

"Artificial Intelligence and its Impact on Technology and Society."

by Joel Schindler



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What is artificial intelligence (AI)? ¹

When I asked myself that question at the very beginning it felt like asking how big the universe is without knowing how big an atom is. Firstly, we must ask ourselves, what is intelligence? With this knowledge, we can point out the differences between human intelligence and artificial intelligence with special regard to the development of AI and its main fields in the last few decades.

Human intelligence is a term that has been redefined in numerous ways throughout history. Until today there is no consensus on its definition or a theory that can claim to include the whole truth about intelligence. Most commonly, when we talk about intelligence we refer to abilities such as learning, understanding, solving problems or planning. By this, we mean to describe intelligence as a set of complex cognitive skills performed by our brains. When we want to explain our current situation on the summit of creation, it is intelligence which brought us there through self-awareness and an elaborate language to communicate, traits that differentiate us from other beings on earth.

Some of the mentioned skills can be imitated by AI. Anyhow, scientists face the problem that intelligence is not measurable due to the lack of consensus of its true nature. The resulting outcomes were easily foreseeable, different approaches lead to different forms of AI itself.

One special ability of our brain caught the attention of many scientists and could be crucial to shaping the idea of where the development of AI should go. This ability can be described as predicting future events all the time. It is a core functionality that enables us to do many things we define as “intelligent” behavior. Our brain is e.g. able to notice even the tiniest changes in well-known environments in a fraction of a second.¹ It may take us a while to figure out the actual change that happened, but it

¹ “Die Zukunft der Intelligenz”, Jeff Hawkins (2006), p.108.

is the precise prediction of the what sensory inputs our brain expects that triggers us to notice that something has changed.

With this basic concept of human intelligence, we can start to answer the question of what AI is by looking at what it was. The term was first introduced by John McCarthy as a project name in 1950. The goal was to teach machines to do tasks such as using language, solving problems and improving themselves. Namely, doing tasks that were formerly only done by humans. Back then, Mr. McCarthy was convinced that he should be able to realize a machine that learns from trial and error with the ability to develop a model of its environment in order to solve problems through experiments in that environment. He did not succeed with his ideas at that time, but nowadays we are seeing breakthroughs precisely in this area. In the same year, Alan Turing invented a test, that is the most popular answer to the question “When can we call a machine intelligent?”. He stated that every computer works fundamentally equivalently. Thus, he proposed a test in which a machine can be considered intelligent if it is able to convince a human that he or she is communicating to another human and not to a machine. In the following years, AI projects were successfully implemented that could learn game strategies, solve algebraic problems, provide logical theorems and speak English. One aftermath of these projects was the introduction of the terms weak AI and strong AI. They address the distinction between a machine having a mind, strong AI, and a machine simulating having a mind, weak AI.

Until today, this questions remains a philosophical one without an existing definite answer whether it is possible to create a real mind and prove it. The development slowed down twice in History around the end of the 1970ies and 1980ies because scientists and politics set the sights too high for the current state of technology which caused a loss of faith in AI. In 1996, IBM won the first chess game against the world chess champion Kasparov with its computer named “Deep Blue”. Until today, the AI sector is steadily growing and of increasing importance in many innovative fields of technology. Large-scale implementation of AI can be found in personal assistants in smartphones, language translation or automated decision making (ADM) systems such as algorithmic trading.

Therefore, AI is the search for computer intelligence. It is an interdisciplinary field of research with great emphasis on computer science. Areas of research include language processing, reasoning, image perception and analysis, robotics and machine learning. Currently, these areas are not connected and many projects try to tackle specific sub-problems.

Along with its historical development, two different technical approaches to AI were formed. One is known as “symbolic AI” and the other makes use of “neural networks” including “machine learning”. Without going into depth about how they work, one can say that the goal of symbolic AI is to create general, human-like intelligence in a machine whereas neural networks aim to solve specific problems. Anyhow, none of the existing systems think or understand like a human does. Most recently, an idea is emerging to combine both approaches to obtain the strengths from both. An example of such an implementation is AlphaGo. It is a machine that was developed to compete against a human in the famous Asian board game “Go” and beat the world champion Lee Sedol in 2016.

Applications

AI is reaching a certain level of utility in certain tasks that the fields of application are growing at a very fast pace. That is why I would like to introduce each field of application by looking at possible future scenarios.

Healthcare

From my point of view, machines could be able to do all the main tasks a doctor does nowadays, at some point in the future. Diagnosing all kinds of diseases and prescribing adequate treatments could just be the beginning. On the one hand, AI could be used to figure out new treatments and help understand the human body

entirely. On the other hand, we may face a drastic decrease of people needed in the healthcare sector simultaneously making us dependant from the machines.

Currently, AI can just assist doctors in different ways. One of them is to process huge amounts of data and drawing conclusions from it.

I would like to take a closer look at a project from the Stanford University.

A team formed by several scientists from different departments trained a so-called “deep convolutional neural network” to diagnose skin cancer. The neural network was trained with 129,450 clinical images of skin cancer and the corresponding 2,032 different disease labels. The training process itself may sound easy to understand but the neural network itself is a highly complex structure that has gone through numerous development stages at Google before it was fine-tuned on the mentioned data set. The neural network did not surpass the performance of dermatologists but it performed equally good. This Stanford project highlights the need for highly reliable medical data to train such machines and the amount of work needed to complete such a project. Nevertheless, a future without human doctors at all and machines doing research on future treatments are still out of reach in a foreseeable future. Beside the mentioned benefits, I am convinced that such technologies lie in the sphere of interest of powerful pharmaceutical companies. Naturally, they are heavily influenced by economic interests that sometimes do not coincide with e.g. the “cheapest” and “least harmful” treatment. We already face such problems without the influence of AI but nowadays we can still search for another doctor that offers different advice. As soon as AI is powerful enough, we could face a monopoly which leaves us no choice but accepting what the AI system offers us.

Automotive

I can imagine a future where driving schools are a thing of the past and self-driving vehicles are the only ones that are allowed for transport. Humans would be considered a threat to others and to themselves when driving. The total number of cars could be way lower than today because car-sharing becomes the only way for an average person to travel without having to buy the expensive vehicle all by himself/herself. Companies that develop such cars have the responsibility for their

algorithms to make the right ethical decisions. I could imagine two possibilities, one of them being that the state employs professionals that supervise the ethics of ADM or secondly companies being so powerful that they can themselves incorporate their ethics with no one to supervise them. One core problem with automated decision making is the fact that it can be altered to act differently for different clients. The standard car could be the ethically trustworthy vehicle that, if there is no other possibility, would rather risk the life of the passenger than crashing into a group of twenty people. The model for the wealthy clients could be altered in a way to prioritize the life of the passenger at any cost thus, ignoring ethical principles.

Several companies like BMW, Google and Tesla are developing self-driving cars. Unlike with other projects, technical details concerning the software are not available to the public. Google's self-driving car company is called Waymo and their cars are equipped with a laser scanner and a variety of sensors in order to generate a 3-Dimensional image of its surroundings. This image is processed with a trained neural network in order to create different data models and navigate the car itself. Waymo announced a cooperation with Jaguar to equip 20.000 cars with the self-driving technology in the next few years.

Military

This field of application is reasonably the most controversial one.

The term "proxy war" could get a whole new signification than it had in the second world war. Autonomous AI could eventually turn out to be the proxy fighting for the countries interest without the need to sacrifice human lives. The autonomy of systems that are currently being developed is increasing and leaves us to the question whether an algorithm can or even should ever correctly evaluate complex situations in which humans are killed. AI is the key technology for such products to obtain complete autonomy in their decision making.

Today, we are talking about systems like "Phalanx" from the US-Army or "Iron Dome" from Israel which are systems that detect missiles, calculate their flight route and

shoot them. Other systems that raised the attention of the public are autonomous ² drones such as the European “nEUROn” or the US “Northrop Grumman X-47B”. These drones can find targets by themselves and land on an aircraft carriers. None of the mentioned systems are yet fully autonomous but the development is clearly going in that direction.

Every once in a while, significant projects by companies are made e.g. participating in a DARPA contest. DARPA stands for “defense advanced research projects agency” and is a US governmental organization with the aim of investing in breakthrough technologies that could serve military purposes.² I am of the opinion that this is an alarming observation because it conveys the impression that AI is somehow a supplier of ideas for the military. This phenomenon has already been addressed in the International Joint Conference on AI in 2017.³ Many scientists have no intention of their ideas being misused which is why there was an appeal after the conference to prevent an arms race with AI-powered systems and protect civilians.

Impact on society

Many scientists and experts agree that AI has the potential to do a great variety of jobs that humans are currently doing. In the past, innovation always generated higher productivity, fewer old jobs but many new jobs. Our current state of the job market demonstrates an obvious development: innovation creates fewer new jobs. This can best be seen in an example: Back in 1979, general motors employed more than 800.000 people and made about 8 billion US Dollar.⁴ In 2012, Google employed around 58.000 people and made about 14 billion US Dollar.⁵ AI has the potential to maximize that effect by an even larger scale. Current systems that make use of neural networks have one particular thing in common, and that is that they need a lot

² “Künstliche Intelligenz”, Manuela Lenzen (2018) ,p.211.

³ “Künstliche Intelligenz”, Manuela Lenzen (2018) ,p.221

⁴ “GM: History of an Automaker”, CNBC (2010)

⁵ “Number of Google employees”, statista (2018)

of data to train them. This could explain their rise at the mere moment where data is among the most gathered resources.

In the following, I would like to take a look at another use case for our data. It is being used on a large scale to train automated decision making (ADM) systems that design our online experience with personalized ads, our news feed on social media platforms and personalized prizes. The effects that these ADM systems have on society in the grand scheme is difficult to depict. Possible effects could be that by e.g. filtering the information on our social media feeds can lead to a more narrow intellectual scope. This could develop into a loop and reinforce itself until people split more and more apart concerning their interests. A society in which the interests of its inhabitants drift apart undermines its solidarity and could cause significant harm.

In addition, there is another downside to ADM in AI systems that are trained with data gathered in our societies. AI incorporates all the problems we face concerning racism, prejudice and much more. The moment we reach the point of development in which AI is involved in important decision making such as judging in a court, predictive policing or credit rating. It is of utmost importance to be able to guarantee that the given AI system is not biased in any form. Therefore, we must be able to understand the paths of reasoning the AI system took in order to give such guarantees. Otherwise, we will perpetuate the problems we face in our society and possibly lose the ability to fix them.

Alongside these potential harms, we have to take a critical view at the process that takes place when we act as a source for data. We are giving up an increasing part of our privacy. There are many authors of science-fiction dystopias where humankind has no right to privacy. One of the most recent ones I have read is "The Circle" by Dave Eggers. The story boils down to a scenario where privacy is considered theft and should not belong to a single being. In our current society, privacy is a human right and the shocking revelations linked to Edward Snowden remind us of the importance of our privacy. One key argument for privacy will always be that humans change their behavior when they are being watched and scenarios where privacy

vanishes always result in societies that breed conformity, obedience and submission.

⁶ If AI seeks to stay as data intensive and companies or governments invest in even more aggressive data gathering, it can be a threat to society in the future. The awareness of these threats has already arrived at the political level. In 2016, the EU passed a law called the General Data Protection Regulation that aims to provide more control to individuals over their personal data.

Conclusion

Innovation in AI is being bred in companies that will cause a big loss of jobs around the world without generating new ones. It appears that whoever is in control of the most powerful AI systems can eventually be in control of humankind to some degree. For me, it seems evident that this could at some point trigger a war between the most powerful countries on earth. The cold war demonstrated to what end countries and governments are willing to go in order to secure superiority over others. We don't even have to think so far in order to acknowledge that "appeals" from some conferences are not enough effort to truly intervene a potentially dangerous development. Instead, laws like the General Data Protection Regulation are a perfect example of a possibility to shape our future with regard to all the changes that are about to come. Selfless actions like the one Edward Snowden did, should inspire us to take action, shape our future and show civil courage.

The chance to shape our future should be taken seriously due to the potential that AI is equipped with. That being said, I want to call upon the benefits and good ways we can start to guide our societies. If AI systems take over jobs, that could be a starting point for social security systems to introduce a basic income guarantee. Such a basic income would give many people the possibility to seek to do things they are actually passionate about. Humanity could try to focus much more intensively on some of the biggest problems we face. Solving environmental problems, tackling poverty, eliminating corruption and providing education to everyone are just some

⁶ "Why privacy matters", Glenn Greenwald (2014)

examples out of the seemingly never-ending list of problems. The urgency to tackle these problems does not in- or decrease due to AI, but the possibilities that could await us are worth every minute we invest to shape our future.

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