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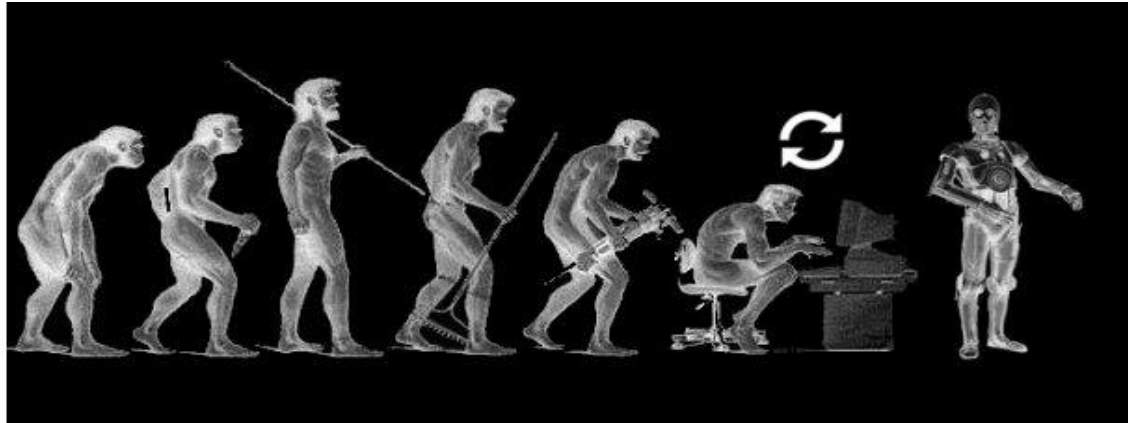
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Artificial Intelligence: Boon or Bane?

Amit Tyagi (Leibniz Universität Hannover)



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ABSTRACT

Artificial Intelligence (AI) is transforming the nature of almost everything which is connected to human life e.g. employment, economy, communication, warfare, privacy, security, ethics, healthcare etc. However, we are yet to see its evolution in long-term, whether it's leading humanity towards making this planet a better place to live or a place which is full of disaster. Every technology has its advantages and disadvantages but advantages always outweigh disadvantages for the technology to survive in the market. Nonetheless, for Artificial Intelligence we are not yet sure whether in the long-term positive effects will always keep outweighing the negative effects and if that is not the case then we are in serious trouble. If we look around us, on the one hand, we seem to embrace the change being brought by technology, be it smart home, smart healthcare, Industry 4.0 or autonomous cars. On the other hand, we often found ourselves protesting against the government in the context of unemployment, taxes, privacy etc. As AI development is speeding up, more robots or autonomous systems are being born and replacing the human labor. This is the current situation; however, in long-term, results seem to get more interesting. Throughout this essay, I will cover the major domains where human life is significantly affected by AI in both positive and negative ways.

Keywords: Artificial Intelligence, Law, Privacy, Employment, Singularity, etc.

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1. INTRODUCTION

It is important to first understand what Artificial Intelligence (AI) actually is. According to the definition of AI in Oxford dictionary [1], Artificial Intelligence is intelligence exhibited by machines. In computer science, an ideal "intelligent" machine is a flexible rational agent that perceives its environment and takes actions that maximize its chance of success at some goal. Thus, when a machine mimics a human-like behaviour e.g. learning, planning, reasoning, problem-solving, the perception of the environment, natural language processing etc., then it falls under the category of Artificial Intelligence.

Eric Schmidt, the executive chairman of Alphabet, the parent company of Google, says that AI could be leveraged in order to solve major challenges, including climate change, disease diagnosis, drug discovery, microeconomics, theorem proving and protein folding. However, Schmidt provides no details on how AI should be adapted to solve such complex and abstract problems [2]. Demis Hassabis, CEO of Deepmind -- an AI company recently acquired by Google and now AI division of Google -- said that the aim of DeepMind project is to leverage the power of AI as by solving intelligence in a general enough way, we can apply it to all sorts of things to make the world a better place to live [3]. Mike Schroepfer, chief technology officer of Facebook, expresses similar hopes that the power of AI technology can solve problems that scale to the whole planet [3].

Despite the fact that we are counting on Artificial Intelligence as the next tool to revolutionize the way we live, work and interact with each other -- which will be mostly enabled by machine-learning techniques -- it remains unclear as to how these intelligent agents will help to solve more complex problems than the ones existing today (e.g. Poverty, Epidemics, climate changes) while keeping in mind that the state of the art in AI today is to intelligently recognize images and smartly playing games. Nevertheless, if it does improve, then it will be no less than a superhuman intelligence and the question arising is that if we do not have a legal framework to prevent malicious use of this intelligence, then it might put the entire humanity on the verge of devastation too.

If we also look at the present situation and who is involved in riding the waves of progress in Artificial Intelligence, then one can easily find big enterprises like Google, Facebook, Microsoft, and IBM are the ones who are big players in the field. The progress in AI is also bringing steady consequences e.g. eradicating jobs by the means of work automation, one such scenario can be seen in the Industry 4.0 framework, which is nowadays in use in the automobile industry. Industry 4.0 creates what has been called a 'smart factory' wherein large number of robots take forward the whole manufacturing process with the help of cyber-physical systems, IoT and cloud computing. [4].

However, if in the near future, machines achieve superhuman intelligence (which Vernor Vinge, author of 'The Coming Technological Singularity', called as 'Technological Singularity'), then many ethical questions arise. For example: Who will own the robots (AI)? What will be the legal and moral liability in self-deriving

cars? Why would robots always make ethical decisions? Is humanity under threat from super-intelligent machines? Would that be the start of a post-human era?

1.1 General issues:

There are many issues which are related to the emergence of Artificial Intelligence. In this essay, I will focus on those I consider significant enough to be discussed. A very important issue nowadays is unemployment. However, in developing countries, it is more severe as compared to developed countries. Nonetheless, as the new technologies and especially Artificial Intelligence are emerging out by leaps and bound and contributing in the automation of processes at industrial and corporate levels, some argue that the state of employment is at risk, however, others argue that it will bring innovation in products and services and hence new possibilities of employment. Another important issue is related to morality, wherein the concern is related to the ethics of intelligent machines which bring up the issue of safety. A lot of major enterprises (like Google, Facebook, Amazon, IBM, Baidu etc.) are in the race of developing intelligent machines but how can it be ensured that they will not be used for warfare purposes. Another issue is related to the competence of the machines. Up to what extent one can count on the intelligence of these machines when it really comes to safety and security? The recent accident of Tesla's autonomous car is the perfect example which suits this position [5]. There was a very good scenario presented in the science-fiction movie called iRobot when a robot saves a police detective from a car crash while leaving a girl to die as according to machine intelligence her survival was statistically less likely than that of the police detective:

Another more severe issue is related to the technological singularity which can be seen as the point in time when machines will achieve Human-Level Machine Intelligence (HLMI). Nick Bostrom said at TED that "machine intelligence is the last invention that humanity will ever need to make"[6]. Consequently, it is really important now to think intensively about the kind of world we are building right now. We have to make sure that at the technological singularity, these smart machines will safeguard humanity and preserve its values and not develop their own values.

Many technological evangelists, inter alia Elon Musk, Stephen Hawking, and others are warning of AI, even though the actual threats they see vary. This essay will do justice to the main issues arising and analyse to which extent they are realistic and how they are taken care of throughout the development process.

1.2 Hypothesis:

Keeping all these issues in mind, the development of AI is debatable in my opinion. If we are going to continue developing AI, then we have to make sure to eradicate all the issue we have now in our mind. All these issues can be tackled if we make a global framework of rule and regulations which has to be followed while developing AI in order to make sure that it proves to be a boon for humanity rather than a bane.

The hypothesis of this essay is, therefore: **"If we keep ignoring the social bugs of Artificial Intelligence (AI), it could be a serious threat to humanity"**.

1.3 Methodology:

In order to test my hypothesis, I will use the analysis methodology wherein a special focus will be put on interdisciplinary analysis methods, combining economical prognostics, the historical development of technologies, and systematic description of the various threat scenarios.

1.4 Applicability of Results:

Issue related to the application are mainly concerning the development of a framework which helps us to eliminate the problems which are connected to the rapid development of AI. However, some of the domains where the results can serve might include the following:

- AI research framework: Creating a system of research and development which can help us fight with existential risk from Artificial General Intelligence (AGI). One such system which is recently established by Tesla CEO Elon Musk is known as OpenAI.
- Economical and Governmental agents: Understanding the process of AI development while it is still adjustable, becoming aware of issues arising and actively taking part in designing the future with policies and informed future planning.
- Legal Aspects: Creating a legal framework in order to avoid all the consequences and make sure no harm is done to society and in turn to humanity. Such a legal framework is becoming a need as AI development is rapidly moving on its way.

2. VERIFICATION

In the recent years, there have been several advancements in the development of AI. For many years it was used for various internet based activities e.g. advertisement, web searches etc. Now it is gaining more commercial fame than ever before. The current state of the art in AI research makes it more competent in some domains than humans, however, it is part of narrow artificial Intelligence (also called Weak AI) which is more focused on a narrow domain of problems e.g. iPhone Siri. In 2015, several milestones achieved in the research and development of AI gave rise to Artificial General Intelligence (also known as Strong AI) and this kind of AI can be applied all kind of problems. In cognitive science, intelligence is defined in many ways which include one's capacity for reasoning, logic, understanding, planning, problem solving, self-awareness, and emotional knowledge etc. A Human-level intelligent machine should have an ability to pass several tests; one of such tests is the Turing

test. However, there is no perfect test which can prove a machine perfectly human-level intelligent.

2.1 Current state of AI:

If we look at the current state of AI, the pace of evolution of artificial intelligence is speeding up. NIPS (Neural Information Processing Network) conference is one of the most famous conferences in the field of Machine Learning & computational neuroscience. It is the same conference wherein 2013, Facebook CEO, Mark Zuckerberg announced to form an AI laboratory and a start-up called DeepMind boastfully displayed an AI which can easily learn to play computer-based games. Afterwards, DeepMind was acquired by Google. However, Artificial Intelligence is not new, it was first coined by the American scientist John McCarthy in 1955, who is also considered co-founder of the field Artificial Intelligence [7]. The term 'Robot' was first coined by Karel Čapek in his play R.U.R (Rossum's Universal Robots) in 1921 [1]. So research in the field of AI has been done since decades, but the conditions were not appropriate for AI to flourish. Nowadays, we have cloud computing to store torrents of data remotely & inexpensive neural network technology which is crucial in learning, which was very expensive back then. Given the fact conditions for AI nowadays are right, largest companies in tech-industry e.g. Google, Facebook, Microsoft and IBM have dived into AI research, where they see a huge potential. Below are some of the images which empirically show the growth in AI domain in recent years:

Computers Stop Squinting and Open Their Eyes

Error rates on a popular image recognition challenge have fallen dramatically since the advent of deep learning systems in the 2012 competition.

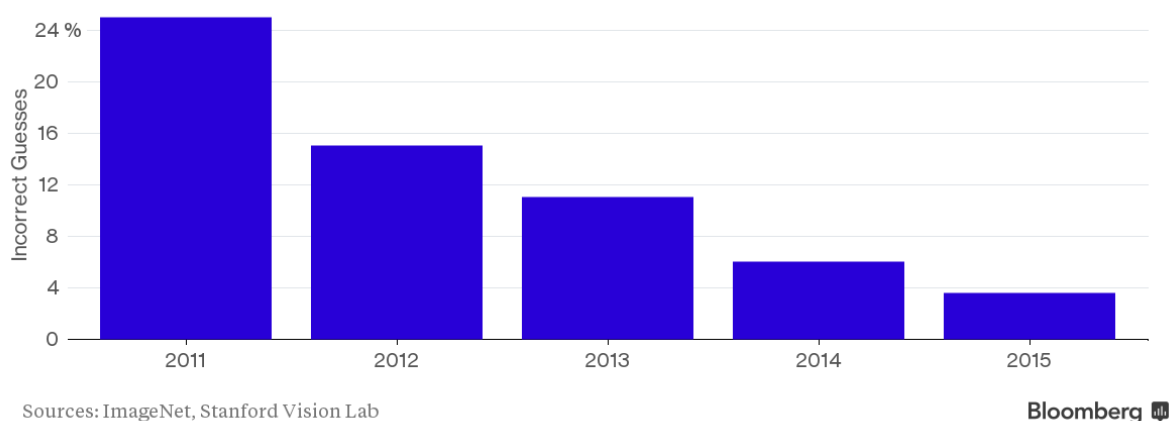


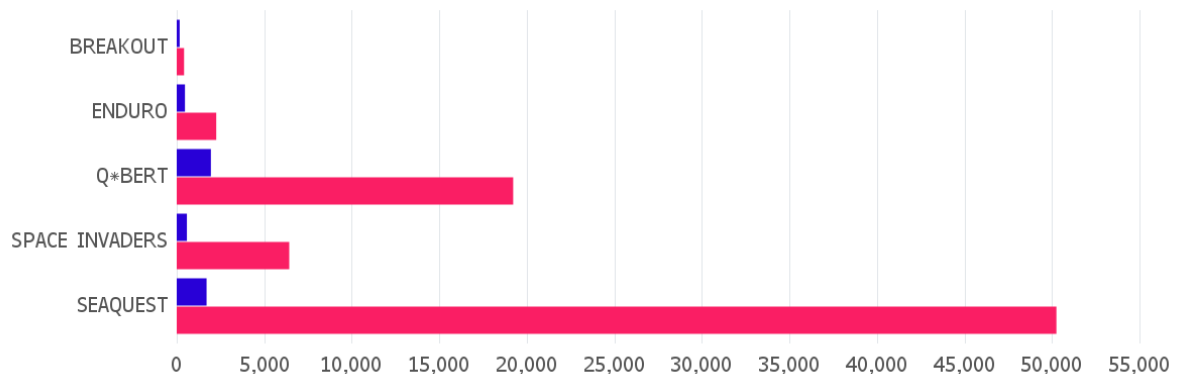
Fig. 1: Error rate fall over recent years (Clark, 2015)

Since Google's acquisition of DeepMind, they are working intensively on making its AI better at playing old Atari games. Below is the bar chart which shows the growth in accuracy of their AI:

Play It Again, HAL

Google researchers have spent the past two years working out how to help their AI systems master old Atari games, and their systems have got much, much better.

■ December 2013 ■ November 2015



Sources:
<http://arxiv.org/pdf/1312.5602v1.pdf> (2013), <http://arxiv.org/pdf/1511.06581v1.pdf> (2015)

Bloomberg

Fig. 2: Accuracy in Google's AI at playing old Atari games (Clark, 2015)

2.1.1 Techniques (Deep Learning) & Companies (IBM, Google, Facebook, Microsoft, OpenAI):

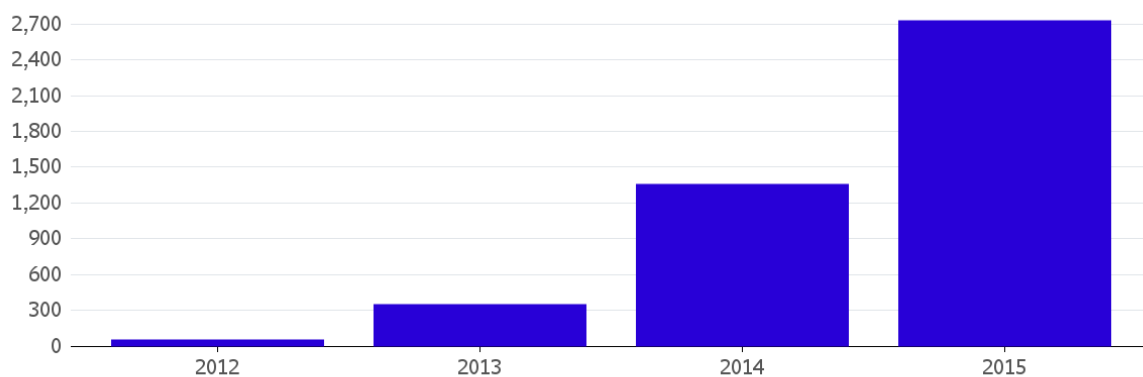
Deep Learning is one of the most growing research areas in the domain of Artificial Intelligence. It facilitates to build and train neural networks. Neural networks provide the foundation for learning and decision making in AI systems. Hence, deep learning lays down the framework for the Strong AI also known as Artificial General Intelligence. In order to create human-level machines intelligence, it is important to achieve advancements in Strong AI because well-structured problems e.g. chess, are solvable by AI, while ill-structured problems e.g. real world, are still relatively difficult for AI like the Winograd Schema Challenge (an alternative to the Turing test based on contextual language understanding and common-sense knowledge etc.) [8].

After putting a lot of effort to develop narrow AI based intelligence, now tech-industry giants are going towards Strong AI, which is the generalization of narrow AI. Unlike Narrow AI, Strong AI is focused on a problem domain which can consist of any problem in the real world. Deep learning is the basis for Strong AI and tech giants like Google, Facebook, Microsoft, and IBM are investing in the research and development of Deep Learning. Each of these giant companies has their own laboratories, where they carry out the state of art research in AI and publish it every year for the academic community. In 2015, Google published their

AI system (in a scientific journal called Nature) that learns and plays video games on its own without directions. Facebook built an image recognition system which can recognize images automatically and can interpret them for blind people. Microsoft boastfully presented a new skype based AI system which can translate from one language to another automatically while IBM indicated AI as one of its highest potential growth areas. IBM is working on its well-known AI system named Watson, who was the winner in the *Jeopardy!* competition in 2011. Companies like Google have even started utilizing Deep Learning in their current running projects to improve their services. Below is the empirical representation of the usage of deep learning into their projects:

Artificial Intelligence Takes Off at Google

Number of software projects within Google that uses a key AI technology, called Deep Learning.



Source: Google

Note: 2015 data does not incorporate data from Q4

Bloomberg 

Fig. 3: Google utilization of deep learning in its project over recent years (Clark, 2015)

IBM developed Watson up to the extent where it defeated the world's best player in the Jeopardy game. Yet, from an intelligence point of view, it is still a narrow problem-solving domain. IBM achieved this state of AI by combining two separate research areas of AI named natural language understanding and statistical analysis of unstructured data. Now IBM is diving into the deep learning research to be added to the commercial version of Watson. IBM made some of the features of Watson available to the developers via its Cloud API (Application Programming Interface). IBM added three new deep learning based features to Watson cloud API which includes translation, text-to-speech, and speech-to-text. Baidu, nicknamed as "China's Google", has also set up its AI lab in Silicon Valley -- and hired one of the most prominent figures in AI, a former employee of Google and an associate professor at Stanford -- to compete with other players in AI research.

However, there is a group of technocrats who is concerned about the future of humanity as AI paced its advancements at a rapid rate. These technocrats and business magnets came together and introduced a new initiative called OpenAI -- a non-profit AI research company. According to OpenAI's official website they believe AI should be an extension of individual human wills

and, in the spirit of liberty, as broadly and evenly distributed as possible [9]. OpenAI recently released a tool named OpenAI Gym which provides a basis to compare different reinforcement learning algorithms which provide machines a mean to learn via positive and negative feedback.

2.1.2 Usage:

As AI research is progressing with a fast pace, a lot of companies are looking forward to utilizing its power to improve their services. The largest U.S. retail company, Walmart, is trying to build robotic shopping carts, while Amazon is developing robots for its fulfilment centres that will serve the delivery between stacker and pickers.

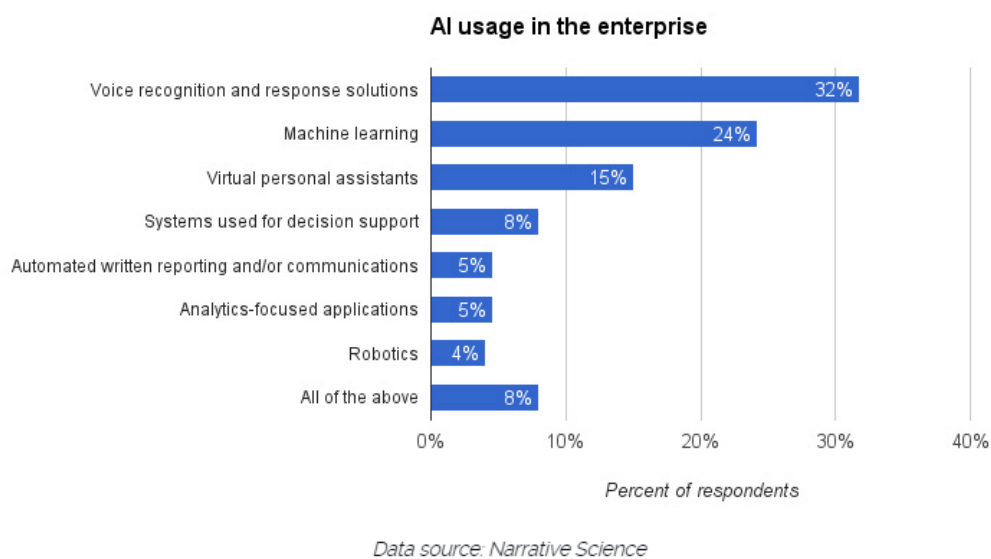


Fig. 4: Usage of AI technology in Enterprise (Clark, 2015)

The automobile industry is investing a vast amount of money to embed AI into cars. In fact, Tesla Motors has already introduced AI into their cars which enable auto-pilot mode and other lane changing features. Toyota is investing billions of dollars to combine Artificial Intelligence with Big Data to facilitate mobility assistance both in & outdoor driving for people who are less confident to drive. It's a big opportunity for the industries who are leaders in AI to build self-driving cars. Hence, the tech giants Google and Apple are investing a huge amount of money to dive into this market.

Google has recently launched an open-source version of its Artificial Intelligence engine named TensorFlow. Tensor came out of 'Google Brain' project which is used to apply various neural network machine learning algorithms to various product and services. Google uses this engine in various product and services. Now researchers outside of Google are using this

engine to test their algorithms. Hence, there is a huge potential in this technology for the usage at various commercial levels.

2.2 Next steps of AI:

The next steps in AI mostly include generalizing the intelligence and create as many use cases as possible, which eventually can be converged into HLMI. OpenAI wants to further advance AI in a way that benefits society as a whole and is freed from the need of generating revenues. As OpenAI has already made its reinforcement learning framework public, it will create possibilities for other companies to create different use cases and contribute to the AI research as an open source project.

Other companies have also started to make use of AI technology into different domains. One such example is Turing Robot, a Chinese company which is behind the HTC's Hidi, a voice assistant. Turing Robot offers Voice recognition and natural language processing for a wide variety of applications including Bosch's car system and Haier's home appliances. Now Turing Robot is focused on developing Turing OS for service bots. Another use case is being developed by Amazon, which is working on developing Alexa in the direction of recognizing emotions. Amazon is making significant advancements in Alexa – which is a virtual helper which sits inside the voice-controlled appliances offered by Amazon. While people get irritated from the repeatedly wrong response from voice assistances like Google Now, Siri, Hidi etc., Amazon focuses on emotion recognition from the voice tone and enable voice assistance to offer an apology for a wrong response. Similarly, a silicon valley based company named Vicarious is developing an entirely a new way of information processing akin to the information flow in human brain which they believe to help machines to become a lot smarter.

Toyota is developing a system which will predict where you are going before you tell it. Toyota has recently announced its new subsidiary named Toyota Connect which will facilitate to collect torrents of data every day and the battle to mine the data already been started. Thus, in the future, your AI will know more about you than you do. A start-up called Brain of Things is developing a smart home which they named 'robot home'. These robot houses keep an eye on each activity of the inhabitants -- whether they are watching a movie, sleeping or doing something else. There are lots of advancements made in different domains all using AI technology while developing it further in parallel to achieve their desired results.

2.3 Problem related to AI:

Artificial Intelligence has impressive capabilities today but they are narrow in nature. However, as researchers are fighting to widen up those capabilities to make it as general as

possible, it seems that AI will eventually reach HLMI which then will facilitate machines the ability to solve any intellectual task which a human can solve. Looking into the future from here makes it difficult to figure out, how much benefit HLMI can bring to society and it is legitimate to ask, how much harm it could bring to society if we build or use it incorrectly. In the near term, automation of services is also going to impact on employment and AI is going to play a major role in making that possible which apparently seems to bring more benefits to big enterprises rather than to society as a whole. Considering for a moment what will happen when, in near term, we have a reliable driverless car system. Thinking about all the drivers -- whether they are Uber drivers, train drivers, plane pilots or ship captains -- how long will those jobs be held by humans? Besides, our dependency on AI based services like using navigation, voice assistance, etc. is also putting our privacy on the verge. There are many such issues which are connected to AI and its development which nowadays are in the debate.

2.3.1 Among AIs:

Once AI reaches human-level intelligence, further development of self-optimizing AIs is unpredictable. The output will then no longer be approvable by humans for errors and conclusions drawn might be beyond human understanding capacities or even beyond human ethics.

The main issues here are problems with the agency, where autonomous machines will need to become a legal entity like companies at one point – independently of the question if a code (algorithm) can be fined in the end. This connects to the possibility of failure and responsibility of such AIs. The second main issue is formed by moral implications, especially since machine learning does not necessary include human teachers anymore and, if not asked to do so, AIs will not necessarily focus on learning what humans count as valuable acts. [6]

Prof. Stephen Hawking -- one of Britain's prominent scientists -- warns that our efforts of creating a thinking machine pose a threat to our very existence. He said that the development of the superhuman intelligence could spell the end of humanity [11].

2.3.2 Between AI & Humans:

Moral Issues:

As soon as AI is able to compete with humans, it will not only lead to a fight for jobs on an economical level but maybe even intrude human relationships in the way that an AI-friend will only focus on its owner's needs, whereas a human relationship flourishes through the exchange of favours (e.g. portrayed in the movie "Her"). Another interesting scenario has been portrayed in the very recent movie called Ex-Machina, where a humanoid robot named Ava who already passed a simple Turing test and eventually shows how she can emotionally manipulate humans. Ultimately, the question arising here is what happens when our computers get better than we are in different areas of life.

Economical Impacts:

A recent bid for the acquisition of a German robotic company Kuka by a Chinese company called Midea Group was \$ 5 billion. Kuka is one of the world's largest robotic companies. China is famous for low-paid migrant labour and Chinese enterprises want to automate the manufacturing process because they do not see any point to rely on such a huge low-paid migrant labour. According to International Federation of Robotics, China is the largest importer of robots [21]. The IFR's calculations show that China has 326 robots per 10000 workers while the US and South Korea have 164 and 478 robots respectively for the same number of workers. Thus, enterprises are seeing a lot of potential in automation of their processes but it will have a negative impact on employment. The Figure below statically explains the impact of technology on employment:

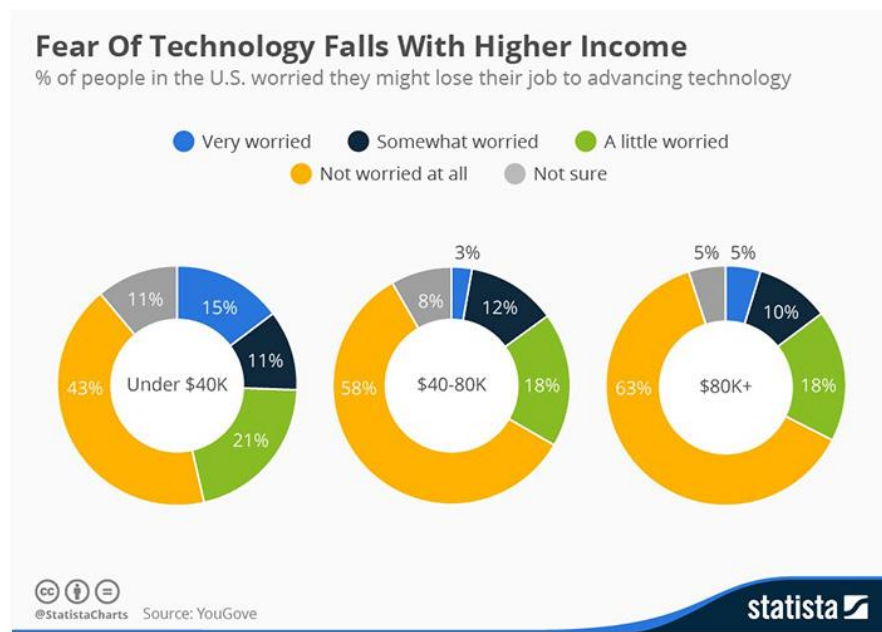


Fig. 5: Percentage of people who are afraid of technical advancements (McCarthy, 2015)

2.3.3 Among Humans:

If not consciously planned, power structures -- especially the widening of the scissor between powerful and powerless -- will impact the political and social freedom both locally and globally. Surveillance, intensification of economic power, etc. are some of the issues raised along with this concern. On the other side, AI is delivering to humans -- what is suitable for them rather than what humans like -- which will intensify their views and most likely lead to boost extremism in all directions.

Political & Social Issues:

AI is helping us on one hand and creating really serious issues on another. Considering the scenario from Baidu and its web search and map services, Baidu has around 700 million users out of which around 300 million use its map services every month. Baidu's research indicates as how the digital footprints can be used to determine the city dynamics. Baidu is mining its data for the city planners to suggest them the right spot to put transportation, shop, and other facilities etc. On the other hand, such kind of mining might also help the government to put a control over society. Baidu's researchers are training their machines to predict crowd problems based on the analysis of user's online map queries. They can predict three hours prior to when and where a huge number of people might gather [12]. While Baidu claims that the data is anonymous, this could be used to also do malicious research. Some examples might include influencing elections based on data which reveals a lot about the behaviour, trend, interest of people, etc. This, in my opinion, is nothing but a serious threat to democracy.

2.4 Policies & Laws:

Beside the general scepticism to new technologies, it is remarkable that drone usage is highly regulated, while big data is not -- while it might actually be a bigger threat to privacy. Is it because the threat can be visualised [13]? Another policy problem arises when errors committed by AI's fall under the range that would not have happened if done by human -- even if the total number of human errors avoided by the AI is still bigger [14]. Yet, this emotional unbalance can even be reversed. If robots look anthropomorphic, people might feel like they deserve rights and some soldiers risked their life to save the team robot [15]. Would AIs claim rights or would humans start the first "AI rights" movement? Considering that animals during medieval ages were moral agents in front of the law to the extent that companies are today [18], it would be possible to see AIs confronted by law. This will bring further issues. There is a question to whether individual learning machines will exchange in a cloud-like manner their knowledge and thus should be collectively law suited or individually [20]. While this might be an issue to deal with in the remote future, coping mechanisms to handle job displacements and unequal capital access caused by the widening imbalance of labour and capital [16] are going to be needed way earlier. The same applies to current bank algorithms using machine learning to evaluate creditability and, consequently, automatically judge on race etc. [19]. While child labour and other issues during the industrial revolution did not get solved by the market, but by politics, it is likely that the same will be needed with current new technologies. Unfortunately, Silicon Valley is way faster than political bodies [17].

Law in EU for Robotics and AI:

The European Parliament committee has set up a working group on legal questions related to the development of Artificial Intelligence. This group will be responsible for drafting civil law rules in connection with research in Artificial Intelligence and Robotics. This group will facilitate the exchange of information and views between experts from academics and

corporate, to the members in order to enable them to conduct a thorough analysis of the challenges which might be brought by the development of AI and Robotics. Inputs from working groups will be put forward to create a foundation for the legislation on the subject. [\[10\]](#)

2.5 Possible Solutions:

Possible solutions for all the problems we discussed throughout this essay might include some of the followings:

- We have to consciously define how we are going to use AI as well as when and where it will be used. At the moment, it is really difficult to predict when we can reach singularity despite the fact that there are several predictions by some AI experts. However, if we reach that point in the future, then it is really important to have a centralized global governing body which lays down the framework for prioritizing the positive outcome over its own interest.
- Initiatives like ‘One hundred years study of Artificial Intelligence’ by Stanford university is necessary to carry out long-term analysis of AI development which will help us to figure out long term harm which AI might bring to society [\[22\]](#).
- Build a system of checks and balances with several AIs, so that they can check on each other and, as a whole, can act as dependency network for decision making. [\[8\]](#)
- As far as the ethics of AI is concerned, we certainly need an ethic charter for the further development of Robotic research and we need to set up operational ethics committees for robotic research advancements.
- Public bodies have to speed up for decision making about the change technology is bringing as of now they are way too slow as to cope with the exponential growth of technological advancements and that could be a possible solution to mitigate the challenges of the impact of AI on employment and economy.

3. CONCLUSION

It seems that we are standing at the point on the timeline where it is really difficult to foresee the future of humanity in the context of Artificial Intelligence. We always embrace new technologies which seemed to be changing our way of living. However, the important fact here is that the kind of change we are embracing must bring a positive outcome for the welfare of society and eventually of humanity. Artificial intelligence is the kind of change which we certainly should not take for granted. It is different than any other technology which humanity has ever developed and the fact which makes it unique is its ability to act autonomously. It is the change which not only starts exhibiting soon its positive impact on society but severely negative impacts, too. So, if we are embracing it as a change which is expected to change the way we live, then we should be happily ready to face the consequences whether it is related to employment, privacy, or eventually the very existence of

humanity. However, whatever the case will eventually be, we certainly need a legal policy framework which can make sure to mitigate the challenges associated with AI and compensate the affected parties in case of a fatal error. Hence, I conclude that if we keep ignoring social bugs of AI, it could be a serious threat to humanity.

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