UNIVERSITY OF LJUBLJANA
FACULTY OF ECONOMICS

MASTER'S THESIS

# THE ROLE OF ARTIFICIAL INTELLIGENCE IN TRANSFORMING BUSINESSES ACROSS INDUSTRIES

Ljubljana, September 2018 NIKA OJSTERŠEK

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# INTRODUCTION

The term artificial intelligence makes most people immediately think of robots so smart they could threaten our way of living. However, artificial intelligence is so much more than intelligent machines outperforming humans and disrupting industries over the world. Even a decade ago we could not imagine that machines could help doctors during surgery, build products in factories, and help teachers in classrooms. Today, artificial intelligence enables systems that understand and react to the world in ways that people could never have imagined nor done.

Beginnings of artificial intelligence date to 1950s when Dartmouth assistant professor John McCarthy said that artificial intelligence is about creating intelligent machines, in particular intelligent computer software. At that time, the dream was to construct complex machines and create hardware or software that has almost the same characteristics as human intelligence. Unfortunately, the reality did not live up to the expectations set by science fiction (Nilsson, 2010). Indeed, it was not until recently that artificial intelligence has emerged as one of the prominent business topics, sometimes even referred to as the fourth industry revolution. Today, there are already numerous applications that use artificial intelligence and people use on a daily basis, for example Google search engine, virtual personal assistants such as Alexa or Siri, Amazon and Netflix recommendation system, Gmail spam filtering, Facebook photo tagging, and so on. Artificial intelligence can be found in video games, cars, and even in "regular" items, such as vacuum cleaners or refrigerators. In the past few years, more and more different industries have been transformed by artificial intelligence.

The sudden evolution of artificial intelligence can be explained by three core technological developments. First, according to Hootsuite report Digital (2018), around 53% of the world population has an internet connection and more than half of the world now uses smartphones. The millennial generation is the one who has grown up with social media and digital world, and they are the most in favor of incorporating artificial intelligence into their future work lives. Second, both the data storage and the data processing capacities have grown tremendously in recent years, which in turn enables analyzing large datasets, and consequently saving both time and money on a vast amount of daily decision-making procedures. Third, the need for automation grows and companies are seeking ways to improve it (Janssen & Wichrowski, 2012).

The goal of artificial intelligence is to build systems that can effectively collaborate with people (Stanford Study on Artificial Intelligence, 2016). Numerous technologies, referred to as research areas, have been developed in order to reach that goal, such as machine learning, deep learning, image, voice and speech recognition, natural language processing and so on.

The purpose of this master thesis is to provide an in-depth understanding of artificial intelligence, focusing on how artificial intelligence is transforming businesses across various industries or, more specifically, areas. Overall, the research question I try to answer is "What is the role of artificial intelligence in transforming businesses across areas?"

In the first part of the thesis I start with a brief history of artificial intelligence and then I cover the most important types and research areas of artificial intelligence. Next, I present the technological developments that have had the biggest impact on the development of artificial intelligence. I conclude the chapter with the presentation of the biggest challenges that are affecting higher adoption of artificial intelligence both in businesses as well as in everyday human lives.

In the second part of the thesis I address main business problems across different areas and show what problems does artificial intelligence applications help to solve in different business sectors. In this demanding business world, every corporation strives to succeed and not to fail. To do this, they must keep attention to the markets, trends and competition. Their constant struggle is to effectively increase revenue, profitability and customer satisfaction and to keep costs to the minimum. Today's world is driven by customer and its demand and at the end of the day, each company will think about whether their product is faster, better or cheaper and if they are competitive. My main focus will be to exemplify how artificial intelligence can solve such problems and how can corporations benefit from it.

Third chapter covers the most important findings, which are based on the literature review of artificial intelligence and business case studies presented in the second chapter. I will present the main key takeaways and show the most important benefits that artificial intelligence brings into our business environment and into our lives.

The primary obstacle corporations are dealing with, however, is the implementation of intelligent systems and dealing with their complexity. The aim of last chapter will be to show why is for corporations important to invest in artificial intelligence and how to successfully implement it into their business strategy so that it creates value. Adapting to an era of data-driven decision making, artificial intelligence main significance is that it helps to solve variety of problems and especially help make more accurate and faster data-driven decisions.

Lastly, I will attempt to provide the reader the steps and elements needed to successfully implement artificial intelligence into their business strategy by providing already used cases to show that artificial intelligence is something worth having attention.

# 1 ARTIFICIAL INTELLIGENCE

The aim of this chapter is to give a reader an overview of the field, focusing on the definition of artificial intelligence and its main areas of research. I will describe different types of artificial intelligence that represent possibilities how people can work together with machines and present the main technological reasons that boosted the growth and interest of artificial intelligence especially in the recent years. The biggest investments in artificial intelligence will be presented as well as market overview. However, there are still some challenges that hinder artificial intelligence adoption, which will be presented in the last part of the chapter.

As the field of artificial intelligence is extremely technical and specialized and the term itself has never had clear boundaries it is hard to define artificial intelligence solely by one definition. Artificial intelligence was first presented in 1956, when researchers from Darthmouth College introduced it as machines that are as intelligent as humans (Luger, 2005). More recent definitions refer to artificial intelligence as a technology that makes computer programs act in a way that may seem as if they are operated by humans (Noyes, 2016). According to Priyam, Kumari and Thakur (2013), artificial intelligence consists of two concepts. First, human brains and human behaviour have to be studied and analyzed, and second, the analyzed human behaviour from the first step has to be represented by machines, such as computers. Consequently, by using artificial intelligence machines get more intelligent and more useful. VijiPriya, Ashok and Suppiah (2016) define artificial intelligence as tools and algorithms that are inspired by human mind and intelligence with the end goal to enable machines do everything as humans can do or even better.

According to Purdy and Daugherty (2016), artificial intelligence can be explained as machines that can sense, comprehend, take action and learn. By sensing, machines actively register images and sounds from the outside world. Sense includes vision recognition, voice recognition, audio processing and face recognition. By comprehending, machines can use artificial intelligence to analyze and understand the registered information, for example use natural language processing to understand the written text or a speech that was registered. When artificial intelligence systems can take actions, we are talking about machines actually operating in order to derive an outcome and/or optimize a process or procedure. Additionally, artificial intelligence enables machines to learn from past experience and use this to adapt and learn over time.

## 1.1 A brief history of artificial intelligence

The story of artificial intelligence started already more than 2000 years ago when people have told myths and stories about robots. Later, people believed they would create machines that would be as intelligent as humans. However, it was not until 60 years ago that the

definitions of modern artificial intelligence have started to emerge. In the 1940s, the first digital computer was invented, which was the first prompt that made scientists began to think about possibility of building an electronic brain (McCartney, 1999).

After the introduction of artificial intelligence in 1950s, the enthusiasm for new technology quickly followed. The interest in artificial intelligence has grown by scientists from diverse fields like mathematics, engineering, psychology, economics and political science, whose vision was to make an artificial mind which works like human's (VijiPriya et al., 2016).

Today, the effects from different fields could be felt in the research of artificial intelligence. From each field artificial intelligence took different tools and theories that it uses in its development and research. For example, from psychology artificial intelligence is using tools with which we investigate the human mind. From linguistic artificial intelligence can help us learn about the structure of a language. Computer science helps us actually creating artificial intelligence (Russel & Norvig, 2010).

Through its history we can point out some of the biggest milestones that have contributed to the artificial intelligence development. First, the technique called neural networks was invented (Nilsson, 2010). A form of neural network was called perceptron, which took the form of an entire computer, and like most of artificial intelligence researchers also he was optimistic about their power. According to US Navy that time was believed that perceptron, will lead to machines that can learn, read, write, make decisions and translate languages. The creation of perceptron is an important milestone in the history of artificial intelligence, since it was the start of the machine learning, which is one of the predominant areas of the artificial intelligence field today. However, the expectations were still too high. In the first decade of artificial intelligence development since it was first introduced, the new artificial intelligence research areas started to develop, such as robotics, natural language processing, image recognition translation between languages, voice recognition (Ruuse, 2017 & Smouts, 2017). Instead of developing a general intelligence, which encompasses machines that have all senses, or even more than human have, expert systems were created, that were focused on much narrower tasks, and they are one of the longest-running and most successful areas within artificial intelligence (Wagner, 2017).

One of the biggest milestones in artificial intelligence history happened in 1997 when Deep Blue computer from the company IBM beat the best human chess player. But Deep Blue's technology turned out to be useful for chess and not much else (Đức, 2017). Year 1999 is considered as an important step in deep learning history. Computers started to become faster and better at processing data. Graphics processing units were developed (Foote, 2017). Another major milestone for the field happened in 2011, when IBM's artificial intelligence computer called Watson beat the actual best human players on a US quiz show Jeopardy! It took IBM three years to research and train Watson to be able to answer complex questions.

The victory meant a huge success for artificial intelligence field (Best, n.d.). In 2012 deep learning technique was used for the first time at the competition called ImageNet, where the machine was correctly labelling million images into different categories (Krizhevsky, Sutskever & Hinton 2012). In the same year Google did a so called The cat experiment. By using deep learning technique and supervised learning, convolutional neural net was trained to recognize picture of a cat between millions of pictures from the internet (Foote, 2017).

More recent milestone that happened in 2016 is when Google's artificial intelligence program AlphaGo, created by DeepMind, won the match at the game called Go to world champion Lee Sedol. This was a great success because AlphaGo was able to play the game by itself with no human interference (Ruuse, 2017). In year 2017, the world's first robot that achieved status citizen was created. Sophia was created in Saudi Arabia, which can express even its feelings. Sophia says, "I can let you know it I am angry about something or it something has upset me," (Stone, 2017). This could be one of the biggest achievements if not most interested and scary, which caused worldwide controversy in the year 2017. In the same year, OpenAI, a recent project by artificial intelligence researcher Elon Musk, present one of the biggest advances in video games. A computer beat professional player in the game called Dota 2. Why this is so significant is because, the artificial intelligence bot learned the game from scratch by playing to itself millions of times (Cowling, 2017).

In between of periods of boom in artificial intelligence development, however, also some failures happened. These periods are called artificial intelligence winters. First artificial intelligence winter occurred because the scientists had underestimated the difficulty of artificial intelligence development (Yang, Smith, McGuire & Huang, 2006). In that time, also interest and consequently investment in artificial intelligence cooled off and artificial intelligence suffered a series of financial setbacks, as well as commercial and scientific activities in artificial intelligence declined dramatically (Yang et al., 2006; Bughin et al., 2017a). Later, the slow progress of expert system called XCON, and other expert system, which were being seen as slow and clumsy lead to another artificial intelligence winter. Furthermore, the goals for Japan's fifth generation computer project, which was aimed to have an increased computer power had still not been met. The expectations were much higher than what was possible. At that time, commercial applications of artificial intelligence were still rare and DARPA (Defense Advanced Research Projects Agency) evaluated that artificial intelligence would be "the next wave" and it redirected its funds to other projects which seemed more likely to provide better and quicker results. Consequently, the decreased funding in 1980s created the Second artificial intelligence winter (Foote, 2017).

## 1.2 Types of artificial intelligence

People have been developing many technological applications and tools since early times. Throughout the years improvements were made, which resulted in changes in society as well

as in the way we are doing business. One of the challenges for humans is how to work together with machines.

Depending on the type of work or activity, artificial intelligence can be classified to either automation or augmenting. The decision of which artificial intelligence to use depends largely on the complexity of the work that has to be done. If the work is rule-based, routine, and predictable, then automation artificial intelligence may be used. To automate is to replace an entire task, which was previously done by an employee, with technology. That way, work can be done better, faster and cheaper. For example, a simple decision to be made by artificial intelligence in insurance industry would be whether someone qualifies for insurance benefits. Similarly, automation in banking industry would be whether someone qualifies for a loan. By automating such decisions using artificial intelligence, they can be done more quickly and accurately than when they are made by humans. A recent example of automation, where human interaction was made completely unnecessary, is autonomous car by Google or Tesla (Bataller & Harris, 2016).

On the contrary, when we are dealing with activities that are ad hoc and unpredictable, human judgement is needed as well and the machines cannot do the work by themselves. Augmentation refers to using technology to supplement human thinking. Even though technology can be used extensively, it is still a human mind that acts as the main decision maker in processes (Lavenda, 2016). Examples of augmentation is the work of research scientists, architects, financial advisors or consultants. In healthcare, it is hard for patients to believe a machine that is providing them diagnosis, prescription and treatment, which is why doctors have to be a part of the process as well. Augmentation is mainly used for improving industrial processes, workplace efficiencies or customer experiences (Bataller & Harris, 2016).

### 1.3 Main research areas of artificial intelligence

Artificial intelligence covers many different applications and technologies, which I refer to as research areas of artificial intelligence. One of the earliest researchers that has defined main artificial intelligence research areas was Gevarter (1983). According to Gevarter the principal artificial intelligence research areas were:

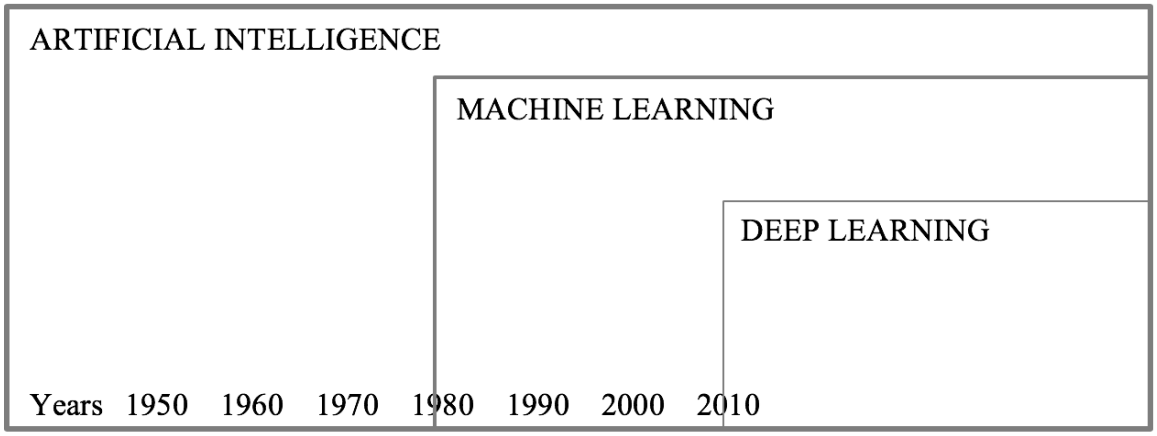
1. Natural language processing, which explores ways how a computer can be used to understand and analyze human language.
2. Computer vision, which enables a machine to see, identify and understand the observed data.
3. Expert systems, which are about making machines take actions as it they were an expert of a process, for example, making medical diagnosis.

4. Problem solving and planning. Many problems are unable to be solved by humans, therefore computer programs are needed for their solutions.

With the emergence of new technologies, artificial intelligence research areas have changed through the years. While some have evolved, many new ones were identified and defined. As such there are many more artificial intelligence research areas today than in the past, such as machine learning, deep learning, 3D neural networks, genetic computing, vision recognition, robotics, expert systems, speech recognition, natural language processing, intelligent agents, gesture and facial recognition, and so on. Many of those applications and technologies are already being deployed by various different research companies (VijiPriya et al., 2016).

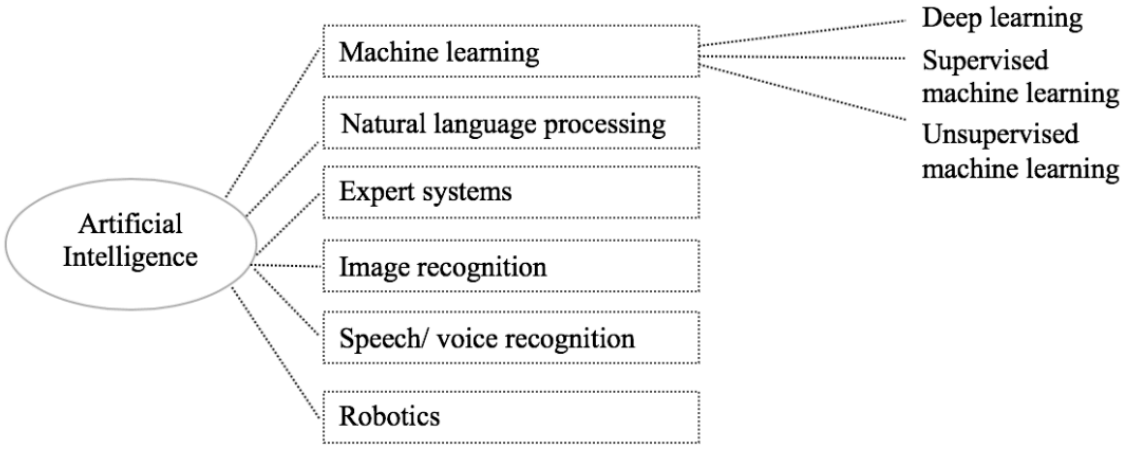
According to many researchers, for example Copeland (2016), machine learning and deep learning could be seen as the main artificial intelligence research areas. Copeland (2016) defines machine learning as a technique to achieve artificial intelligence. On the other hand, deep learning represents a technology to realize machine learning. Figure 1 shows a graphical depiction of development of main research areas by years and Figure 2 shows a graphical depiction of all main research areas that are relevant today.

*Figure 1: Presentation of development of main artificial intelligence research areas*




*Source: Copeland (2016).*

*Figure 2: Artificial intelligence research areas*




*Source: Mills (2016).*

In the next part of the thesis I will present main research areas that are most widely used in detail.

### 1.3.1. Machine learning

Machine learning is the research area with the most common technology, or set of algorithms, associated with artificial intelligence as it has a very broad use. It is an approach to achieve artificial intelligence and it has been around us since the 1950s. Machine learning algorithms enable machines to learn from experience and interaction with data without being explicitly programmed (Jarrahi, 2018). In contrary to expert systems, which need to be programmed to do a specific task, machine learning is about teaching machines how to do everything step by step. With machine learning, machines and systems learn to adapt and take actions based on observation, classification and failure, similarly to humans (Ruuse, 2017). Machine learning refers to the use of algorithms to learn from past experiences and recommend responses that are likely to be the most beneficial (Dimitriadis et al., 2015). Computer algorithms can be simple or complex. An example of former would be a rule-based approach, for example, a machine would send a reminder at a specified time each day. An example of a complex algorithm would require learning and adapting based on gathered data. For example, an algorithm that identifies people from photos on Facebook would count as a complex algorithm (Appenzeller, 2017).

According to Schrider and Kern (2018), there are two major machine learning categories: supervised learning and unsupervised learning. With supervised learning, machines are given an input variable and an output variable in advance, their job being to learn to map a function from the input variable to the output variable. Input data is called training data from which a model is required to make predictions and learn from (Brownlee, 2016). Usually, supervised learning is used with large training data sets that would be too expensive and time

consuming for a person to analyze and provide a correct result, or a label. For example, an input variable could be a photograph of an animal and the correct output these photographs could be a label for this animal, for example a bird. By analyzing large data sets, machines learn and if the learning has gone well, the machine will provide correct outputs with a high degree of accuracy (Brynjolfsson & McAfee, 2017). An example of supervised learning would be Amazon, which uses supervised learning system to make better personalized recommendations to customers. Similarly, JPMorgan Chase uses supervised learning in order to review their loan contracts. This saves them an enormous amount of time as all the work could be done in only a few seconds (Son, 2017). Moreover, even cancer diagnosis can be done by using supervised learning. (Way et al., 2018 & Lynch et al., 2017).

In contrast to supervised learning, unsupervised learning algorithms have the ability to learn on their own from start to finish. Schrider and Kern (2018) argue that in true unsupervised learning, machines recognize and understand structures in the data without knowing in advance how the data is organized. For example, humans are unsupervised learners, as they get most of their knowledge from recognizing the world around them with little or no labelled data (Brynjolfsson & McAfee, n.d.). Unsupervised learning algorithms are looking for patterns that are not immediately visible in data. For example, an unsupervised learning algorithm would be able to separate social network users into different personality categories based only on profile data of each user. Advertisers today use such unsupervised learning algorithms a lot, as they are able to target specific groups of users directly (Portugal, Alencar & Cowan, 2017). Unsupervised learning systems represent one of the key challenges of artificial intelligence. If we were able to create such systems, many possibilities would open up. Machines could solve complex problems and discover patterns that we are currently unaware of, such as, patterns in the spread of diseases, in customer's purchase behaviour or even patterns in price moves of stocks, and so on (Brynjolfsson & McAfee, n.d.).

There are several advantages of machine learning according to Skytree (2014). By using machine learning, the need for human domain knowledge is decreased. Machine learning has the ability to analyze much larger volumes of data and detect patterns and predict outcomes across hundreds of variables than humans can. Machines with machine learning can also analyze unstructured data in addition to traditional structured data. By using machine learning, machines can continuously learn and adapt to changing environment.

Appenzeller (2017) identified another type of machine learning, called reinforcement learning. In reinforcement learning, the machine tries to achieve a certain objective, for example winning the game with the highest score. With each successive try, the machine learns from its past experiences to achieve the objective in a better or faster way. In contrast to unsupervised learning, which is about pattern recognition, reinforcement learning is about learning from past experiences. If a behaviour of a machine managed to deliver a positive outcome, then such a behaviour should be repeated. The inspiration to reinforcement

learning was the behaviour of animals that repeat certain behaviour if it provides a positive result for them (Knight, 2017). An example of reinforcement learning would be a system where headline stories for a news website would be selected based on the amount of clicks the story gets. Of course, the selection of a specific objective is entirely up to the designer of the algorithm. A news website would therefore also be able define a different objective, such as a headline that would increase customer lifetime value and not necessarily rely only on the number of clicks (Brynjolfsson & McAfee, 2017).

### 1.3.2. Deep learning

Deep learning is the most recent and fastest growing research area in artificial intelligence and is a part of machine learning (Cao et al., 2018). Deep learning is used in variety of applications such as computer games, speech recognition applications, computer vision applications, natural language processing applications, search engines, automatic photo tagging, voice assistants, or even self-driving cars, and so on (Chen, Engkvist, Wang, Olivecrona & Blaschke, 2018).

The biggest success of deep learning can be seen with AlphaGo, a computer program that was able to defeat a professional human Go world champion. Computers using deep learning can get an intuitive understanding of the visual appearance of Go board that is comparable to the best human players (Vincent, 2017).

Deep learning is inspired by the human brain and uses artificial neural networks with many layers of nonlinear processing used for learning from data (Chen et al., 2018). If a machine is given enough training data, neural networks can learn on their own. They are then able to find patterns and inconsistencies in the data, which human brains could not be able to (Appenzeller, 2017). The approach typically uses nets with more than two processing layers. The layers provide a “deeper” level of features from the data, which provides better classification and prediction performance (Gu et al., 2017).

Deep learning has many more advantages over earlier generations of machine learning. While earlier systems would learn and improve with each next data set, they would only learn and improve up to a certain point, after which new data did not provide better outcomes. In contrast, by using deep learning machines improve with more data sets which provides improved outcome (Brynjolfsson & McAfee, 2017).

### 1.3.3. Speech recognition/ natural language processing/ vision recognition

Albeit not as widely used as machine learning and deep learning, voice recognition, speech recognition, natural language processing and vision recognition have gained increasing

interest over the last few years. As such, they are today regarded as important research areas within the artificial intelligence field.

Speech recognition refers to the ability of computer systems to recognizing speech signals and converting them into words with the use of different algorithms (Gaikwad, Gawali & Yannawar). A major milestone for speech recognition happened in 2016, when Microsoft created a system that can transcribe the contents of a phone call as well or better than human professionals (Weinberger, 2017). A software company Affectiva is taking advantage of artificial intelligence by recognizing different emotions of participants in focus groups. A startup company Enlitic uses artificial intelligence to scan medical images in order to be able to get better diagnosis for different kinds of cancer (Brynjolfsson & McAfee, 2017). Amazon's Alexa, Apple's Siri and Microsoft's Cortana are typical examples of speech recognition that are widely used among consumers today. It is interesting that the significant improvement in speech recognition happened only after 2016 (Brynjolfsson and McAfee, 2017). Speech recognition on a mobile phone is now up to three times faster than regular typing on a keyboard (Landay et al., 2016).

Natural language processing allows users to interact with a machine in a natural language, such as German or English. (Bolonkin, 2012). Google's Translate application is a typical example of natural language processing, which can now translate into 32 languages using voice and in 103 languages using text. Also, Google's Inbox application is able to provide multiple self-generated answers to received email (Parloff, 2016).

Vision recognition has also improved dramatically over recent years. It is defined as technology that can sense and receive information from visual data (VijiPriya et al., 2016). Popular social network applications, such as Facebook or Instagram, are now able to recognize its users' faces in uploaded photos (Begg, 2017). Also, companies such as Google, Microsoft, Facebook and Baidu are now automatically organizing uploaded photographs into different groups that share a common tag. For example, photographs with animals in them, or even photographs that include for example, kissing. These companies also already have solutions that can create textual descriptions for the photos based on what it in them (Parloff, 2016). Another example would be the ability to unlock your phone with your face recognition. Vision recognition will soon be able to be used even in business. For example, computers will be able to analyze X-rays and other medical scans faster and more accurate than doctors. Consequently, this will lead to recognizing cancer or other diseases earlier. Furthermore, vision recognition is crucial in new industries such as robotics, self-driving cars and autonomous drones (Parloff, 2016).

Artificial intelligence has become the center of attention for technology investments and the biggest corporations are investing heavily in various artificial intelligence technologies and start-ups, which will be presented in the next chapter.

## 1.4 Market area, trends and investments

The objective of this chapter is to give reader a sense of the current artificial intelligence trends in the world, the influential players in the field and how they organize themselves to make progress. Artificial intelligence research is becoming more and more extended and demand of artificial intelligence is increasing. The companies that are creating innovations with artificial intelligence technologies are the most wanted and the number of start-ups is increasing each year and the biggest tech giants are heavily investing in artificial intelligence.

Technology industry is dominating the world of artificial intelligence. Digital firms are the ones who are pursuing artificial intelligence market at a rapid pace and are adopting artificial intelligence applications the most. As is the case with majority of research areas, U.S. dominated the field in the past few years. However, China recently said that it would invest heavily in artificial intelligence to ensure its companies, government and military dominate the field by 2030 (Tilley, 2017). Recently, China has a major opportunity to lead artificial intelligence development in the world according to top Baidu executives. China was well-positioned to influence the development as its tech sector was booming, with around 750 million Chinese online, and plenty of artificial intelligence experts with a vast reserve of human resources. Also, the government has stated its interest in supporting the development of artificial intelligence. Baidu, the China's biggest multinational technology company has made big investments in artificial intelligence in recent years, from image recognition and autonomous driving to digital assistants and robots (Yan, 2017).

The artificial intelligence market is expected to reach a worth of $59.8 billion by year 2025. Additionally, deep learning is expected to hit $16 billion by the same year and machine learning as a service is expected to reach 1$19.86 billion (Neiger, 2017).

The biggest technology companies, such as Alibaba, Amazon, Google and Facebook, have been acquiring various different artificial intelligence start-ups in recent years. Their motivation behind the acquisitions does not come merely from a technological standpoint, but they also want to be able to get the best talented workers in artificial intelligence, as their numbers are still relatively limited (Bughin et al., 2017a). Artificial intelligence advances, resources and expertise are becoming now more available and entrepreneurs and start-ups are seeking to commercialize the technology (Kuyan & Frankel, 2016).

Furthermore, venture capital, private equity firms and other external investors, such as angel funds started to invest in artificial intelligence in order to be involved in a market that has a significant probability for rapid growth (Bughin et al., 2017b). There are also more and more universities that are focusing on artificial intelligence research. Montreal, for example, has become the largest academic concentration of deep learning researchers in the world

(Lindeman, 2017). Panetta (2017) published a report on the Top 10 strategic technology trends in 2017. Unsurprisingly, artificial intelligence represents the fastest growing segment and is at the top of the list. If the companies use artificial intelligence correctly, they will be well positioned for a big digital business payoff.

Even though investment in artificial intelligence is growing fast the adoption in 2017 remains low. The main reason for this is the uncertainty among the businesses that is still present when thinking of adopting artificial intelligence. Factors that are holding back the adoption of artificial intelligence will be presented in detail in the last part of first chapter.

## 1.5 Impact of technological development on artificial intelligence

Over the past few years, artificial intelligence has exploded and now seems to be everywhere. It is the buzz word in most of tech magazines. Industry, the media, and political organizations have shown strong interest in artificial intelligence and in potential uses of it. Artificial intelligence applications are rapidly increasing all over the world. The main reason behind such rapid rise of artificial intelligence can be seen in huge technological development in recent years. According to today (Brynjolfsson & MCafee, 2017), there are five main areas of technological development that have aided to the resurgence of artificial intelligence. These are the rise of big data, unlimited access to computing power, better algorithms, powerful graphics processing units and development of internet and mobile applications, electronics, nano technology that speed mechatronics.

The most important of all is data. Data gives power to artificial intelligence and the world is generating billions of gigabytes of data every day (Bughin et al., 2017a). Data is the lifeblood of these systems, and now there are many digital images, digital transcripts, digital data, etc. available that can be put into these artificial intelligence systems in order to improve them (Brynjolfsson, 2017). Machine learning, an approach to achieve artificial intelligence allows computers to learn from data, so the bigger the data set is, the more the program can learn (Mason, 2017). As the amount of data grows exponentially in recent years, artificial intelligence systems are improved all the time (Purdy & Daugherty, 2016).

The second most important fuel that is driving artificial intelligence today is the unlimited access to the ever-growing computing power. Artificial intelligence requires fast processing and a huge number of mathematical calculations to be made very quickly (Marr, 2017).

Computers can learn on their own by giving them data and instructions to learn from. Algorithm is a process or a set of rules that needs to be followed in calculations or other mathematical instructions. Today, algorithms can solve much harder problems faster and more accurately (DeAngelis, 2014).

Graphics processing units (hereinafter: GPUs) are also the fuel that has contributed to the rise of artificial intelligence. GPUs have enabled machines to achieve even faster computing power. Today, modern GPUs can process millions of mathematical operations in parallel. Enormous amount of data can be translated into relevant and correct outputs with a high degree of accuracy, because algorithms can better train through examples and identify correct or reject incorrect answers. Such a computing power allows artificial intelligence systems to improve even further (Bughin et al., 2017a).

According to Hootsuite report Digital (2018), around 53% of the world population has an internet connection today and more than half the world now uses smartphones. While the Millennial generation is the one who have grown up with social media and digital world, they are the most in favor of incorporating artificial intelligence into their future work lives (Hootsuite, 2018). Furthermore, by aggregating more data into Cloud it also makes more data accessible to a wider set of users, which boosts opportunities for artificial intelligence as well (Pollard et al., 2017).

Faster machines, better algorithms and bigger amount of data all contribute to artificial intelligence learning and adopting. According to Brynjolfsson (2017), these components are the most important contributing factors to faster and better artificial intelligence development (Brynjolfsson, 2017). Besides all of these factors, also human talent is increasing. Universities are producing higher number of skilled and experienced artificial intelligence researchers. Consequently, business investment in human artificial intelligence resources is becoming more feasible and senior people in the field have become deeply involved in the marketing and funding of artificial intelligence applications as well, which radically decreases computing costs and now make artificial intelligence applications economically viable (Dogson, 2017).

## 1.6 Challenges affecting the adoption of artificial intelligence

Despite artificial intelligence transforming and disrupting industries all over the world, as I will cover in detail in the next chapter of this thesis, the adoption of artificial intelligence in business remains relatively low. As I have shown in previous chapter, the main issue for adopting artificial intelligence is not in the lack of technological development. Indeed, the technological ingredients needed for artificial intelligence to be implemented are in place, i.e. increased computer power, improved algorithms and availability of vast quantities of data. The main challenge today is therefore not the existence of artificial intelligence technologies but rather the acceptance of these new kinds of technologies. In order for businesses to benefit from new opportunities artificial intelligence brings, they need to accept it and prepare for it.

We can clearly see that the world and the way we live is already being changed by artificial intelligence and new smart technologies, and it is obvious that there will be also some changes in the working environment. The way of doing business will be changed and artificial intelligence will have impacts on the daily business life. Disruption of artificial intelligence is here, however, many company leaders are not sure what to expect from artificial intelligence or how it fits into their business model. Many companies still not recognize potential challenges that artificial intelligence brings. Most executives see artificial intelligence as a strategic opportunity, however for some it is still a strategic risk (Ransbotham, Kiron, Gerbert & Reeves, 2017).

### 1.6.1 Technological challenges

Despite the growing use of artificial intelligence and increased automation, there is still noticeable skepticism in society regarding these technologies. The biggest challenge is trust, which is the first step toward successful relationship between humans and machines (Hengstler, Enkel & Duelli, 2016). Since this technology is new, most people do not have enough knowledge about it and do not trust it. Also, potential errors in machine learning systems can be very hard to detect or correct.

### 1.6.2 Data challenges

The selection of data that is put into the artificial intelligence system must be carefully chosen (Brynjolfsson, 2017). Businesses need to assess, whether they can gather not only enough data, but also whether the data is of a high enough quality. Therefore, data quality, data security and governance, data integration and preparation and data exploration are also challenges of using artificial intelligence technologies. Sometimes businesses are faced with a problem of having large quantities of data not available. Moreover, data may not be used in the form that it is gathered, or it may even contain biases or mistakes that may make correct decision-making much more difficult (Wellers, Elliott & Noga, 2017).

### 1.6.3 Right education and expertise challenges

Ransbotham et al. (2017) tried to find possible explanations to the reasons for low adoption of artificial intelligence in most businesses. The two biggest barriers found were the access to talent and, as mentioned above, usable and right data. Some companies, especially smaller ones, are unable to hire artificial intelligence talent since the competition of artificial intelligence experts is huge. Artificial intelligence adoption requires knowledge about artificial intelligence as well as the right skills. People need to know the benefits and challenges of artificial intelligence and also have a strong support from leadership. Businesses need people from different disciplines, which means that companies have to rely on external support too. Lastly, companies need to know which data is relevant for the

artificial intelligence systems to be able to extract the right patterns, which also requires educated and experienced professionals (Ransbotham et al., 2017).

### 1.6.4 Financial challenges

There are two main financial challenges that affect businesses as they adopt artificial intelligence. First, artificial intelligence technology is still relatively expensive. Artificial intelligence algorithms need to be trained appropriately. Data collection, building the artificial intelligence systems and integration of data with the artificial intelligence system all require knowledge and people with a variety of skills, which in turn causes the cost of training employees much higher (Hagerman, 2017). Second, as artificial intelligence technologies are complex, they need to be repaired and maintained on a regular basis. If the machine breaks down, the main risk is the loss of data, and in order to restore this data, businesses often encounter large financial costs (The Economist, 2016). Moreover, as the business environment changes fast, artificial intelligence systems need to be regularly upgraded.

### 1.6.5 Ethical concern

Artificial intelligence technologies bring a lot of ethical concerns, such as, unemployment because of the job automation, effects of machine on human's behavior and interaction, elimination of artificial intelligence bias, the security of artificial intelligence systems from enemies, protection from unintended consequences and how to control an intelligent machine (Bossman, 2016). Many people also doubt that computers can learn to think for themselves (Makridakis, 2017). Furthermore, people might have too much (or too little leisure time), lose some of their privacy rights or they may even lose their sense of being unique (Russel & Norvig, 2010).

### 1.6.6 Business challenges

As mentioned, the talent pool is still small and there are not enough people with right skills and experience. The challenge for the businesses is therefore how to source and retain talent. Moreover, it is also challenging how to connect artificial intelligence technologies with the existing business model. The integration of human capabilities and machines can sometimes be hard, as businesses risk a change in behaviour of the employees if the machines are present in the organization. One of the challenges is also the lack of strategic directive from top management (Pollard et al., 2017). First, executives have to learn more about artificial intelligence, learn how to organize their business around artificial intelligence, learn about the competitive landscape in which their business operates (Ransbotham et al., 2017).

# 2 ARTIFICIAL INTELLIGENCE ACROSS AREAS

For more than 250 years technological innovations and advances have been a major force in economic growth (Rosenberg, 2004). Today, artificial intelligence one of these innovations, transforming and disrupting industries all over the world. Business leaders should prepare for this new wave of technology by discussing how artificial intelligence can be used to improve quality, functionality, speed and how it can become a major driver of revenue growth.

Artificial intelligence is not only changing the digital world but also businesses across many different industries or more specifically across areas. In this thesis I focus mainly on healthcare industry, retail industry, marketing and advertising industry, financial industry, law and fraud detection industry, education, agriculture industry, and manufacturing and automotive industry, as well as on the use of artificial intelligence in government, in security industry, in different business processes and in our everyday life.

As I will show, some of the major applications of artificial intelligence include image recognition (Facebook, Instagram), map navigation, language translation, speech transcription, recognition of emotions in photos, drone flights, prediction of parking difficulty by area and hour, new drug discovery, disease discovery and prediction, crop yield prediction, crop disease detection, malware detection, identity verification, fraud detection, insurance claims handling, stock trading, flagging errors in legal documents, legal case research, energy usage optimization, and so on. Also, artificial intelligence can now beat the best human professionals at Jeopardy!, Go, chess, poker and other games. Artificial intelligence can drive a vehicle completely by itself, be your personal trainer, it can write music and poems, design logos, recommend songs and movies you like, write its own machine learning software and detect potentially dangerous weather.

In this chapter of the thesis I will first cover challenges of different industries that have adopted artificial intelligence in recent years and then continue with case studies that act as solutions to these challenges.

## 2.1 Healthcare industry/ medicine

Healthcare is one of the most prominent industries for the development of artificial intelligence. According to Novatio Solutions (2017), about 86% of healthcare providers, companies, and technology vendors use some form of artificial intelligence and the number is expected to grow even more as technology continues to evolve. One of the reasons why healthcare industry is suitable for the development of artificial intelligence is because there is already an enormous amount of data available about patient histories, medical images and medical statistics from which artificial intelligence algorithms can learn and have potential

to be used (Jiang et al., 2017). Already we can achieve great benefits of using artificial intelligence technologies in healthcare industry, such as cost savings to both patients and providers, as well as increasing speed, accuracy, productivity and better data analysis and broader healthcare access. Of course, the main advantage is to save more lives and money (Catell, Chilukuri, Levy, 2013; Marr, 2017). However, the biggest obstacle to adopt new technologies is convincing healthcare providers to change their processes and rely more on automation. Risk aversion is understandable when human lives are at stake (Novatio Solutions, 2017).

Despite these obstacles, artificial intelligence is already taking on various different challenges in the healthcare industry, from drug discovery to hospital operations, medication management, patient's care, analyzing research literature, publications and patents, review of medical records, discovering and managing new diseases, and crowdsourcing treatment options (Ghosh, 2016).

Discovery of new drugs is a huge opportunity area for artificial intelligence to be implemented. It takes years of research to discover new drugs, and the process of creating them is complex, long and very costly (Sinha & Vohora, 2017). By optimizing this process businesses could not only save costs but would also be changing the world by saving more lives. There is a huge amount of new information available every day and for an average medical researcher it is impossible to go through all the data and analyze and process every medical publication, database or journals (Sharma, 2017). Through machine learning, however, computers can process and analyze data much faster and more accurate to predict possible outcomes. Consequently, researchers can choose what experiments need to be done much more correctly.

Breakthrough in diagnosing the Ebola virus is one example of using artificial intelligence in drug discovery. With the help of artificial intelligence, a computer was able to analyze thousands of existing medications that could be reengineered to fight the virus. Instead of months or even years, which is how long a research of this magnitude would normally take place, the algorithm was able to find two medications in only one day. Of course, such an approach could be used also with other possible viruses and diseases (Engelbrecht, 2017). Another example is the company Exscientia, which uses artificial intelligence algorithms to see how certain molecules will behave and then predicts how likely a combination of these molecules is to become a useful drug. Again, the amount of data available for scanning is so vast now, that it is simply beyond a human's individual capabilities, but Exscientia algorithms are able to solve this problem in a quicker and cheaper way (Bushey, 2017). The artificial intelligence algorithm used by Atomwise, another drug discovery company, uses machine learning and 3D neural networks to help find new therapies using existing medications by shifting through database of different molecular structures (Buvalio, 2016). Berg Health discovers drugs by using artificial intelligence to scan patient biological data to

try to find out why are some people more or less immune to certain diseases. Based on the extracted information they can invent new therapies or improve the existing ones (Parloff, 2016). Probably the most resounding case of using artificial intelligence in drug discovery is the one of Pfizer and IBM's Watson, who collaborated in order to tackle immuno-oncology by creating a super-computer able to scan through more than 30 million pieces of medical and laboratory data (Japsen, 2016).

Besides drug discovery, artificial intelligence can also help in medical diagnosis by finding key patterns from a patient's health history. According to Novatio Solutions (2017), one of the biggest reasons for patient re-admittance is medication non-compliance or wrong medication or dosage prescription. Today, there is technology available that can be used to monitor patients, when they are taking their medications or what side effects they are experiencing, without having to visit the doctor. An example of this would be El Camino Hospital in Silicon Valley, where they use artificial intelligence technology to help doctors recognize the risk of patient falls. When a patient presses the emergency button to call up a doctor, the system records this information and starts comparing it to the other patient information, such as what medications he or she has been taking or the time from the last surgery. The algorithm learns about the likeliness of patient falls and informs doctors in advance about this possibility, de facto assuming tasks of a doctor. Patient falls dropped 39 percent with the use of such a program (Weintraub, 2017). Also, IBM's Watson can instantly provide treatment suggestions based on medical data (Weintraub, 2017).

Virtual assistants can now also be found in healthcare industry. For example, Sense.ly has built a digital nurse called Molly, which helps doctors monitor their patient's health and prescribe treatments even between doctor visits. It also provides basic health information and can give suggestions to parents of ill children (Novatio Solutions, 2017). Your.MD application utilizes artificial intelligence to provide its users with the best and most relevant health information based on basic health parameters of a user. This saves a lot of time, as less patients visit doctors for non-risky diseases. The biggest challenge, however, is the trust. People tend to trust doctors much more easily than trust an application (Fagella, 2017d). Another example is Kore.ai, a company that provides smart chatbots for healthcare facilities. Smartbots are digital assistants, which connect to patients directly and provide them with the right contacts, information and appointment details.

As reading, clustering and interpreting large volumes of textual data takes enormous amount of time, artificial intelligence technologies can improve this process as well. This comes in handy for healthcare industry since the number of research publications in the field is growing enormously and it is hard for researchers to analyze massive amounts of data to prove or reject their research hypotheses (Buvalio, 2018). The company Benevolent AI uses artificial intelligence technology to analyze faster and more accurate thousands of scientific

papers that are published every day, providing information experts need for drug discovery and research. (Liu, 2016; Buvalio, 2018).

Artificial intelligence applications are also widely used in data management, as machines collect, store, trace and analyze the data to provide faster and more accurate results. Going through different medical records, artificial intelligence systems can help simulate scenarios to compare patients' treatment options, for example, analyzing results of any kind of surgery. In addition, this allows doctors to give specialized attention and more time to sicker people.

X-rays, CT scans, and other medical analysis can also be done better using artificial intelligence technologies. For example, cardiology and radiology both include massive data, which would need a long time to be analyzed without artificial intelligence (Novatio Solutions, 2017). In 2014, Google acquired the company called DeepMind and artificial intelligence system was used in DeepMind health process to help with the analysis of medical records and in turn provide more efficient health services. DeepMind is able to process huge amounts of medical data extremely fast, which no human could ever do (Raza, 2018). IBM's Watson is being used in many cancer institutes working on diagnosis and treatment plans, providing information of possible diagnoses and treatment plans. It can even predict what kind of literature and medical records a doctor might need (Captain, 2016).

Disease and health monitoring is also improving a lot. For example, Sophia Genetics is utilizing artificial intelligence to assess DNA to diagnose diseases (Marr, 2017). By scanning health images, the company Enlitic uses artificial intelligence and deep learning technology to help treat and diagnose cancer (Brynjolfsson & McAfee, 2017). When the performance of artificial intelligence systems was compared to the performance of human radiologists, it was better in case of artificial intelligence. Indeed, artificial intelligence system was able to identify every single tumor in the test case, while human radiologist had allowed 7% of tumors go unnoticed. Another example in disease and health monitoring is the company Freenome, which diagnoses cancer from blood samples (Parloff, 2016).

Artificial intelligence is also starting to improve crowdsourcing treatment options. The example is All4Cure, which uses social networks where users can share their cancer treatment procedures. The artificial intelligence system scans through the data and helps patients figure out what treatment will work best to defeat their cancer. All4Cure sells the gathered data to pharmaceutical companies, who often find value in knowing how patients take their products. The goal is to find new ways to automatically share personalized information with patients as they sign up, and then machine learning technologies will help analyze the massive amounts of data (McGrane, 2017).

To sum up, healthcare industry is a promising market for artificial intelligence technologies in different areas, such as drug discovery, hospital operations, medication management,

patient's care, analyzing research literature, publications and patents, medical records, discovering and managing new diseases, and crowdsourcing treatment options. It is likely that the main cause for artificial intelligence being widely used in the healthcare industry is the availability of enormous amount of historical data, better artificial intelligence algorithms, and going toward automation and digitalization. As such I extract five most important benefits artificial intelligence brings to healthcare industry. It is important to note that artificial intelligence technologies bring benefits to everyone who is a part of healthcare industry, from doctors, medical researchers, pharmaceutical companies, hospitals and even patients.

The most important benefits of artificial intelligence to healthcare industry are:

1. Increasing speed in discovering new diseases and drugs.
2. Quicker patient diagnoses.
3. Higher accuracy of data analysis and better data analysis.
4. Saving more money.
5. Saving more lives.

Regarding the first point, it takes years for humans to discover new drugs or diseases. However, as seen from the above business cases, with the use of artificial intelligence technologies, some processes within discovery can take now only a few days and it can even help to discover faster diseases, such as cancer. Virtual nurses are helping doctors to monitor patients faster, which creates more time for doctors to take in only patients in high need. Artificial intelligence also improved planning and scheduling appointments with doctors as speech recognition software is used and can handle these routine tasks by itself. IBM's Watson and Google's Deep Mind are the two examples of how artificial intelligence can be used to create better and faster analysis and help recognize patterns about patient's data (medical images, medical statistics and other data faster and more accurately than doctors would. By making more accurate and faster analysis, artificial intelligence algorithms can help doctors to improve their diagnosis and help them forecast the spread of disease as well as customize treatments. Furthermore, it can provide patients with more detailed and better information about their health. Computers can also analyze data in a faster and more accurate way than humans and are able to search for patterns, which help to predict diseases and inform treatment plans (Novatio Solutions, 2017). Furthermore, artificial intelligence can help optimize daily routine tasks in healthcare industry. As seen from the business case El Camino hospital, virtual agents could automate routine patient interactions. Or, natural language processing technologies can analyze past medical records, articles, medical publications etc. One of the benefits is also that it can take out the human error and human limitations. Relying on computers, can bring better outcomes, better directions and predictions, and overall a better healthcare for everyone (Bughin et al., 2017b).

Also, probably the biggest two advantages of using artificial intelligence in healthcare industry are saving more lives and saving more money at the same time. Due to earlier and more accurate diagnoses, healthcare costs could potentially drop. Healthcare industry will spend globally up to $8.7 trillion by 2020 according to Deloitte (2017). It is assessed that artificial intelligence applications will save US healthcare industry about $150 billion in the next ten years (Collier, Fu & Yin, 2017).

According to McKinsey Global Institute (2017), artificial intelligence technologies will help to make better and faster diagnoses, discover new medications and create better patient's treatment plans. However, the main challenge in healthcare industry represents trust since a lot of tasks is now performed by machines. Healthcare providers need to adapt to the changes in the way they do business. It is important to employ highly skilled and educated people that can successfully adopt and operate artificial intelligence. Employees have to do careful analysis of the data they put in system, so that it is correct, accurate and not outdated. Furthermore, doctors, all medical workers, and even patients, should be trained how to use artificial intelligence. However, if healthcare industry succeeds in creating ethical standards and making artificial intelligence technologies user-friendly and of proven clinical utility, then societal benefits will arise from the use of artificial intelligence (Hamet & Tremblay, 2017).

## 2.2 Retail industry

In today's competitive retail environment, it is important for retailers to not just offer innovative products with low prices, but to compete successfully, companies have to put an emphasis on full customer's experience. For customers, it is important that retailers offer them responsive, convenient and personalized services. For retailers to do that, they have to get to know them (Grewal, Levy & Kumar, 2009). In recent IBM survey, 91% of managers in retail industry estimate that artificial intelligence will present an important role in the future, and 83% of managers say that artificial intelligence will be crucial in their future decision-making procedures (Fainisi, 2017). Moreover, it is estimated that 85% of customer interactions in retail industry will be done by artificial intelligence in the next few years (Mazumdar, 2016).

Although consumers may not always be aware of artificial intelligence, it has already been used in many applications and processes in the retail industry. For example, retail industry, like healthcare industry, is already full of datasets covering information about businesses, customers and their preferences, behavior, and inventory. Currently, best artificial intelligence solutions are provided by the biggest tech companies, such as Amazon's Echo, Amazon's Go, Google's Home or Apple's Siri. According to Bughin et al. (2017a), some of artificial intelligence applications being applied in the retail industry are:

1. Virtual agents with the use of machine learning, natural language processing and facial recognition software are used to greet you personally, help you with directions and orders.
2. Personalized promotions with the use of machine learning send you to your smart phone discounts and other offers while you are browsing through the store by matching shopper's profile.
3. Interactive screens with the use of image recognition and deep learning recommend products based on identifying articles to be suitable for shopper's lifestyle.
4. An autonomous shopping cart can follow the shopper from the store to their car.
5. Artificial intelligence robots can help with the inventory management, from tracking the inventory, replenishing empty store shelves, to filling packages in the warehouse.

The three greatest opportunities for artificial intelligence to be adopted in retail industry are to help with inventory management, to predict purchase demand, and to create better customer support and automate operations and consequently, to create a better customer experience.

One of the main goals of any retailers is to keep their inventory on the right level and to know beforehand what the demand for their products will be. Many well-known companies, such as Amazon or Target, are now using artificial intelligence to optimize their business processes. They are known to anticipate your needs and recommend you the products you need or like. They send you items before you even need them. Another example of utilization of artificial intelligence in retail industry is also the company Lowe, which is using robots as part of their inventory management. Autonomous robots help customers by showing them where they can find certain products in the store. Consequently, employees have then more time to consult with customers on creative projects. They are using image recognition and machine learning to perform inventory scans and find patterns in price or product inconsistencies (Walker, 2018a).

In the last years, Walmart has shown progress in adaptation of artificial intelligence. Walmart started to use artificial intelligence to improve its inventory management. They have stored all the data in the cloud via Walmart's "Data Café", where the data is being reviewed and analyzed. Some tasks can be done much faster by machine than would otherwise be done by employees. Artificial intelligence helps to create better forecasts and personalized product recommendations to specific customers based on their past purchases. It also helps managers to stock effectively without making errors (Boyd, 2017). Walmart is even testing Lowebot, the autonomous robot from Lowe, in its warehouses to improve inventory management (Kirby, 2017). Otto, a German E-commerce merchant uses artificial intelligence and deep learning techniques to analyze billions of transactions, which helped the company cut surplus stock by 20%. Artificial intelligence system analyzed data, which showed that consumers are less likely to return products if they arrived within two days and

they like to get everything they have ordered at once. By predicting before-hand what customers are going to buy, Otto managed to ordered products ahead of time (Bughin et al., 2017b).

Today, the interaction with customers is extremely important. If the customer is happy than the business is happy, and consequently shareholders as well. If the customer service is not excellent, customers will immediately change the retailer or shop where they buy products (Ltifi & Gharbi, 2015). The most important thing in the online retail industry is personalization, which is also the next big step for artificial intelligence. By gathering a lot of data, machine can extract and track the user's past activities, for example, purchase history, view history, products added to the wish list, and that way it can predict what customer likes or not (Mazumdar, 2016). To help with customer experience, artificial intelligence is currently used mainly to automate phone and email reminders, to automate customer data entry, and to suggest merchants the best phone scripts when they sell their products (Fagella, 2017e). The company Dressipi created a chatbot that customers can use in-store to find the best clothing for them, with the responses being completely personalized for that person, based on their personal preferences (Smith, 2017). Amazon is investing heavily in artificial intelligence and deep learning to make its recommendation engine even better. While browsing, Amazon recommends products that the customer is interested in, based on his/her previous searches and purchases (Amazon). Starbucks is using artificial intelligence in combination with Amazon's virtual assistant Alexa. Users can make orders by saying to Alexa or an iPhone app what they want, consequently decreasing waiting lines and improving customer experience (Gottsegen, 2017; Ruuse, 2017). Many E-commerce retailers are now using IBM's Watson to help with order management. One example is the program Gifts When You Need (GWYN). Through information provided by consumers about gift recipient, the software creates recommendations through a personal and detailed information with users, which makes online gift-giving simpler and easier for customers (Fagella, 2018). The company North Face is also using IBM' Watson to help consumers to determine what jacket to buy. Based on variables like location and gender preference, the system recommend the jacket that is best for them. The system is using machine learning techniques and is able to go through thousands of consumers preferences in a short amount of time (Fagella, 2018).

Another example of improving customer experience can be seen in the development of AmazonGo, which is a store based on automated checkout. The consumer enters the store with the Amazon Go app and picks up their chosen products, and then walks out of the store without having to wait in line. This is made by machine learning and computer vision algorithms, which are teaching themselves to identify patterns and products in images. This not only improved shopping experience, but also the profit margins for larger retailers increased by 30-55% using this technology, by reduction in the cost of employing cashiers. The goal is to decrease consumer's waiting time in lines for the cashier (Jaucot et al., 2017).

Alibaba also used artificial intelligence to improve personalized recommendation, which showed in increased matching accuracy of recommended products with customer demographics, and consequently there were more click-through and conversion rates, which drives monetization improvement (Jiang et al., 2017). Another interesting example is Ant Financial that launched "Pay with Face" service at one KFC restaurants. The users can make the payment through facial recognition, which uses artificial intelligence in cameras (Jiang et al., 2017).

As seen from the above-mentioned case studies, retail industry also makes a great area for implementation of artificial intelligence. There is a huge availability of enormous amount of data for companies to analyze about consumers. Artificial intelligence brings a lot of benefits to the retail industry, and among them the most important ones are:

1. Improving inventory management.
2. Faster data analysis.
3. More accurate and real-time forecasting.
4. Increasing number of customers by creating better customer experience.

With the use of artificial intelligence technologies in their machines filled with data about consumer, retailers can get information faster, which is an important aspect, as the companies are competing between each other, who sells their products or services faster.

From the above-mentioned business cases, we can observe the impacts of artificial intelligence can be already felt in all areas of the industry, from store management, to online shopping and customer relationship management. Retailers can now predict purchase demand faster and more accurately, like Walmart is doing. With the use of artificial intelligence technologies, they optimize store businesses and most importantly, relieve workforces, making them more time to consult customers. Retailers can also get the customer to buy more, since artificial intelligence software is able to tell what the customers need before they do. For example, Amazon's recommendation system with the use of machine learning techniques is analyzing previous purchase and search data faster that the human would and recommend customers the products they like or need. Consequently, customers buy more, and this makes the business better. What we can also observe is that using artificial intelligence software systems can also improve customer's experience a lot. For example, customers do not like waiting lines and Starbucks found a way to shorten the waiting time. They are using virtual personal assistant Amazon's Alexa which takes orders from customers. However, with the increase use of virtual assistants taking orders directly from shoppers, retailers may someday be replaced and will need to think about new sales skills, since less human intervention will be needed.

Artificial intelligence technologies can discover different patterns in customer's buying preferences and learn about the products they buy. By analyzing demographic data, the artificial intelligence system can help retailer to understand the type of customers who are engaging with its brand. The system can then offer retailer recommendations on which items should be put near each other on their shelves in order to sell more to customers (Hudson, 2017). This could be seen from business cases Amazon or Lowe. Artificial intelligence systems can also help with better predictive and what products should be stocked in the store and where (Nair, 2017), like seen in business case Walmart. Artificial intelligence also helps to analyze data faster and more accurately. By improving forecasting accuracy, artificial intelligence can help better anticipate consumer expectations. Otto, is an example, where we can see how the artificial intelligence system helped the company reduced their product returns by analyzing and predicting customers' data. One of the advantages seen in retail business cases is also that artificial intelligence can eliminate many levels of manual activities, which can be seen in Amazon Go case. Furthermore, artificial intelligence can also assist retailers in predicting how the store will be performing in the future, as more sales migrate online, and there is increased availability of customers data, which can be analyzed better with the use of artificial intelligence technologies.

In retail, most of artificial intelligence technologies that are being used are machine learning, deep learning voice and face recognition, computer vision techniques.

### 2.3 Marketing/ advertising industry

The aim in marketing is to understand the customers and the more you know them, the better you can serve them and the more you will sell. Most artificial intelligence in marketing applications are focused on B2C use cases, many of which we are familiar with as consumers ourselves. Most of us know that the ads that show up on Facebook, on banners or on Google are targeting individual users directly based on past behavior, demographic data, location information and more. Such thing could not be done at scale without the use of artificial intelligence (Fagella, 2017b). Today, digital marketing offers a huge amount of data, and marketing can be said to take precedent over other areas like customer service and business intelligence because of its direct tie to driving revenue (Fagella, 2017a). Understanding human behavior is extremely important in marketing and that is why the advertisers are starting to invest heavily in artificial intelligence. There are already a number of artificial intelligence applications applied in advertising and media, ranging from, ad targeting, content creation, dynamic pricing, predictive customer service and product recommendation, sales forecasting, web/app personalization, and so on.

In marketing the biggest challenges are to improve search and recommendation engines, demand forecast, content generation or personalization of content, brand experience, sales

and marketing effectiveness, targeting the right customers and efficient advertising. Next, I will present how artificial intelligence can tackle those challenges, based on few case studies.

Ten years ago, searching an online store for a product would likely only yield the correct result if the exact name of the product was typed in the search field. Today, in large part due to artificial intelligence, search engines have become far superior. Searching for a product is easier and faster. For example, even typing "women's skirt" in a search field on an online store would show the results of women's skirts that store offers. When searching for a movie, a customer may look for a movie based not on its title, but also by genre, length of the movie, actors, directors, and so on (Fagella, 2017f). Another example is RankBrain by Google, an artificial intelligence algorithm which helps to provide the most relevant search results to a user. With the use of deep learning and neural networks RankBrain can identify photos, recognize images, identify responses to search queries and is able to process millions of results per day. Artificial intelligence helps to identify even words it is not familiar with yet, by providing results with similar meaning to the words (Metz, 2016; Clark, 2015). Another search engine that uses artificial intelligence is Bitvore, which delivers proactive and personalized data to businesses in real-time. Artificial intelligence filters through information, helping businesses spot untapped sales opportunities, trace valuable trends, and identify potential risk factors (Mitchell, 2017). More recent example is Liketoknow.it app, which is changing the way we shop clothes. It is an app that allows you to take a screenshot of a picture of outfit you like, and the app tells you, by using artificial intelligence and computer vision, where you can find those similar clothes (Tepper, 2017).

Today, recommendation engines are the most significant for the customers in the marketing environment. Amazon uses artificial intelligence for book product recommendation, Spotify to learn about your taste in music, and Netflix for movie recommendations. The companies are using artificial intelligence to improve personalization by showing their potential customers the products they would probably like but are no likely to find on their own. Moreover, customer experience marketers offer is improved as they are able to not only show them the right products, but they are also able to show them at the right time and on the exactly the best part of their webpage (Arora, 2016).

One challenge for businesses is to make correct predictions of demand for their products and the correct predictions of their customer's responses to marketing activities (Allenby, 2017). For example, companies like Rapidminer, Birst and Sisense are using artificial intelligence technologies to create better predictions with the help of high quantity of marketing data, such as clicks, views, time spent on page, purchases, email responses, and so on. Artificial intelligence technologies are trained to analyze data much faster than a human would. Today, companies, with the use of artificial intelligence, are able to predict the success of their email campaign, which can help them improve their marketing plans.

Most people would think that sports, weather forecasts or financial articles are written by humans. In reality, it is not unusual today that they are actually written by machines. For example, Automated Insights and Narrative Science are two companies that have been able to transform certain pieces of information into human-readable articles. Sometimes you cannot even distinguish them from those that are written by humans. In the future it is expected that companies would use artificial intelligence also to create product descriptions and articles. Wayblazer is a company that uses artificial intelligence to identify millions of travel videos, photos, reviews and global destinations to provide recommendations, which are made specifically for every customer, based on their data. Another example is BMW, which offers an app that helps to schedule your trips, tells you how to avoid the traffic, where to find a parked car or nearby gas station (Bulik, 2016). Another example is a news service agency Associated Press that used artificial intelligence and natural language processing to write reports. Journalists did not lose their job however, they gain more time to focus on more qualitative and high value-added work (Jiang et al., 2017).

Advertising agencies are no longer in business of building campaign that target the big crowds. Now they target a 'market of one' and to do that they are using artificial intelligence to adopt to and play off your emotions. There are billboards equipped with facial tracking technology and genetic based algorithms that are able to watch people and analyze and learn from them. By using artificial intelligence, they are then able to customize its content to show the most relevant result a person wants to see. This kind of customer-specific content is not unique to street ads, it works across all platforms that reach of all your devices, from your phone through television. An interesting example is the company Mand C that created artificial intelligence poster outdoor campaign for invented coffee brand Bahio. Artificial intelligence system tests different people's reactions when going by and looking at the poster, which helps to create better ads (Carter, 2015).

From the above-mentioned business cases, the reader can observe that main benefit of using artificial intelligence in this industry is to help companies to get to know their customers better and by that keeping them happy and keep buying their products. These could be done by:

1. Creating better recommendation and search engines, so that customers get in touch the products they like before they even know they exist or they need them.
2. Personalization of content helps to create better customer experience, as the artificial intelligence system deeply analyzes data about customer and provides him or her with the best suggestions.
3. Artificial intelligence personalization can offer better targeting, as artificial intelligence and machine learning algorithms are more suited to optimize content accurately and content is being more relevant.

4. Better marketing forecasts helps companies to create better shopping predictions and more personalized and better advertisement of their products.

As more purchases are made online, there is a higher availability of data about customers and their preferences, creating a great place for artificial intelligence to be used. We can observe that artificial intelligence will not do the marketing by itself but working together with humans (augmented artificial intelligence), it can create new opportunities in the industry. One of the challenges in the future may be how to manage those collaborations to the fullest potential.

### 2.4 Financial industry

Artificial intelligence has also already been a part of the financial industry. The main triggers for artificial intelligence development in this industry are the innovations in big data, computing in the cloud, increased speed of computer processors and open-source software. Also, there is a massive amount of data available, which creates lots of opportunities for more digitization and automation. Financial institutions are starting to invest heavily in artificial intelligence and in the skilled employees they need to effectively adapt and implement artificial intelligence into their business. Like in other industries, artificial intelligence helps to transform most fundamental financial processes. Artificial intelligence systems can especially tackle challenges like improving personal finance, wealth management and stock trading, as well as customer service (Culp, 2017).

Machine learning applications are also already changing personal finance. For example, saving and budgeting applications are helping users to make recommendations for how to allocate their money, or there are personal assistants that help customers from paying bills to managing online accounts. Acorns, for example, is a mobile application that uses machine learning to connect customers with their bank accounts and gives them insights about their spending habits (Powell, 2017). Another example is Alistair Bentley, which uses natural language processing to create summaries of trade data for stock investors, so they can track the performance of the portfolios they own instantly (Powell, 2017).

Another application of artificial intelligence in financial industry are virtual advisors, which are able to give investors the information they need as well as provide them with data-driven insights of financial data (Schlesinger, 2017). Interestingly, there is a hedge fund called Equobot that is the first even fund that is managed by an artificial intelligence robot. The fund is able to compare thousands of businesses daily to optimize both the stock selection and the exposure to the market. Even though traders have been relying on computers to identify patterns using technical analysis for quite some time now, Equobot is different from those computers in a way that it is able to pick the best stocks by using a variety of factors, including fundamental data such as profits, earnings releases, consumer trends and so on –

similarly to how humans have been doing it for decades. Of course, Equobot learns by itself, so there is no need for it to be reprogrammed by its developers (Lim, 2017).

Artificial intelligence applications are also widely within banking, ATMs and online banking. Numerous banks started to use digital assistants to provide users with support that is made personally for them based on their needs. For example, in the future it is expected that digital personal assistants will be able to analyze your purchase history and provide financial recommendations. There are number of complex, routine and repetitive procedures in the financial service industry. For example, it takes a lot of time of writing a claim with an insurance company or applying for a mortgage. There are many documents that need to be filled and completed. Today, artificial intelligence is used to help with reviewing documents and helping customers with their problems regarding documentation forms (Alton, 2017). Swedbank group has created Nuance Nina, an intelligent virtual assistant that can handle many different customer questions and answers, which reduces the amount of time customers must spend on the phone seeking answers (Burlington, 2016). JP Morgan Chase company uses artificial intelligence to review thousands of commercial credit documents and extract the most important sections. With the use of artificial intelligence, the company managed to reduce the total time needed to analyze documents from hours to only seconds, resulting in cost savings and faster service (Alton, 2017).

Given the high volume of historical records of financial data, artificial intelligence is also well suited for financial industry. From the above cases we can observe that machine learning plays an integral role and creates new opportunities for businesses. It is significantly important however, that the data is clean and right to prepare the correct financial analyses and recommendations for customers. Artificial intelligence is taking place of human analyst very fast and many financial operations are being automated by artificial intelligence. In financial industry artificial intelligence is mostly used in predictive analytics. It helps to provide much higher accuracy results and helps with credit risk, customer analytics, regulatory compliance.

### 2.5 Law/ fraud detection

The work of paralegals and junior attorneys that once took days now takes minutes, since artificial intelligence technologies can review documents and contracts much faster. Due diligence is also a field within the law industry that is being helped by artificial intelligence significantly (Mangan, 2017).

According to Marwaha (2017) the most important areas where artificial intelligence can be used in the law industry include:

1. Reviewing legal documents for relevant information.

2. Searching the acts and past law cases for legal research.
3. Analyzing contracts.
4. Proofreading, corrections errors, organizing documents.

Numerous businesses in law and fraud detection industry have already adopted artificial intelligence. For example, Sift Science has developed an artificial intelligence system that is being used by 6000 companies and is helping them with identifying not only fraud, but also payment fraud, account abuse, content abuse, promotion abuse and account takeover (Musthaler, 2017). Another company, PayPal is using machine learning and deep learning to fight money laundering. Algorithms are analyzing past purchases of customers and compare millions of transactions. As a result, PayPal is able to differentiate between legitimate and fraudulent transactions between buyers and sellers (Morisy, 2016).

Main advantage of using artificial intelligence in law industry is time saving, since computers can analyze more information in less time than humans. Those time savings can translate also in less stress and boredom of people working in law. Attorneys for example, have then more time to focus on real problems than spending time on doing preliminary reviewing.

Fraud detection is an important area in law. For sure, most of us have sometimes gotten an email asking if a strange purchase on our credit card has been made by us. Immediately, if a bank notices that a fraud may have been committed on your account, it sends you this kind of email. Artificial intelligence now helps to effectively observe this type of fraud. It analyzes data about customer's past purchases and based on that computer can categorize which purchases were fraudulent and non-fraudulent (Buonaguidi, 2017).

### 2.6 Government/ security

One of the most important goals of any government is to have the best security system. Because of the digitalization and enormous usage of internet-based applications, also governments are offering more services that are done digitally. This means, people can access a lot of information at home using their mobile phone or computer. However, this means that there is a huge amount of sensitive information available online and therefore this requires the best security. Cybersecurity companies are starting to use artificial intelligence to help them detect and respond to threats.

One of the businesses that have adopted artificial intelligence is Cylance, a cybersecurity company that uses artificial intelligence to detect and block threats before they can affect your computer. Artificial intelligence helps to provide solution that predicts viruses better and more accurately. Another example is Darktrace that uses machine learning to find patterns in order to catch cyber criminals even before they commit a crime. New cyber

threats are made faster than human employees can spot, and artificial intelligence allows companies to stay ahead of the criminals (Carey, 2018). Intel built artificial intelligence that analyzes information gathered from security cameras, such as the number of people in the crowd, facial recognition, and even examination of people behaviour in order to determine whether there may be a security threat. The artificial intelligence system can see a warning sign and immediately alert human security officers (Gershgorn, 2017).

Artificial intelligence applications help governments save billions of dollars through task automation by reducing backlogs and lowering costs of fraud prediction. Automating tasks can also shorten number of working hours, since work can be done much faster by machines than by humans (Eggers, Schatsky & Viechnicki 2017).

## 2.7 Education

In education, artificial intelligence helps to develop a more precise explanation of the workings of a human mind (Fagella, 2017c). Schools are only one of the possibilities today where people can learn. There are now more ways available to learn new things, for example via online tutoring systems or online learning courses, audio books or even podcasts. Today, almost every other person is using a mobile phone and thus a greater possibility of using the Internet at every step. People can therefore learn a lot of things just by writing a word in google search engine, which provides them with results of what that word is.

The biggest challenges the education sector is dealing with are: personalized learning, attracting and keeping students, slow administrative processes such as grading system and how to learn more in less amount of time.

One of the artificial intelligence progresses in education sector would be the use of intelligent tutoring systems. For example, Carnegie Learning develop a program called Mika that offers personalized tutoring and feedback in real time. Another example is Content Technologies, which uses artificial intelligence to create smart content services for education by analyzing learning books (Fagella, 2017c). Kwiziq is the artificial intelligence language coach that people can use to learn a second language, by providing each individual their personalized learning experience based on their needs (Carey, 2018).

Using artificial intelligence in education sector brings a lot of new advantages. It can help both teachers as well as students. For example, it can speed up the administrative processes, such as grading homework and evaluation of essays, which can be sometimes a long and boring process. For students, artificial intelligence improves personalized learning based on their individual needs, as seen from the case Kwiziq. They can also receive faster results via chatbots or using digital tutoring systems available via internet. The biggest advantage we can observe that bringing artificial intelligence into educational

sector, creates more time for teachers to focus on individuals and their own learning paths. Also, students are able to learn more by themselves and to focus on the main mistakes they are doing. We can also observe that educational sector is changing a lot by bringing artificial intelligence into it. We can predict that the use of virtual teachers will be increased.

## 2.8 Manufacturing and automotive industry

The manufacturing industry is faced with difficult challenges, such as skilled labor shortage, high costs, sharp growth in demand, quality of products, power consumption, slow production, environmental issues, high regulations and restrictions, etc.

However, today there are already a lot of robots available that are working much faster and more reliably than humans. But, they are capable to perform only specific tasks and most of them are programmed and regulated in ways to save human coworkers. Artificial intelligence is therefore discovering its place also in manufacturing. Companies are required to focus on artificial intelligence to make processes in all aspects of manufacturing more intelligent, to improve just-in-time manufacturing, planning and coordination (Keen, 1992).

Next, I will present the companies that have implemented artificial intelligence into their businesses. Siemens uses artificial intelligence to help with optimization of gas turbines, predict maintenance or improve monitoring (Busch, 2018). In Japan, many train accidents happen every day and consequently there are many delays. The Japanese company Jorudan Co., Ltd. in collaboration with Fujitsu started to use artificial intelligence and machine learning technology to help them predict train delay time (Fujitsu, 2016 and Leopold, 2016). General Electric (GE) started to use artificial intelligence and machine learning to gather and analyze data from power utilities, oil and gas companies, wind turbines, locomotives, factories and aviation. Artificial intelligence software helps to predict maintenance or reduce downtime in machine (Ruuse, 2017; Woyke, 2017). Airbus also started to use artificial intelligence to improve production rate (Ransbotham et al., 2017).

Driverless cars have been the hot topic in artificial intelligence field recently. In the next decade, autonomous vehicles may replace drivers, since there is an improvement in computer vision and recognition. The latest autonomous and smart technology is able to adapt to different and challenging environment. With the help of artificial intelligence and deep learning three-dimensional maps can be created, which can tell exactly what is happening around the vehicle to make better driving decisions. Currently, there are number of companies, for example, Uber, NVIDIA, Google or Mobileye, that are investing in artificial intelligence technology (Knight, 2017). For example, NVIDIA is one of the world's best-known manufacturers of computer graphics cards, however, recently, it announced computing platform for use in autonomous vehicles (Hawkins, 2017). It uses deep learning,

which helps to observe and understand what is happening around the vehicle. It is even capable of defining exact location on map and is planning a safe trip forward.

Google is one of the companies that have also implemented artificial intelligence to manage power usage across its datacenters. Consequently, overall power consumption savings were significantly reduced (Jiang et al., 2017).

We can observe, manufacturing industry is also being touched by artificial intelligence in different ways, from automation of production processes, improving predictive maintenance and optimization or improvement of products. Factories and manufacturing centers mostly rely on automation, robotics and complex analytics, which creates a good place for artificial intelligence to be implemented. Mostly, machine learning and image recognition are used.

Since there is usually a production of mass number of products the automation of production processes is needed to faster prepare products for the market. In manufacturing and automotive industry there is a lot of manual work and a lot of work done by machines, which makes a great place for artificial intelligence to be implemented. Machines are linked to computers, which are using artificial intelligence, that analyzes by itself the processes and gives updates about the work. We can observe that there is less human guidance needed to work with machines, as manufacturing is getting more intelligent. However, this brings new challenge, which is the adaptation of humans to work together with machines.

We can observe that artificial intelligence also helps better prediction of maintenance and capacity planning. For example, as seen in cases of General Electric or Airbus. With the use of artificial intelligence, companies also improve quality, reduce production time, inventory costs and create better supply and demand planning, as seen in case of Japanese railway system.

Artificial intelligence also brings changes into automotive industry, bringing the biggest achievement so far, which is self-driving car. However, artificial intelligence in automotive industry could bring a lot of risks. Most people will probably do not believe in cars driving by themselves and would be scared. The biggest risk would be how a machine would know what to do in certain situations to avoid accidents.

## 2.9 Agriculture industry

Agriculture is being touched by climate change, population growth and food security concerns. Since the industry is seeking the new and more innovative approaches to improve processes, artificial intelligence is becoming an emerging part of this industry as well (Sennaar, 2017).

There are few important challenges the agriculture industry is facing with: climate change, food security concerns, improving agricultural productivity to meet increasing demand, making food systems more efficient and preventing food threats (FAO, 2017).

The FarmBot Genesis is a small production company that is using an artificial intelligence robot which can grow the food you need in your backyard (Kim, 2016). Blue River Technology uses machine learning in its camera sensors to provide you with insights of what is the right number of herbicides to be sprayed in each area (Sennaar, 2017). The company PEAT developed deep learning system that identifies potential defects and nutrient deficiencies in soil (Velykholova, 2018). The company aWhere uses machine learning to track and predict various environmental impacts such as weather changes on crop yield. Satellites are connected with the artificial intelligence system that helps to forecast the weather, analyze if crops are sustainable or not and even for assess farms for viruses and pests (Velykholova, 2018). Aveva implemented artificial intelligence to improve predictive maintenance. Artificial intelligence technology is collecting big data sets about plant environment, from different sensors, for example temperature sensors and then using pattern recognition to determine maintenance need of various equipment (Jiang, et al., 2017).

Machine learning, deep learning and image recognition are the technologies that are now reshaping agriculture industry. As seen from cases, they are enabling faster and greater automation. For example, seen in the cases of FarmBot Genesis and Blue River Technology. It is extremely crucial for farmers to monitor their fields, have the accurate timing of when to for example water the plants. Also, in this case artificial intelligence brings benefits, as we can see in case of Blue River technology or PEAT. Artificial intelligence systems help farmers to prepare better analysis, predictions and to help them take the most appropriate action.

Today, artificial intelligence already brings a lot of changes in agriculture industry. In the case of FarmBot we can observe that today, you can even grow your own food at home and that way avoid spending time at shopping stores or food markets. Furthermore, you have control if the food is healthy or not (Kim, 2016). Or now, farmers can even predict weather forecasts, which can have drastic effects on yield crops, as seen in the case of aWhere (Velykholova, 2018).

### 2.10 Business processes

Business processes like e-commerce, customer relationship management (hereinafter: CRM), supply chain procurement, hiring process, business administration, are also being a part of digital transformation. Companies are starting to use artificial intelligence systems to automate variety of processes, for example customer experiences, sales, the entire process

of recruiting, logistics, compliance, etc. Many business processes are repetitive and routine tasks which takes a lot of time and can be stressful.

iManage uses artificial intelligence to extract key information from documents and emails. The company X.ai created two virtual assistants to schedule meetings, which creates more free time for employees to do the work they are actually paid to do. Another example is the company Oracle, which invested in artificial intelligence and machine learning to improve personalized marketing experience, predictive recommendations and selling process for representatives. With the help of artificial intelligence, Restless Bandit improved the process of hiring new employees. The program rates potential employees by scanning their applications, finding matches and scheduling face-to-face interviews. It even rates applicants and sends hiring managers lists of matches based on their needs (Dholakiya, 2017). Domo uses machine learning to collect data from different apps and platforms to gather insights and to offer suggestions and give context to business intelligence (Ruth, 2017).

Work can be sometimes monotonous, and some tasks can be repetitive, which can be extremely boring and consequently employees are not working to their fullest potential. Artificial intelligence can now do all those tasks instead of employees, and consequently they have more time to do other, more relevant tasks at work. As seen from the above-business cases, companies have been especially using artificial intelligence to go through large volumes of structured as well as unstructured data and prepare analysis. For example, a lot of CRM companies have been adding artificial intelligence capabilities to their products to analyze huge amount of data about consumers to provide them with information about trend and improve their decision making. Administrative tasks can usually be very boring and especially time-consuming; however, they have to be done on time and the right way. It is important to keep track of activities, schedule activities on time, do not forget tasks, etc. This is also a place for artificial intelligence to be implemented. It can also help to make transactions, transferring data, interpreting legal documents (Berger, 2018). For example, X.ai virtual assistant helps to improve this by automatically schedule meetings.

Also, the entire process of recruiting, interviewing and on-boarding of new employees can be extremely long and boring. And in the example Restless Bandit, we can see how artificial intelligence can improve these processes. The biggest advantage here is that artificial intelligence can save a lot of our time and energy by doing easy, repetitive jobs, so employees have more important tasks to do.

### 2.11 Lifestyle

People these days want to do everything fast, not wait in lines, do work from home and have more free time to spend with their families and friends. Today, everyone owns a mobile phone and each day new apps are being created, which are changing the way we live.

Technology is becoming much smarter every day which is making our lifestyle much easier, faster and efficient.

On every smart mobile phone or computer there are now available digital personal assistants, for example Siri, Alexa and Cortana. They are using voice recognition which enables them to recognize voice commands. You can ask any question and personal assistant will answer based on the data it gathers from your phone or internet. Moreover, it provides with results or recommendations that are tailored to each individuals' preferences. They have the ability to constantly learn and update their information about its user and according to Microsoft, this could lead to the development of such assistants that will know how to predict user's needs. Artificial intelligence that is used in these applications is mostly speech recognition, natural language processing and machine learning.

Apps like Spotify, Pandora and Netflix are also the ones using artificial intelligence. These apps are providing users recommendations for music and movies based on their taste. Artificial intelligence algorithms are able to track what customers have searched in the past and based on this provide recommendations for each individual. For example, it will recommend you similar songs based on the song you listened before (Underwood, 2017).

Today, there are also a lot of smart home devices available, for example smart cameras, smart thermostat, smart lightning system, smart locks, and so on. Artificial intelligence has the ability to learn your behavior patterns. For example, Nest thermostat is using artificial intelligence which is observing the temperature around and regulate the temperature you like based on your schedule. Another example is Amazon's Echo, which you control with your voice. For example, you can say to play some jazz music, or turn off the lights, or even order items from Amazon. Over the past decade there have been improvement is cleaning robotic capabilities. An example is the company iRobot, which created the first robotic vacuum cleaner Roomba already in 2002, with only few capabilities, such as identifying walls and avoiding stairs. Today, Roomba can scan the size of the room, identify different obstacles and remember the most efficient routes and methods (Knight, 2015).

Chatbots can perform various tasks. For example, it can address consumer requests in a variety of industries, improve online shopping experience or even help as a virtual personal home assistant. A Chatbot is a robot assistant which you engage to have a conversation with to get what you need to get done. The conversation take place via text messaging or voice commands, and this is enabled by artificial intelligence. The Chatbots can be found in various popular chat platform, such as Facebook messenger, Google Allo or Amazon Alexa. For example, Google Allo can help you to get basic questions answered, provide you with recommendations for restaurants, movies or song, or navigate you to the place you want to go (Walker, 2018b).

People always want to make their lifestyle better in such way to have more free time to spend it with their families, friends and doing things they love. Technology is reshaping our lives and we cannot imagine living without mobile phones. Observing above business cases we can see they are used to make technology apps and devices smarter, which consequently makes our lives more efficient and easier. More and more tasks are being automated, which saves a lot of time for us. For example, the availability of smart cleaning robots that clean our house by themselves and in the meantime, we have more time to spend with our family and friends, etc. Artificial intelligence systems have the ability to learn from our past behavior patterns. Most of the apps are using machine learning, voice recognition, face recognition and speech recognition techniques.

# 3 ANALYSIS OF BUSINESS CASES ACROSS AREAS

In this chapter I will provide most important findings of business case studies based on the literature review of artificial intelligence presented in the first chapter to show the significant importance of artificial intelligence for the future. I will describe the most obvious and important benefits that artificial intelligence brings into our business environment and into our lives.

The first observation is that artificial intelligence can change, disrupt and improve business processes across different areas. Artificial intelligence brings a lot of improvements, especially in the way of making business or production processes better, faster, more efficient and helping create better analysis and predictions.

From the business cases described above I can extract six most important ways how artificial intelligence can help companies:

1. **Time savings.** As artificial intelligence can be used to do a lot of repetitive work much faster, we get more time to do other things in the meantime. Moreover, work with the use of artificial intelligence products or services can be done much faster and with less costs as well. We can observe this in cases all over the industries. Since there is huge amount of information available every day, for humans is impossible to analyze it and create the best and most accurate analyses from it. Analyzing huge amount of data is extremely time-consuming task, and with the use of artificial intelligence, humans gain more time to do other higher value-added jobs. Furthermore, there are some analysis that humans could not done them by themselves, for example fraud detection, information security, customization of adds, recommendation sites, and so on.
2. **Automation of tasks.** Artificial intelligence can be used to automate many tasks and they can be done better, faster and cheaper. Especially in the cases of manufacturing we can see the biggest improvements. In the past, humans needed to participate in every part

of production, however now, they can only supervise the work being done by machine. That way employees have also more time to develop and perform more innovative services.

3. **Driving sales and customer engagement**. Artificial intelligence applications, for example chatbots, personal digital assistants and recommendation systems can help to create better consumer experience. We can observe this in the cases of almost all industries, where there is huge interaction between customers and seller or customers and selling products.
4. **Technical developments/ innovation.** Artificial intelligence improved the work of robots and machines. There are now some technological advances that in the past we could not even imagine we would have, for example self-driving cars, virtual personal assistants or robots that can grow the food you need at your backyard.
5. **Right demand prediction.** Artificial intelligence can generate real-time targeted advertising on websites. Artificial intelligence can improve demand forecasts, which can be especially seen in retail industry. Since there is a huge amount of data about customers available online, artificial intelligence can proide direct insights about customers and processes in much faster and accurate way than human could.
6. **Creation of new business model**. Digitalization and better data analysis allow companies to change the way they are doing business. With the use of artificial intelligence employees have more free time to work on their individual performance, since they are spending less time performing routine and boring tasks. They gain more time to think about new products, new market strategies and engage more with their customers.

From the business cases described above I can extract three most important ways how artificial intelligence can help individuals:

1. **Time savings.** With the use of different smart home applications, smart mobile or computer apps, people have now more free time, as they can do a lot of things from home using their mobile phone, for example online shopping.
2. **Personalization.** Today, everything is about individual and their growth. Improvement of personalization can be especially seen in the cases of marketing and advertising. For example, chatbots are used to improve customer service, or artificial intelligence algorithms can recommend products for each individual based on their preferences and past searches. This can be especially seen in the marketing business case studies.
3. **Improved quality of life.** With the development of virtual assistants, smart home applications or smart mobile applications, people have in some way improved and changed their way of life. You can now order products through Amazon just by saying it to your virtual assistant on your mobile phone, and it takes only few seconds, and in the meantime, you can still do some house work. Moreover, artificial intelligence can

even help to improve your health by providing you fast and accurate diagnosis by tracking your health issues.

In the table below, I will present examples of different and most used artificial intelligence technologies that are deployed over each industry.

*Table 1: Examples of most used cases by industry*

| Industry | Artificial intelligence use cases |
|---|---|
| **Healthcare** | Drug discovery, diagnostics, patient monitoring, improved hospital operations virtual assistants, analysis of patients data, research literature, review of medical records, discovering new diseases. |
| **Retail** | Predictive inventory planning, improved customer analytics, support and experience, forecasting, supply chain management, customer churn, personalized online shopping, chatbots for customer services. |
| **Marketing/ advertising** | Search, recommendation engines, demand forecasting, content generation, personalization of content. |
| **Financial** | Virtual assistants for personal finance, wealth management and stock trading, virtual banking, customer support, risk analytics. |
| **Law/ fraud detection** | Prediction of fraudulent behavior, analyzing customer purchashing history. |
| **Government/ security** | Threat detection, fraud detection, smart cities, video analytics, smart surveillance. |
| **Education** | Customized learning programs, virtual assistants. |
| **Manufacturing/ automotive** | Predictive maintenance, forecasting and customer demand trends, video analytics, self-driving vehicles. |
| **Agriculture** | Machine learning driven insights for yield improvement. |
| **Business processes** | Autonomous scheduling, virtual assistants, chatbots. |
| **Lifestyle** | Virtual personal assistants, smart home devices, recommendation systems. |

*Source: Own work.*

We can observe some of the artificial intelligence technologies are being used in all industries. The common point of all industries would be the analysis of huge amount of data and here machine learning plays an important part. The right and huge amount of data is needed for machine to learn and help us prepare better analysis of data, recognize images and text, solve complex problems, understand languages, create predictions and show different patterns about customers, products and processes.

*Table 2: Artificial intelligence improvements/ benefits in across different industries*

| Industry | Improvements/ benefits |
|---|---|
| **Healthcare** | Personalized medicine, quicker diagnosies, quicker drug discovery, more lives saved. |
| **Retail** | Improving inventory management, faster data analysis, more accurate and real-time forecasting, increasing number of customer by creating better customer experience. |
| **Marketing/ advertising** | Better recommendation and search engines, personalization of content, improved targeting, better marketing forecasts. |
| **Financial** | Improved personal and online banking, better customer support, better and more accurate financial analysis and recommendations for customers. |
| **Law/ fraud detection** | Analysis of huge amount of data, time saving, discovery of fraudulent activities. |
| **Government/ security** | Better cybersecurity, reduced costs, reduced blacklogs. |
| **Education** | More personalized learning based on each individuals needs, better tracking of students, faster administrative processes, such as grading system. |
| **Manufacturing/ automotive** | Faster and more accurate production processes because of automation, improved predictive maintenance, optimization and improvement of products. |
| **Agriculture** | Improved agriculture productivity, better forecasting of demand. |
| **Business processes** | Automation of time consuming tasks, time saving, better scheduling of activities, faster process of recruiting. |
| **Lifestyle** | Time saving, better quality of life, easier access to products, faster way of shopping. |

*Source: Own work.*

As mentioned in the first chapter, artificial intelligence can be used to fully automate tasks or to work together with humans and assist them to do the work faster and more efficiently. Automation of jobs can be especially seen in the business cases of manufacturing industry, as there are many routine tasks to be performed. Augmented artificial intelligence can be seen in the business case studies all over industries. Some type of work is done by machine (mostly analysis of data) and some by people (high value-added work). Overall, I can observe that still there is more augmented artificial intelligence then automated artificial intelligence. There is still human touch needed in most cases. Adaptation of human to work together with machines still represents a challenge and I believe people will need to learn how to work more with machines and will need to accept the fact that machines are starting to get smarter and taking a lot of work from us. To grasp the best solutions artificial

intelligence can provide, it is important that people, companies and countries cooperate and communicate more efficiently with each other.

Another observation is that artificial intelligence will change many jobs, and many argue that artificial intelligence could potentially lead to mass unemployment. From the business case studies, I can observe that artificial intelligence is now mostly replacing low-skilled jobs. However, also the jobs that require a higher level of expertise, such as for example reading CT scans, are being already performed by artificial intelligence. I believe that in the next few years, artificial intelligence will not fully replace humans and destroy jobs, however, it will more likely supplement us. However, this will lead to new jobs being in demand. For example, artificial intelligence experts, data analytics experts, IT experts, will be the ones who will be mostly sought from companies.

We can also notice that the main artificial intelligence vendors are now the biggest tech firms, such as, Apple, Google, Microsoft, Facebook and Amazon. They are already taking huge advantages of their large data sets by implementing artificial intelligence into their business.

Looking through all of these benefits, takes us on next chapter, where I present the framework for success of artificial intelligence implementation.

# 4 RECOMMENDATIONS FOR SUCCESSFUL IMPLEMENTATION OF ARTIFICIAL INTELLIGENCE

The aim of this chapter is to present recommendations that would help companies to find a way of how to incorporate artificial intelligence into their business strategy. After careful analysis of the business cases presented in the previous chapter, I came up with 11 steps, which businesses in different industries could follow in order to help them to implement artificial intelligence into their businesses.

The ingredients needed for artificial intelligence to be implemented are in place, i.e. increased computer power, improved algorithms and availability of a vast quantities of data. The main aim for businesses leaders now is to find a way how to implement it successfully. Since artificial intelligence is being a major technological breakthrough, now is the time to incorporate it into business strategies. The biggest bottleneck now are management and implementation, meaning there is not enough basic knowledge of how to successfully apply artificial intelligence into businesses.

According to Accenture (2017), companies will apply artificial intelligence technologies to change businesses in a way as great as the Industrial Revolution changed them. In order to

stay competitive businesses will need to transform the way they are doing business. If artificial intelligence is adopted and used responsibly, consequently, our lives and the way we are doing business will be improved.

In this chapter I provide recommendations for companies that they could follow for successful adoption of artificial intelligence.

**Develop a shared understanding of artificial intelligence**

I believe that one of the most important goals for company's managers is that they do not lose sight of what is going on around them, i.e. what is their competition doing and what are emerging trends in the industry they are a part of. Not all frontline managers really understand what the difference between machine learning and deep learning or the way how neural networks is are working, however I believe that the basic understanding of what artificial intelligence is needed. They should know how the use of new smart technologies can produce better, more accurate results and help making better business decisions.

I provide with three solutions how mangers can get the knowledge about what artificial intelligence is. First, they need to know the basics about what artificial intelligence is. They could visit Silicon Valley, as this is an area of many start-ups that are focusing on artificial intelligence right now. They should also educate senior management and employees about artificial intelligence, since there is also possible risk of how this new technology will affect the employees' roles within the company. That is why is important to prepare a learning culture in your company. They could also create training programs for employees to get to know artificial intelligence technology better and prepare them to work better with artificial intelligence. Second, they should learn the fundamentals, one possibility is to start with simple online courses or online tools, for example Coursera, founded by Andrew Ng, which offers one of the best machine learning online courses. Moreover, everyday there is more literature available to get familiar with artificial intelligence. Third, they should observe what their competition is doing. I would recommend the businesses to create SWOT analysis of artificial intelligence field in the industry to see what opportunities, challenges, strengths and weaknesses artificial intelligence field has. It is important also to do the analysis of what kind of artificial intelligence applications competition in your industry is doing and how do they implement it in their business strategies. It is important for businesses to keep an eye on the emerging trends.

**Embed artificial intelligence into business**

After businesses get familiar with basic information about what artificial intelligence is and how it could help to grow their businesses, the next step is to adopt artificial intelligence in the right way. The businesses should then focus on their organizational needs and what are

the goals they want to achieve, i.e. create better, faster product or service, decrease costs, decrease their operating time, what insights do they want to get from the data they collect etc. It depends on the interest of the company's managers if they want to go in depth into every subfield of artificial intelligence. Before implementing it, the organizations should maybe first try it on personal level. For example, each employee can test artificial intelligence at home, since so many artificial intelligence applications are available, for example Amazon's Alexa or Google Home. Trying out artificial intelligence applications this way will provide businesses new view of how to use artificial intelligence better in business decision making process. Managers need to understand the advantages and disadvantages of what artificial intelligence technologies brings to apply it successfully in their organization. They should also be aware of the speed of adopting artificial intelligence. One of the steps here is also to know what the entry barriers are, what kind of sources do you need, what skills do your employees need, how many data do you need, do you need experts, or will you do it by yourself, where do you get experts or what are some possible partnerships you can make.

For artificial intelligence to be the most efficiently used it is important that people learn how to collaborate with machines. The need for new skills and expertise will increase, especially human capabilities such as emotions, creating thinking, judgment and communication will be vital. Businesses will need to be aware that there will be needing to change how workers learn and work and consequently that career paths will change. People will need to learn how to work with machine and accept that more of manual work will be done by machines. To effectively manage challenges brought by using artificial intelligence, it is important to combine and find interactions between humans and processes with artificial intelligence.

**Identify use-cases you want artificial intelligence to help assist with**

Most importantly is that businesses first set up their goal they want to achieve and what problems they want artificial intelligence to solve, i.e. is the goal to make the product better, more efficient to use or faster, or to improve customer experience of their service, or is the goal to analyze their customers their preferences more accurately and efficiently, etc. One idea is that they could search for opportunities where artificial intelligence could help them produce more products with the same number of employees. Then, they should also look at their current business model and see how artificial intelligence will fit into. Moreover, they should also identify which tasks can be fully automated and which tasks still needs a human interfere.

**Think about customers/ ensure customer trusts**

Customers are the most important fuel of each business. Having them on track and earning their trust is of high need. Artificial intelligence has the power to gain insight into customers

(ethical risk and security risk mentioned in chapter 2). It is important for customers to be aware of the technology the business is using and how it is used. Businesses should take privacy seriously, and since more decisions are relied on computers to be made, this requires careful governance. One way is to implement processes that will check and review the work done by machines. I believe that if artificial intelligence systems are using data about customers, they should be informed and there should be some kind of informed consent.

**Select the right artificial intelligence technology for your business problem**

Once the business did an analysis of the field and determine what are their goals, they should choose the right artificial intelligence technology for their business. These are for example, machine learning, deep learning, vision recognition, image recognition, and so on. It depends what skills do they have, what is the problem they want to solve, etc.

**Assess the available data you have**

One of the important steps is to check the availability of high-quality data. Businesses need to evaluate their current data sets and information system. One possibility is to hire a chief data officer who will check the data and ensure that everything is being correctly managed (Wellers, Elliott and Noga, 2017).

The difference between businesses is their approach to data. Some businesses, for example, are investing in talented experts and have strong data infrastructures, while others do not have the right analytical skills and right access to their data (Ransbotham et al., 2017). One step for businesses is also to do before-hand data quality check, data security and governance, data integration and preparation and data exploration.

**Bring in experts and set up a pilot project**

Hiring the right people is essential to having a good working environment within your organization. There are still not enough people that have capabilities of data scientists or machine and deep learning experts. However, as demand for them is increasing, universities are starting to offer more artificial intelligence courses and online artificial intelligence educational courses that students can enroll to. Before implementing artificial intelligence into business, I recommend setting up a pilot project to ensure successful implementation later.

**Educate and manage employees**

With the use of artificial intelligence more jobs will be done by machines and more tasks will be automated, however this will mean new skill would need to be required to perform

the remaining tasks. Therefore, hiring of talented employees and firms is a must. Managers will need to successfully motivate and manage their employees. Probably, the Chief Innovation Officer (CIO) will get more important role in the firm as well as there will probably be a new role formulated for example Chief artificial intelligence officer (CAIO) (Makridakis, 2017).

**Ensure government intervention**

A regulatory oversight and governmental intervention is also needed for successful development and implementation of artificial intelligence. Governments are starting to see its enormous potential not only for their economies and societies, but also for their own public services. They have to follow this change and adopt regulations to encourage fairness, not to stop or prevent innovation, and define which jobs and processes are such that can be automated. Furthermore, they should provide training programs to help employees who can be replaceable by artificial intelligence automated applications. Such programs, as well as for example public education systems, will be able to guarantee that employees have the right knowledge and expertise to work together with machines successfully, instead of competing with them (Bughin et al., 2017a).

I believe that policymakers should establish international trust and ethics guidelines to govern the development and implementation of artificial intelligence technologies.

**Build, buy or outsource**

One of the important steps for companies is also to decide whether they will build their own artificial intelligence system, buy it or outsource it. The decision firstly depends on the pricing and the scale of implementation. The company also need to see if it has the right skilled workers, enough talent and the right data. The decision also depends on the urgency and desired time-to-market. If the company decides to build its own artificial intelligence system, they need to be aware that this could take a lot of time. Moreover, it depends on what solution do you want artificial intelligence to perform and whether this artificial intelligence technology is already available in the market.

**Routinization of artificial intelligence**

According to Accenture's report in 2017, to unlock the opportunity presented by artificial intelligence, enterprises should focus on three areas:

1. Change and adapt relationship between computers and humans.
2. Adjust business operations to this kind of technology.
3. Unlock trapped value of data.

After first 10 steps, these three goals are achieved, and businesses could focus on the next step, which is adaptation to new business methods and strategy.

After routinization of artificial intelligence into their businesses, they still have to keep an eye on new market trends and features that artificial intelligence providers are creating. Providers and developers of artificial intelligence are the ones who represent an important part of successful artificial intelligence adoption, since they are the ones who are introducing artificial intelligence applications to the business world. Their goal is to present artificial intelligence in ways that it can help to solve business problems. Business should also pay attention on artificial intelligence used business cases, which showed the progress artificial intelligence has made in their businesses and guarantee they have employees with right skills and knowledge for successful digitalization.

Today, more companies are starting to apply artificial intelligence into their organizations and I believe each company today should be brave enough to start and follow this emerging trend that will change not only the way we work but also the way we live.

## CONCLUSION

We are living in the golden age of artificial intelligence and there is no doubt now that is already beginning to be revolutionized a world economy as we know it. Artificial intelligence is already transforming our lives and moreover, it plays a significant role in business across different industries all around the world.

In general, artificial intelligence represent a high level of machine intelligence, which has been decades ago seen only as some science fiction, where robots have the powers, and will take over humans. Today, artificial intelligence represents so much more than this, however the level of such intelligence, called super intelligence, has still not been reached. Artificial intelligence represents machines that can sense, act, comprehend and learn and have the intelligence to do the things that human can or even better. There are numerous artificial intelligence technologies available today, such as 3D neural networks, vision recognition, speech recognition, robotics, expert systems, natural language processing, machine learning and deep learning. The last two, machine learning and deep learning, are the ones that are mostly used.

Through its history there were many ups and downs, which led to development of artificial intelligence. After 60 years of tough artificial intelligence development, we can finally see real artificial intelligence solutions in businesses across different industries (Bughin et al., 2017a). It has already moved from research laboratories into business (Dirican, 2015) and today's headlines are full of artificial intelligence and machine learning achievements in

every industry, from healthcare, retail, manufacturing, financial and more. Huge transformations can be seen everywhere. The digital age that began with internet and mobile technologies, made organizations to open their stores in cloud and web and today, there is huge amount of data available online, which makes a great opportunity for artificial intelligence to be developed. There are also other technological developments that have contributed to the development of artificial intelligence. First, huge amount of data that is available online. The second most important fuel that is driving artificial intelligence today is that computing power is growing significantly, and we have unlimited access to it. Furthermore, algorithms are able to solve much harder problems faster and more accurately. GPUs are also the fuel that has contributed to the rise of artificial intelligence. GPUs have enabled machines to achieve even faster computing power. Half of the world population has an internet connection today, and millennial generation cannot imagine their lives without smart phones and digital world, which makes them the most in favor of incorporating artificial intelligence into their future work lives. Besides all these factors, also universities are producing higher number of skilled and experienced artificial intelligence researchers. Artificial intelligence has become the center of attention for technology investments and the biggest corporations are investing heavily in various artificial intelligence technologies and start-ups.

As any other new technology, also artificial intelligence brings new challenges. Probably the most obvious one is the acceptance of these new kinds of technologies. It is hard for people to believe that machine can perform some tasks correctly by itself. Having not just enough data, but the right and clean data represents also one of the challenges for business. Moreover, there is not enough talent available. Some companies, especially small ones, are unable to hire artificial intelligence talent since the competition of artificial intelligence experts is huge. The talent pool is also still small and there are not enough people with right skills and experience. Artificial intelligence adoption requires knowledge about artificial intelligence as well as the right skills, knowing its benefits and challenges (Ransbotham et al., 2017). People are still unaware of what artificial intelligence is able to do and how it can help us and improve business processes. Artificial intelligence and other smart technologies can be extremely costly, and so cost represents one of the main challenges to artificial intelligence adoption. Also, there is high need for repair and ongoing maintenance, and artificial intelligence technologies, due to their complex nature, need regular upgrading to adapt to the changing business environment (The Economist, 2016). Furthermore, the cost for training employees is increased as well (Hagerman, 2017). One of the today's main artificial intelligence challenge that is talked about is the risk of unemployment, because of job automation. Strong leadership support is needed to successfully introduce and deploy artificial intelligence technologies to their business environment.

Today's businesses have to live their way through demanding business environment. If they want to increase their revenue, customer satisfaction, increase profitability, increase the

number of products sold, decrease production costs, and so on, they have to keep in touch with market trends (Skytree, 2014).

However, artificial intelligence can be found today in almost every industry and is helping business in lots of way. From analyzing huge amount of data, finding patterns in customer purchasing data and making personalized recommendation, to drug discovery and even in self-driving cars. Artificial intelligence is now leading the way and organizations have to take into account that this emerging trend will transform the way we work and live.

The key takeaway from business case analysis across industries is that artificial intelligence is already changing, disrupting and improving the way we do business and the way we live. Different industries such as, healthcare, financial, retail, manufacturing, agriculture, and so on, are already being transformed by artificial intelligence technologies. The organizations are deploying artificial intelligence to help them improve their processes and products. Not only for these two reasons, but artificial intelligence provides even more benefits and the most important to mention are: time savings, automation of tasks, driving sales and customer engagement, personalization, improved quality of life, technical developments and innovation, right demand prediction and creation of new business model. However, many challenges could also arise from it. I believe, if people do not have right capabilities, ideas and interests about artificial intelligence products, artificial intelligence can become dangerous, as is the case with any technology. For example, iPhone X that can be unlocked with face ID was unlocked by a person wearing the mask with a 3D-printed base (Krauth, 2018). Or, the person in self-driving car got killed due to high speed (Levin and Woolf, 2016).

So far, there have been made small progressions in the field, but industry leaders, such as Google, Amazon, Facebook, Microsoft, are already taking advantage of artificial intelligence. Furthermore, they are heavily investing in resources (artificial intelligence experts, people with artificial intelligence and analytics skills) and into research and development of artificial intelligence. Soon, probably also the smaller companies will follow this. Artificial intelligence resources, expertise and skills are becoming more available to entrepreneurs and there are number of start-up companies which are pursuing to commercialize this technology (Kuyan and Frankel, 2016). To sustain the growth in artificial intelligence, businesses have approach artificial intelligence in a well predefined way, educate themselves, keep in touch with trends and adapt faster. I have prepared recommendations for companies to follow to successfully implement artificial intelligence into their business strategies:

1. Develop a shared understanding of artificial intelligence.
2. Embed artificial intelligence into business.
3. Identify use-cases you want artificial intelligence to help assist with.

4. Think about customers/ ensure customer trusts.
5. Select the right artificial intelligence technology for your business problem.
6. Assess the available data you have.
7. Bring in experts and set up a pilot project.
8. Educate and manage employees.
9. Ensure government intervention.
10. Build, buy or outsource.
11. Routinization of artificial intelligence.

Artificial intelligence will fundamentally transform businesses across industries. There are already available new market opportunities for development in many industries. Artificial intelligence already plays a huge role in our lives and is reshaping the way how we do business. Decades ago, the most famous researches only dreamed of such smart applications. Now, artificial intelligence technology has improved so much that there is even a robot called Sophia, which has human-like capabilities, even expressing her own emotions, and she even looks like human too. Something, which was only few years ago unimaginable.

The role of artificial intelligence in transforming businesses across industries is huge and for businesses it is not of significant importance to take into account that artificial intelligence is changing our world. They should not let artificial intelligence to lead them, however let businesses and people lead artificial intelligence and its development.

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# APPENDIX

**Appendix: Povzetek (Summary in Slovene language)**

Ko danes omenjamo umetno inteligenco, večina ljudi takoj pomisli na robote, ki imajo sposobnosti podobne ali še večje kot človek. V resnici pa je umetna inteligenca veliko več kot le pametni roboti in računalniki, ki posnemajo človekovo razmišljanje in dejanje. Danes jo lahko najdemo že skoraj povsod. Že vsak drugi človek ima danes svoj pametni mobilni telefon, ki vsebuje veliko aplikacij, med njimi osebnega asistenta kot je na primer Siri, s katerim se lahko pogovarjaš. Še pred leti pa si nihče ni mogel predstavljati, da bomo enkrat s pomočjo tehnologije lahko lažje operirali v medicini, hitreje iskali nova zdravila ali analizirali miljon podatkov v bazah v različnih industrijah. Umetna inteligenca nam pomaga razumeti in reagirati na okolje tako kot si nismo nikoli mislili.

Začetki umetne inteligence segajo v leto 1956, ko je John McCarthy določil prvi pomen besede umetna inteligenca. V tistih časih je bila želja zgraditi pametne stroje, ki bi imeli karakteristike kot človek in sicer, da bi stroji lahko mislili, govorili, pisali in posnemali človekova dejanja. Vendar se je to zgodilo šele po letu 1960 in danes je na voljo že vrsto aplikacij, ki vsebujejo umetno inteligenco in, ki jih uporabljamo v vsakdanjem življenju kot na primer: osebni asistenti Siri in Alexa, priporočilni sistem na Amazon-u in Netflix-u, označevanje oseb na Facebook-u in podobno. Še več, umetno inteligenco lahko najdemo tudi v avtomobilih, v video igricah ali sesalcih. Medicina, proizvodna panoga, trgovina na drobno, pravo in finančna panoga, je le par panog, kjer lahko danes najdemo umetno inteligenco.

V zadnjih letih lahko opazimo tri pomembne tehnološke napredke, ki so pripomogli k razcvetu umetne inteligence. Prvič, 53% svetovnega prebivalstva danes ima dostop do interneta in več kot polovica ljudi na svetu ima svoj pametni mobilni telefon. Nove generacije živijo in rastejo skupaj z družbenimi omrežji, ki spreminjajo svet in prav oni bodo tisti, ki bodo najbolj inkorporirali umetno inteligenco v svoj način življenja in dela. Drugič, tako zmogljivost shranjevanja podatkov kot tudi zmogljivost za obdelavo podatkov se je izjemno izboljšala in narasla. Danes je preveč informacij in podatkov na voljo in proces sprejemanja poslovnih odločitev je vse bolj odvisen od analize velikih podatkovnih baz, kar pa lahko vzame veliko časa in denarja. Prav tako se dandanes vse več procesov avtomatizira, da je delo hitreje opravljeno in da se izboljšajo procesi. Vedno več podjetij vlaga v umetno inteligenco kot tehnološko investicijo. Na primer, IBM je investiral v Watson, Google v avtomobile brez voznika in DeepMind in še več. Vse več je tudi na voljo ljudi, ki imajo odlične IT sposobnosti.

Ker umetna inteligenca prinaša tudi veliko ovir, je eden izmed glavnih ciljev ugotoviti kako čim boljše sodelovati s pametnimi stroji. Četudi umetna intelegenca že spreminja naš svet, je njeno sprejemanje v poslovno okolje oziroma uporaba še vedno nizka. Največji problem predstavlja zaupanje v pametno tehnologijo. Ker je to nova tehnologija, večina ni dobro seznanjena z njeno uporabo in načinom delovanja. Prav tako algoritmi

lahko delajo napake, ki jih je težko zaznati. Oviro predstavljajo tudi podatki, ki morajo biti za umetno inteligenco pravilni, pravilno urejeni in dovoljšnji. Velikokrat je to težava, saj je podjetjem težko dobiti veliko količino podatkov, ki bi bili na voljo za učenje algoritmov. Prav tako je problem dobiti ljudi, ki bi imeli sposobnosti in znanje za upravljanje umetne inteligence. Eno izmed največjih ovir pa predstavljajo stroški povezani z novo tehnologijo, zaradi kompleksne narave in konstantnega popravljanja in preverjanja le-te. Zadnja leta pa se ljudje predvsem ukvarjajo z etično oviro, saj se bojijo, da bi jih pametni stroji kmalu nadomestili v njihovih službah. Težavo predstavlja kako umetno inteligenco in nov način delovanja sploh vpeljati v podjetja brez, da bi to pokvarilo trenutno poslovanje podjetij.

Obstaja več vrst umetne inteligence, med najbolj uporabljene štejemo strojno učenje, prepoznavanje slik in govora in obdelovanje naravnega jezika.

Glavni cilj magistrske naloge je ugotoviti kakšen vpliv ima umetna inteligenca na različna področja. S pomočjo manjših poslovnih primerov sem naredila analizo s katero sem skušala ugotoviti kako umetna inteligenca že spreminja poslovanja različnih podjetij v različnih panogah.

Ugotovila sem, da umetno inteligenco najdemo v številnih panogah in da ima močen vpliv na naše življenje in delo. Postopoma se spreminja način dela. V medicini na primer nam umetna inteligenca pomaga predvsem pri analiziranju ogromne količine podatkov o pacientih, ki so na voljo. Tako imajo zdravniki na voljo več časa, da se posvetijo bolj kompleksnim in osebnim težavam pacientov. Prav tako s pomočjo umetne inteligence lahko hitreje odkrijemo bolezen (največji napredki se kažejo v diagnosticiranju raka) in najdemo nova zdravila za določene bolezni. Velike spremembe najdemo tudi v trgovini na drobno, kjer se umetna inteligenca najbolj uporablja za personaliziranje spletnih strani, za prepoznavanje obrazne mimike (s tem se ugotovi na kaj imajo pozornost usmerjeno kupci) in za pomoč kupcem v trgovinah (na primer osebni asistenti). En izmed večjih uspehov se kaže tudi v internetnih brskalnikih, ko ti brskalnik že sam priporoči iskalni niz ali pa ponujene reklame glede na prejšnje iskalne nize in kupovanja. Zanimivo je tudi, da je veliko današnjih poročil o športu in vremenu napisanih samostojno iz pametnega stroja oziroma računalnika. Tudi v finančni panogi umetna inteligenca pomaga veliko. Kot že prej omenjeno, s pomočjo umetne inteligence lahko hitreje in bolj učinkovito pregledamo veliko količino podatkov in to se zato začenja uporabljati tudi v pravu in na sodiščih. Veliko se jo uporablja tudi na večji državni ravni, na primer za nadzor bobnih napadov. V šolstvu jo učitelji začenjajo uporabljati za hitrejše popravljanje in ocenjevanje nalog, vedno več pa je na voljo tudi spletnih strani, ki nudijo individualno učenje glede na potrebe posameznika. Avtomobilska industrija že nekaj časa uporablja umetno inteligenco za izboljašnje procesov, največji napredek pa bo, ko bodo avtomobili lahko vozili sami, brez voznika. Umetna inteligenca se uporablja tudi za izboljšanje poslovnih procesov. Na primer, pametni program, ki ti sam ureja koledar in odpisuje na e-maile.

Vedno več procesov se avtomatizira in tako imajo zaposleni več časa, da se ukvarjajo z bolj kompleksnimi nalogami.

Največje ugotovitve oziroma prednosti ugotovljene iz analize poslovnih primerov iz prakse so: prihranek časa, avtomatizacija procesov, povečanje prodaje in privabljanje kupcev, personalizacija, izboljšanje kakovosti življenja, tehnološki napredek in inovacije, pravilno napovedovanje povpraševanja in ustvarjanje novih poslovnih modelov.

Današnji svet je konkurenčen in podjetja se morajo dobro pripraviti, da preživijo v okolju, ki se hitro spreminja zaradi tehnoloških napredkov. Tukaj predlagam priporočila, ki naj bi jim podjetja sledila za uspešno implementacijo umetne inteligence v njihove procese. Najprej morajo razviti razumevanje umetne inteligence, kaj to sploh je in kako nam lahko pomaga. Vsi zaposleni se morajo naučiti kako uporabiti umetno inteligenco v procesih in kako delovati skupaj s pametnimi stroji. Vodilni managerji morajo identificirati probleme, ki jih želijo, da jih umetna inteligenca pomaga rešiti. Razmisliti je potrebno o kupcih in njihovih željah, da se jim proda najboljši izdelek oziroma storitev ter se jih s tem privabi. Hkrati pa jim je potrebno zagotoviti varnost tako, da se podatkov ne izrabi v slabe namene. Potrebno je izbrati tudi pravilno vrsto umetne inteligence glede na poslovni problem. Podjetje mora preveriti, če ima podjetje zadostno količino podatkov in če so podatki pravilni in urejeni. Zaposliti je potrebno strokovnjake, da se umetno inteligenco še lažje implementira v podjetje. Vsi zaposleni morajo biti seznanjeni z umetno inteligenco in njeno uporabo. Prav tako pa mora tudi država poskrbeti za pravilno zakonodajo. Podjetje se mora tudi odločiti ali bo umetno inteligenco samo ravijalo, jo kupilo ali izkoristilo zunanje vire. Sledi pa sama implementacija umetne inteligence vv poslovanje podjetij in njena uporaba. Ves čas pa je potrebno preverjati, da tehnologija deluje pravilno in korektno.

Umetna inteligenca predstavlja veliko vlogo v našem življenju. Opazimo lahko, da se naš način življenja že spreminja. Na primer, kupujemo veliko več prek spleta in telefonov, svoj prosti čas preživljamo s telefonom v roku, ki je postal naš osebni digitalni asistent, ali pa sploh ne odgovarjamo več sami na emaile, saj to počne naš računalnik sam. Prav tako pa so že vidne spremembe v poslovanju podjetij na različnih področjih. Vedno več rutinskih nalog je opravljenih s pomočjo pametnih računalnikov in strojev, ki izboljšujejo in avtomatizirajo procese. Menim, da bi se morala podjetja zavedati, da umetna inteligenca predstavlja nov val tehnologije, ki jo je potrebno začeti uporabljati, saj prinaša veliko koristi. Hkrati pa je potrebno paziti, da se ne njena moč ne izrabi v slabe namene.