quality of the algorithm and the research and business environment may be a matter of the weights and the probabilities which one could apply. We leave this judgement the reader.

However, we would like to quote the scoring in the balance of capabilities between USA and China presented by one of the leading experts

in AI, Mr. Kai – Fu Lee who decided to quit his job as a Google of China President to start Sinovation in 2009. His company promotes investments in Chinese AI businesses which perhaps explained his scoring to show China's advantage (Lee, 2018).

Table 2. The balance of capabilities between the US and China across the four waves of AI

Today (2018)	Capabilities	In five years
China/ US = 5 : 5	Internet AI	China/ US = 6 : 4
China/ US = 1 : 9	Business AI	China/ US = 3 : 7
China/ US = 6 : 4	Perception AI	China/ US = 8 : 2
China/ US = 1 : 9	Autonomous AI	China/ US = 5 : 5

Source: Lee, 2018, p. 136.

AI is a ground-breaking technology which will fundamentally change human relations to the outside world. It will disrupt all known paradigms or production, medicine, shopping and, generally, the exploration of human environment, blurring the barrier between virtual and real. It still in its entering into maturing stage and it will not stop there. In the next two stages: perception and autonomous there is a chance that humans may feel out of control and under the command of the machines. But, this is all driven by the fear of the unknown. AI was created by people and can be ultimately governed by the people who set it in motion. The luddite-type fears are unfounded. AI will enhance the concentration power, polarize societies between winners and losers, capital and labor and enhance the gaps which were on rise with the industrial revolution. We are at the outset of another revolution which will give humans a better command of nature. The negative effects of the revolution should be addressed and resolved in the future. Perhaps AI will provide answers how to control ourselves from a runaway deep or general AI. But this is a subject of another paper.

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