Matias Pottala

Artificial Intelligence

Artificial Intelligence in Sports

ABSTRACT

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The aim of the study was to narrate what artificial intelligence is and how it can be utilized in today's world. This thesis contains the results of qualitative article analysis and literature reviews done about artificial intelligence and artificial intelligence in sports. The theoretical framework of the thesis discussed the past, present and future of artificial intelligence. In the thesis artificial intelligence was also studied from the economic point of view, looking more closely on investments and the global leaders now and in the future. What kind of an impact will artificial intelligence have in the society is discussed more precisely when studying the possible threats and opportunities of artificial intelligence.

As a research method, a documentary analysis of qualitative research was used in the thesis. The study analyzed 20 electronic articles and publications about artificial intelligence in sports.

In the thesis the sports field was taken into account as a whole; from players, organizations and spectators point of view. The thesis shows what kind of an impact artificial intelligence will have in the sports industry and how the industry might change and look like in the future.

In conclusion artificial intelligence will have an impact to the world and societies we live in, but how it will possibly change the future is to be seen.

Key words
Artificial intelligence, machine learning, sports, technology

CONCEPT DEFINITIONS

AI   Artificial Intelligence

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1 INTRODUCTION

Face recognition, self-driving cars, industrial robots, tumor detection and automated sport journalism are all real-world enigmas being solved with applications of intelligence (AI.) Today AI applications focus on very narrow tasks, but together these AI-driven tasks are reshaping businesses, industries and markets as the technology becomes more sophisticated, the use of AI will continue to grow quickly in the coming years.

The thesis was a qualitative research, with the main focus on article analysis. The aim of the research was to get an overall knowledge about AI. What artificial intelligence is, how it can change our everyday life in the future and how AI is used in sports and how it can change the sports experience of a sports fan. The research for the thesis was done by researching multiple different references about AI. What are the possible threats and opportunities for AI, now and in the future? In the thesis a closer look was taken at the global leaders of AI at the moment and in the foreseen future. This part mainly consists of the power that China holds in AI technology. The business perspective of AI is looked more closely, when a closer look is taken at AI investments, how much have companies invested in AI companies and how smaller AI startups are acquired by big companies, such as Google, Apple and Facebook. In the thesis the focus was also on how artificial Finnish companies have reacted to the rise of AI and what kinds of future plans Finland have for AI. The theory mainly consists of statistical and analytical articles about artificial intelligence with graphs showing the growth during recent years in the technology.

The field of AI was founded at a conference in 1956, however AI has become more widely known to the public audience during the past five to ten years. This is an interesting fact and was one of the reasons for why this subject was chosen to be the subject of the thesis. AI is disrupting some of the industries permanently. This paper gives an insight on what industries and jobs are taken by AI and how people should adapt to the changing environment and working life in the future. Taking an insight into the future of AI, it will help the author of the thesis to be more adapted to the changing environment and the future working life.

AI is widely known in sports industry and is shaping the industry at a fast pace. AI is not only used to track player statistics but also by teams and organizations to enrich the fan experience. This paper takes a closer look at how machine learning and AI can help a team to win, but also how teams, organizations and companies can improve their annual turnover by creating more effective marketing campaigns, sponsorship deals and better sports events in general. In this paper the fans' perspective, as well as how

AI can change the future of spectator sports is discussed. By reviewing articles and statistics this research shows how AI has reshaped and deepened fan experience in Tennis, Basketball and Football.

2 BACKGROUND OF AI

This chapter focuses on the key concepts of the research. What are the main achievements of AI in the modern history but also expressing more closely what AI really is and how much companies are investing in this new technology.

2.1 Modern history of AI 1950-2000

John MacCarthy invented the word Artificial Intelligence when he held the first academic conference on the subject in the campus of Dartmouth College in 1956. During the 1960's the first article of AI was published under the name "Computers and Thought" and the computer mouse was invented by Doug Engelbart. The first ever international conference about AI was held in 1969 in Washington DC. In the 1970's a famous Scottish robot called Freddy was built, could spot and compile models with eye technology. INTERNIST-program was also invented in the 1970's the program could provide medical diagnoses based on what information it receives. In the 1980's neural networks became widely used and "The Society of Mind" a theoretical description of the collective mind, was published by Marvin Minsky. In the 1990's AI took significant developments in areas such as machine learning, virtual reality and in games. A chess program build on AI won the chess world championship and the first autonomous robotics machinery system "Sojourner" was deployed on the surface of Mars by NASA. Interactive robot pets (a.k.a "smart toys") became commercially available, Stanford's autonomous vehicle, Stanley, won DARPA Grand Challenge race and The Nomad robot explored the remote regions of Antarctica looking for meteorite samples during the early years of the 21st century. (Tekoäly 2018)

AI is one of the most mysterious subjects in computer science although it has been studied for decades. The subject is very vague and ranges from machines capable of thinking to search algorithms used to play board games. Algorithms, machine learning algorithms, and integrating statistical analysis into understanding the world have been the main advances of AI in the past 60 years. AI not had a rapid progress over the decades and significant AI breakthroughs have been guaranteed in "10 years" for the past 60 years. In the field of AI expectations always outruns the reality. (University of Washington 2006)

2.2 What is AI?

Artificial intelligence is a part of computing science that focuses on creating intelligent machines and programs. The purpose of artificial intelligence is to try to mimic human consciousness and perform tasks such as human beings. In practice it means the ability of a machine or program to think and learn. Generally, the term artificial intelligence means a machine or program that tries to emulate human consciousness. AI has become a significant part of the technology industry. (Tekoäly 2018)

AI has had three stages throughout the history of AI, in 1950's – 1970'S the so called neural networks era, 1980 - 2000 the machine learning era and deep learning era in the present day. A neural network is a form of machine learning that is made up of interconnected units (like neurons) that processes information by responding to external inputs, relaying information between each unit. The process requires multiple passes at the data to find connections and derive meaning from undefined data. Machine learning automates analytical model building and uses different methods such as; Neural networks, operations research, statistics and physics to find undisclosed insights in data without decidedly being shown where to look or what to achieve. Deep learning is almost similar to machine learning but on a deeper level. The goal of deep learning is to create a nerve network using the algorithm that can solve the problems it has been given. It is used in particular to solve problems where solutions with traditional methods would require very complex rules. Deep learning is used, for example, in identifying or handling speech, images and texts. (Sas 2018)

An algorithm is a step by step method of solving problems. It is regularly used for data processing, calculation and other mathematical and computer operations. It is an accurate series of instructions for carrying an operation or solving a problem. Algorithms are able to do various tasks easily and quickly, when appropriate data is entered into the system. (Techopedia 2018)

The most influential factors in the rise of AI now are computing ability and power, data and algorithms. The power and ability of processors have significantly increased. Today there is an enormous amount of data available of the weather, social media and medical science, and machines are finally able to exploit this data. At the same time, the storage costs for data management have fallen and the development with data storage have led to a faster way to analyze massive amounts of data. (Tekoäly 2018)
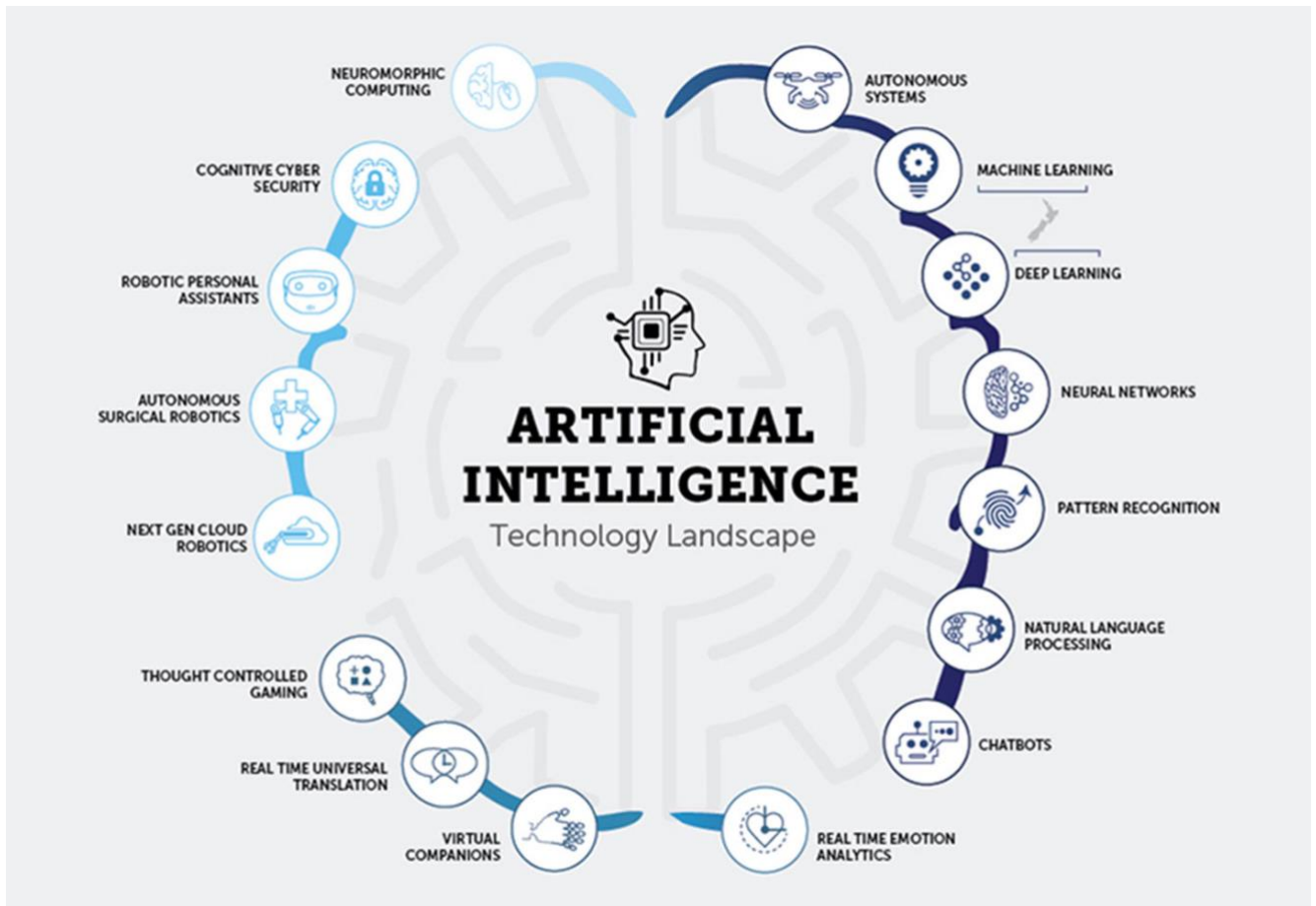
FIGURE 1. Artificial Intelligence (Adapted from codingdojo 2018)

There are two types of AI, narrow AI and general AI. Narrow AI can solve one problem, to which it is taught, for instance to identify cancer by using machine vision, to organize personal and business calendars and to respond to simple customer service queries. Practically, all the current AI is narrow AI. General AI solves a wide range of different problems, drives cars, understands languages and cooks. General AI have not reportedly been developed yet, but AI experts are fiercely divided over how soon it will become a reality. (Tekoäly 2018)

In 2013 a group of AI experts and researchers conducted a survey and reported that Artificial General Intelligence (AGI) would be developed by 2040 – 2050 and estimated a 50% likelihood for it. Developing AGI by 2075 was estimated to have a 90% likelihood. Some experts believe that those projections are ferociously optimistic and believe that AGI is centuries away, because of our limited understanding of the human brain. (Zdnet 2018)

Global AI business value is expected to reach $1.2 trillion in 2018, which is a 70% increase from 2017. The global AI business value is forecast to reach $3.9 trillion in 2022. AI business value increases by

better customer experience, by creating new revenue with new products or service but also by increasing the sales of existing products and with reduced costs both in new and existing products. In the next four years business value is expected to grow significantly but growth rate percent is estimated to slowdown in 2020. (Gartner 2018)

	2017	2018	2019	2020	2021	2022
Business Value	692	1,175	1,901	2,649	3,346	3,923
Growth (%)		70	62	39	26	17

Table 1. Forecast of Global AI-Derived Business Value Billions of U.S. Dollars (Adapted from Gartner 2018)

2.3 How AI can be utilized in sports?

The North American sports industry alone is generating billions of dollars of revenue each year. In 2019 the North American sports industry is projected to reach $73.5 billion in revenue. Fans can feel closer to the game and players with the help of AI technologies and more personalized experiences and interactions mean more fan loyalty and engagement in the future. AI in sport won't be much different than its applications in media and software generally. (Techemergence 2018)

The impact of AI on sports is significant and will continue to grow. Teams and organizations look for game changing advantages, with the help of AI to become better than their opponents. Wearables are already used in sports, to analyze players' workload, strength and technique. AI can also facilitate players' safety in sports. Long-term concussions can be detected with the help of AI. Concussions can cause a long-term brain damage, and the new AI technology can detect concussions with up to 90 per cent accuracy. AI can also suggest mentally tough players for teams. An AI based platform can analyze the mentality of players and not only suggest the best players but also the ones who actually can live up to their potential. AI will offer a giant step forward to the franchises that are willing to invest in AI. (Inbenta 2017)

2.4 AI investments

Big companies are acquiring AI startups. Acquisitions are used by companies for strategical benefits such as access to a new market, products and services. Acquisitions also help companies to diversify

their portfolios and to achieve economies of scale. Companies need to protect their market share and be competitive and with the help of acquisitions they are more likely to do so. AI is the new technology niche, and AI startups are selected and targeted for acquisitions. Since 2012 more than 250 private companies that use AI algorithms have been acquired. Companies generate a large amount of data, and with the help of new AI technologies they are able to control, analyze and understand all this data and information to make more effective business decisions. (Entrepreneur 2017)

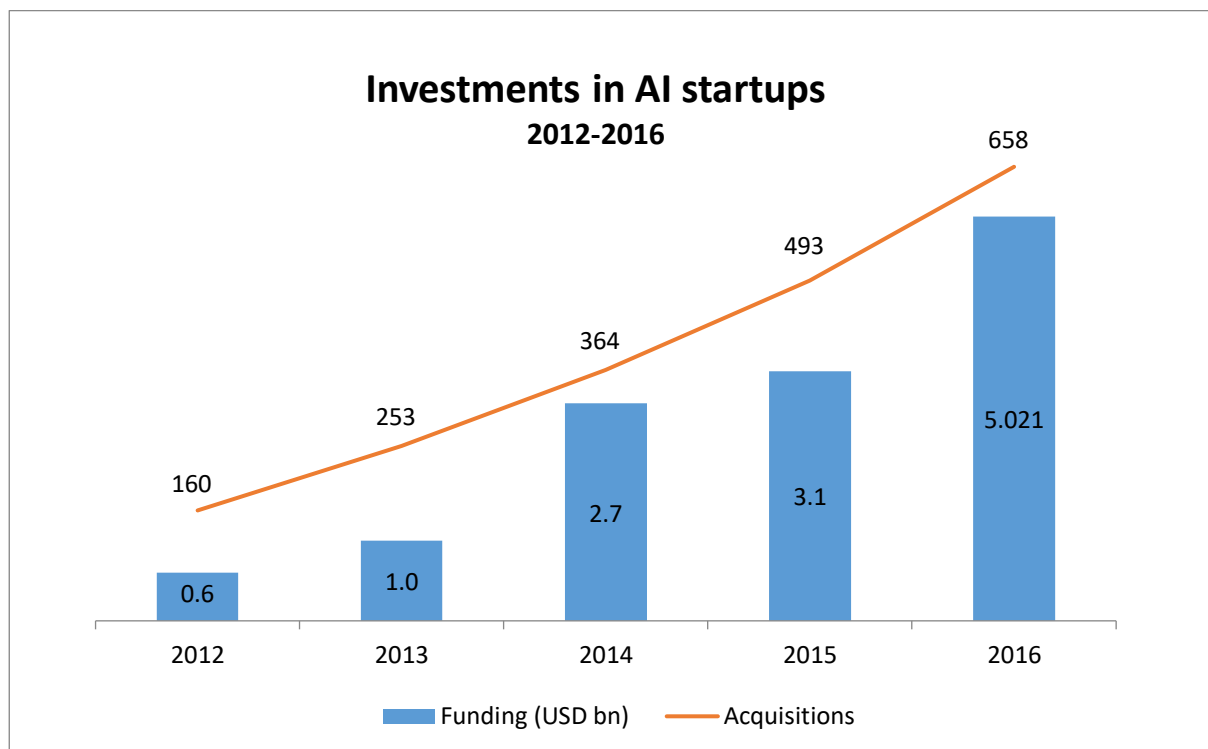**Investments in AI startups**
2012-2016

FIGURE 2. Investments in AI startups (Adapted from Tekoäly 2018)

AI is seen as a catalyst for success and investments are done by companies to stay ahead of their competitors and to gain market share. The market research firm Tractica expected that AI spending is forecasted to grow to 37 billion US dollars by 2025. AI is likely to be the most invested area for businesses in the coming years, as global corporates are competing against each other acquiring smaller private start-ups. (Financierworld 2017)

AI acquisitions are done by technology giants, Google, Apple, Intel, Microsoft and Facebook. Smaller tech brands are also making AI acquisitions, but also non-technology brands invest billions of dollars on AI acquisitions. Acquisitions are predicted to boom in the future with new applications, tools and platforms to be born while current platforms will integrate into other organizations to meet companies' needs. (Entrepreneur 2017)
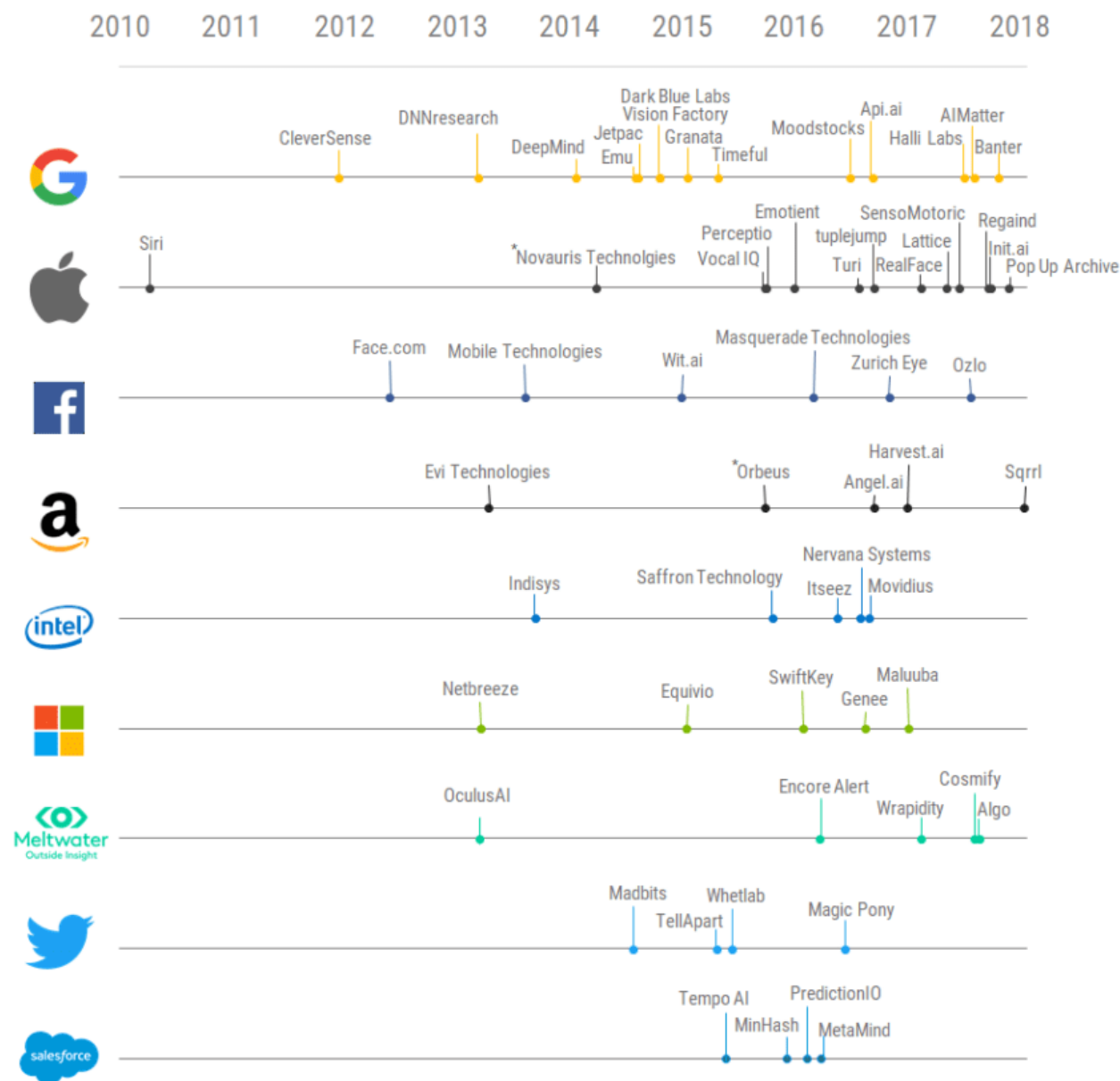
FIGURE 3. AI acquisitions 2010 – 2018. (Adapted from cbinsights 2018)

3 AI – THE NEW ELECTRICITY

This chapter gives an insight to what are the possible threats and opportunities that come-along with AI and which countries are leading the AI race. In this chapter the Finnish government's plans for AI are discussed.

3.1 AI threats

"AI is a fundamental risk to the existence of human civilization" is a quote by Tesla and SpaceX CEO Elon Musk. On another perspective Chris Bishop, Microsoft's director of research has concluded "how different the narrow intelligence of AI today is from the general intelligence of humans, saying that when people worry about "Terminator and the rise of the machines and so on? Utter nonsense, yes. At best, such discussions are decades away." (Zdnet 2018)

An unrealistic picture of AI has been lately pictured by the media. At the moment AI is just transforming advertising, e-commerce, finance, logistics and web searching e.g. and in the short-term future AI is expected to affect many industries but it is not magic. With AI, data is used to generate a response. The amount of data needed for building a photo tagger or a speech recognizer is enormous and tens or hundreds of thousands of images and tens of thousands of hours of audio are needed. (Hbr 2016)

What Machine Learning Can Do
A simple way to think about supervised learning.

INPUT A	RESPONSE B	APPLICATION
Picture	Are there human faces? (0 or 1)	Photo tagging
Loan application	Will they repay the loan? (0 or 1)	Loan approvals
Ad plus user information	Will user click on ad? (0 or 1)	Targeted online ads
Audio clip	Transcript of audio clip	Speech recognition
English sentence	French sentence	Language translation
Sensors from hard disk, plane engine, etc.	Is it about to fail?	Preventive maintenance
Car camera and other sensors	Position of other cars	Self-driving cars

SOURCE ANDREW NG   © HBR.ORG

FIGURE 4. What Machine Learning Can Do (Adapted from hbr 2016)

AI replacing the human workforce in the near future is a more credible possibility. AI will not replace all the human work, but most certainly will change the nature of work. AI automated machines take over repetitive and routine-based jobs. Supermarkets without cashiers are the future and accounting jobs are decreasing year by year. (Zdnet 2018)

In 20 – 30 years it is predicted that AI will replace nearly half of the current jobs. Logistical work is already highly automated. Robots working in factories and warehouses and automated healthcare robots working in medical care and hospitals are becoming more common. AI quickens technological and social change in the society at a fast rate. According to the researchers, this is followed by technological singularity in the long run. It means that technology transforms the world so fiercely that we still cannot understand what kind of a world will follow the change. (Aamulehti 2017)

Since it is unknown what the job market will look like in twenty or thirty years, already today schools do not know what to teach to children and the information they get might be totally irrelevant by the time they are forty years old. Commonly life has been divided in to two main parts: The period of learning and the period of working. This traditional model will become useless, and people need to keep learning and reinventing themselves all the time to keep up with the changing environment. (Harari 2015, 380-381)

Wealth and power might become concentrated in the hands of the tiny elite that owns the algorithms, which cause social and political inequality, when algorithms push humans out of the job market. Millions of bus drivers, truck drivers and taxi drivers have a significant political and economic influence, each ruling a tiny share of the transportation market. They can go on a strike, stage boycotts and unionize if their collective interests are threatened. However, if the drivers are replaced by an algorithm, all the power and wealth will be cornered by the corporation that owns the specific algorithm and by the few billionaires who own the corporation. (Harari 2015, 376)

3.2 AI opportunities

AI also brings many advantages, and AI is already making people's lives better, and will do so in the future. Driverless cars will become available for anyone in the future. The AI automated Google Driverless Car already took the first test drive in 2011. Driverless cars give humans time for relaxation or a possibility to work but also are much safer than vehicles driven by humans. In the medical field the

current AI also in most cases can already make more accurate medical diagnoses, which can save lives. Humanity can benefit from new technology, but it can also be dangerous if deficient care is taken for safety and unforeseen side effects. With the new AI technologies researchers and innovators have to make sure that the advantages outweigh the disadvantages. (Ea-foundation)

In a recent experiment lung cancer cases were shown to human doctors and to a computer run by algorithms. Human doctors correctly diagnosed only 50 per cent of the cases while the computer algorithm correctly diagnosed 90 per cent. Mammography and CT scans are also already checked by specialized algorithms, and sometimes an algorithm detects tumors that the doctors missed. The process for training one human doctor takes years and is expensive and complicated. With new technologies, no matter how expensive it is at the moment, one will get an infinite number of doctors, available 24/7, in every place of the world. In the long run it would be much cheaper than training human doctors. (Harari 2015, 368)

AI can already detect diabetic people's eye diseases with up to 97 per cent accuracy by analyzing images from the eyes of the patients. Deaths caused by acute renal damage, bacterial infection or the possibility of melanoma can all be detected with the help of artificial intelligence. A patient getting a potential myocardial infarction can be predicted by taking images from the retina coupled up with another patient information. According to a study in the United States, the filters used in Instagram images can predict the depression of the user. The algorithm revealed the depression better than the mental health professionals and depression was seen in the pictures even before the person had been diagnosed with the illness. (Yle 2018)

Using artificial intelligence long-term concussions suffered by athletes, which may have caused lasting brain damage can be detected. Before the only way diagnose the effect of concussions have been post-mortem examination, which is not very helpful for patients that are still alive. Researchers from the Université de Montreal, The Montreal Neurological Institute and Hospital (The Neuro), and the Ludmer Center for Neuro Informatics are developing new techniques to address this deficiency with the help of AI and a new tool called diagnostic signature. In the US alone 1.6 to 3.8 million concussions happen a year, and in ice-hockey, football and soccer the concussions rates increased 40 per cent between 2004 and 2014.   With the new technology, the objective is to help the former athletes that experience neurological issues after retiring from contact sports. Researchers recruited former athletes between the age of 51 to 75 who had played ice-hockey or football, to test the new method. Two groups of 15 people were narrowed down after the selections, and there was one group of 15 people who had suffered

concussion during their career and the other group with 15 people who had not been concussed. A wide variety of neurological tests were made, and AI was able to find differences between the brains of the previously concussed athletes and the brains of those who had not suffered concussion AI was able to detect concussions with 90 per cent accuracy. (Consumeraffairs 2017)

AI will replace nearly half of the current jobs in the foreseen future, but jobs that require social intelligence, fashion design, PR consultation and creativity for example are the hardest jobs to automate. Jobs likely to be replaced by computer algorithms by 2033 are for example, human telemarketers and insurance underwriters by 99 per cent probability, 98 per cent probability for sports referees, 97 per cent for cashiers and 96 per cent to chefs, waiters 94 per cent, tour guides 91 per cent, bakers 89 per cent, bus drivers 89 per cent, construction labors 88 per cent, security guards 84 per cent. Archaeologic work requires highly sophisticated types of pattern recognition and the likelihood they are replaced by algorithms by 2033 is only 0.7 per cent. (Harari 2015, 380. Ea-foundation)

Media companies especially have noticed that with the help of AI human labor can be freed up for more intense creative efforts and noticed that AI is strategic necessity and an immense opportunity for the companies. People can also work alongside AI, doing tasks that are highly complex and repeatable, which at the same time frees up time for professionals to make more intelligent decisions. AI helps to improve efficiency and to create new and better user experiences and products. The key is to understand all the different dimensions in which AI can aid a company. (Strategy-business 2017)

AI is already making customer experiences better and customers can benefit much of AI. With the help of AI companies can target advertisements for a particular group of people, but also design products that appeal to larger audiences as well. In Japan, in a test by a local company, two advertisements were made for Clorets gum, one by AI and one by their own creative director. Japanese public voted which one was better, and the one done by the human director won, but only by a 54 to 46 per cent margin. (Strategy-business 2017)

Personalized and customized Spotify, Netflix and HBO recommendations for customers are done by AI, which helps customers to pick their favorites quickly and effectively, but this is necessarily not only a good thing. Consumers are less adapting to find new types of content out of their comfort zones. The next step of for AI to evolve could be to find ways to broaden the horizons of discovery for the consumers. (Strategy-business 2017)

Exhibit: **The Creative Intelligence Matrix**

Where you are depends on the targeted user (workers vs. consumers) and AI's role in completing the task (full automation vs. working alongside people).

Consumer Innovation	**Simplifying Content Creation** AI-generated music Facebook Timeline Movie Maker Google Photos face recognition Google Photos movie assistant	**Improving the Consumer Experience** Athletic performance monitoring (content enhancement) Video exploration (content interactivity) Recommendations (film, TV, music) Content curation (e.g., Spotify playlists) Digital assistants (e.g., Alexa)
Workflow Optimization	**Freedom from Repetitive Tasks** Customer service process automation Credit control process automation Churn prediction engines Programmatic ad buying Newsletter curation, creation, distribution Content tagging Content editing (e.g., movie trailers) AI-generated sports summaries AI-generated film scoring, stock music	**Better, More Creative Decisions** Acceleration of sales team readiness Maximization of film revenue Maximization of content licensing Mitigation of regulatory risks Monitoring/filtering of comments Insights gained from video Insights gained from social media
Source: PwC analysis	**Fully Automated**	**Human Works with AI**

FIGURE 5. The Creative Intelligence Matrix (Adapted from strategy-business 2017)

Companies need to make their working environments more open and attractive for people who work with AI. AI will be the new employee in the company, rather than a tool or a function which can be put aside when wanted. AI as the new employee will increase productivity and human workers can spend more time on building relationships and engaging within and outside the companies. Companies need to think also is AI primary job to cut costs or to drive new revenue growth and create new level of engagement with consumers. AI is evolving quickly, and leaders must educate themselves and their colleagues on the potential of AI. (Strategy-business 2017)

Countries that will benefit the most from the technological progress are the ones with well-trained computer specialists who can understand and use the data AI provides. To be able to minimize the risks, it is crucial that legal frameworks are in place before driverless cars and other AI technologies come to general use. Governments should prepare for the upcoming changes ahead. Workforce training and public education systems will have to be rethought so that workers would have the skills to complement with machines and not to compete with them. (Ea-foundation)

3.3 AI global leaders

China is executing a vision for AI aggressively. In 2017 China's AI startups took almost 50 per cent share of the dollars invested in AI startups globally. In 2016 China took only 11.3 per cent share of the global funding. The Chinese government is building up a futuristic artificial intelligence plan. It includes everything from intelligent logistics, smart agriculture to new employment opportunities and military applications with the help of AI. The USA is steadily losing its global deal share despite they still lead in terms of the number of AI startups and the total equity deals. In July 2017 Chinese government said they want to become global leaders in artificial intelligence by 2030. Already there are more Chinese investments in AI startups in the US than vice-versa. (CBinsights 2017)
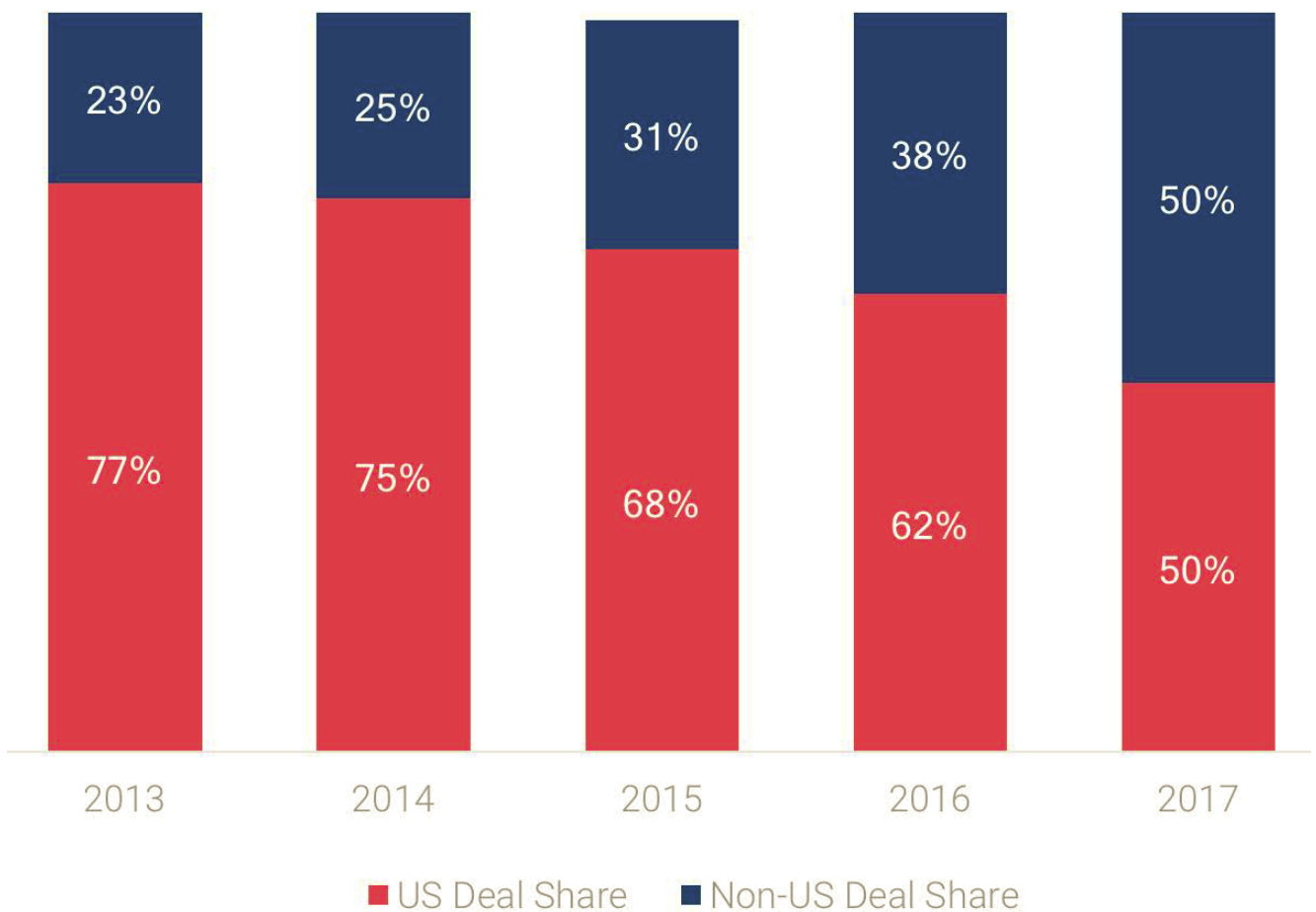

FIGURE 6. Equity deal share 2013-2017. (Adapted from cbinsights 2017)

China's biggest advantage in AI is their massive population. There are 1.3 billion people in China with approximately 730 million Internet users. This large amount of population produces useful data for AI to grow and evolve. The large population is not though an unmatchable advantage. It is good to have a large population in one country, but it would be better to have the same population spread across the world. This would provide diversity and affluence in the data. China lacks international reach, which the US have with platforms such as Facebook and Google. (theverge 2017)

Facial recognition is speeding up China's growth in AI, which helps the government's country-wide surveillance plans. In 2017, about 55 cities in China were part of the so called Xue Liang or "sharp eyes" plan. Surveillance camera footage from private and public properties will be processed centrally to monitor events and people's actions. (CBinsights 2017)

There are 176 million surveillance cameras in China, but the number is expected to rise to 626 million cameras in a few years. In the United States there are only 50 million cameras for comparison. In 2017, BBC reporter John Sudworth tried to escape to China, to test the power of the surveillance cameras. The test was made in a city called Guiyang, where there are approximately 3.5 million people. Sudworth's face was filmed and recognized in the police station and the information was sent to the control system as a "suspect." Sudworth managed to walk 7 minutes in the streets of Guiyang before a group of police officers captured him. Facial recognition technology is booming in China. People can withdraw money from ATMs, pay coffee and even get paper in a toilet by giving a permission to be filmed. (Yle 2018)
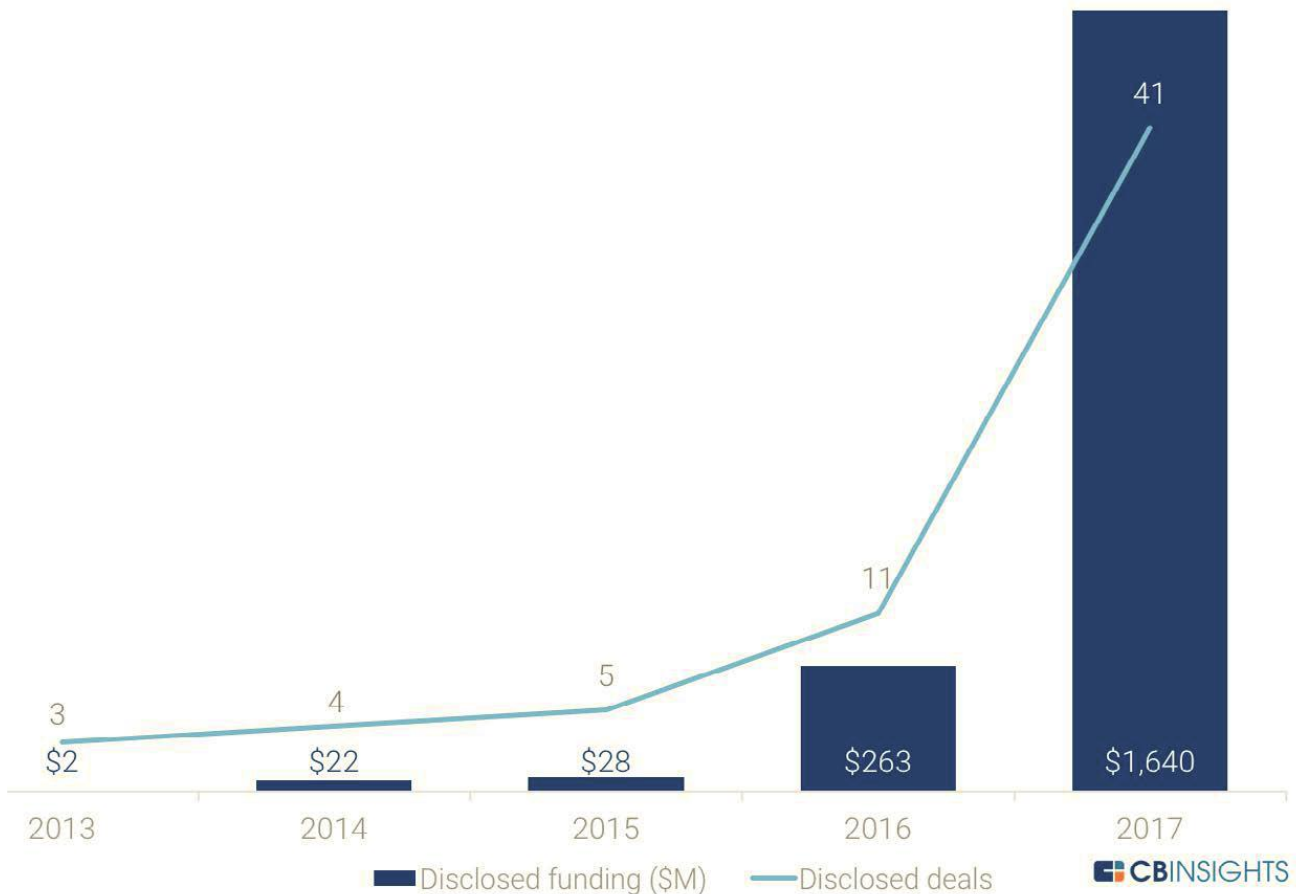
FIGURE 7. Facial recognition, all deals including grants 2013-2017. (Adapted from cbinsights 2017)

Twenty-Five European countries agreed to work together and signed a declaration of cooperation on AI in April 2018. The opportunities of AI can be assured, and threats can be dealt collectively. The goal is to work together to ensure Europe's competitiveness in the research and deployment of AI, to handle with economic, social, ethical and legal questions. Mission with the technology is to solve societal challenges such as sustainable healthcare and migration but also climate change issues. AI's transformation of labor market should also be addressed, and new legal and ethical questions should be studied. (ec-europa.eu 2018)

The Swedish government has presented a national strategy regarding the country's development in terms of artificial intelligence. In addition to presenting a plan for how to proceed, the government plans to invest SEK 1 billion over the next 10 years via Swedish enterprises and Swedish innovation agency Vinnova. The Swedish investments are still small in comparison to one of the global leaders, China which plans to invest about SEK 19 billion in AI research to become the market leader by 2030. (Dagensnäringsliv 2018)

McKinsey, American worldwide management consulting firm estimates that AI techniques might create between $3,5 trillion and $5,8 trillion in value annually across nine business functions in 19 industries. Additional value in marketing and sales is predicted to be $2,6 trillion and $2 trillion in supply chain management and manufacturing. AI will have a 11.6 per cent impact on travel industry revenues and up to a 10.2 per cent impact on high tech revenues. In retail industry AI will add $200 billion value to pricing and promotion and $100 billion in customer service management. McKinsey reports that the value of AI is not found on the models themselves, but in companies' ability to make use of them. Even though the use of AI techniques creates economic potential, such concerns as data security, privacy and potential issues of bias must be taken into consideration. AI-driven logistics optimization can reduce costs by optimizing the routing of delivery traffic which improves fuel efficiency and reduces delivery times. Through improved speech recognition in call center management and in marketing and sales AI techniques can generate individualized product recommendations. (McKinsey 2018)

3.4 AI in Finland

Finnish government has launched a €160 million AI investment program, and Finland intends to be one of the leading AI countries, making Finland the best place for research, develop and utilize AI, and to attract additional investment. Finland needs to compete other countries with innovativeness, agility and with the ability to learn AI fast, as other countries are investing massive amounts into AI innovation. The Chinese government is investing €1.7billion on AI investment and the French government has funded their national AI program with €1.5 billion. If Finland's AI program is successful and increased workforce productivity, improved service and product quality can be achieved, a €20 billion increase in the Finnish GDP (gross domestic product) can be achieved in 2023. In 2017 the Finnish Ministry of Economic Affairs and Employment published a guidebook with eight directives to help Finland to become one of the leading AI countries.

1. Enhancement of business competitiveness through the use of AI
2. Effective utilization of data in all sectors
3. Ensure AI can be adopted more quickly and easily
4. Ensure top-level expertise and attract top experts
5. Make bold decisions and investments
6. Build the world's best public services
7. Establish new models for collaboration

8. Make Finland a frontrunner in AI

(PWC & Microsoft 2018)

Valossa is a Finnish startup company which develops AI technology to help a machine to recognize people, objects and situations in a video. Valossa is also able to translate speech into text and picks up the keywords. In a football game the technology is able to quickly pick up red cards, yellow cards, shots on target, goals and injuries. Valossa aims to having one million turnovers in the present year. (Kaleva 2018)

In May 2018 Technology Company Reaktor and the University of Helsinki will launch a free artificial intelligence online course. Elements of AI is an English online course worth two ECTS credits and suitable for anyone irrespective of the work situation, industry or age. The University of Helsinki and Reaktor have a mission to educate 1 per cent of the Finnish population, 54 000 people to understand what AI and the opportunities of AI are. To develop this course, is estimated to cost about 100 000 – 200 000 euros. The course is in English but a similar course in Finnish is scheduled to start in autumn 2018. (Kauppalehti 2018)

4 RESEARCH METHOD

In this chapter the research method of the thesis will be discussed more specifically as well as the validity and reliability of the used method.

4.1 Qualitative research

Qualitative research is a naturalistic process that strives to in-depth understanding of social phenomena within their natural setting. Qualitative research focuses more on questions such as 'why' rather than 'what' and relies on the direct experiences of human beings in their everyday lives. Qualitative researchers use multiple systems for the study of human phenomena. Qualitative methods allow the researcher to study selected issues in depth and detail without being constrained by pre-determined categories of analysis. Qualitative researchers prefer logical and statistical approaches such as case study, biography, discourse analysis, historical analysis, ethnography, grounded theory and phenomenology. Qualitative research values flexibility and openness. (University of Utah 2018)

4.2 Document Analysis

Document analysis was selected for the qualitative method of collecting data for my thesis. Documentary analysis involves collecting data from existing documents, without having to question people through interviews, questionnaires or to observe their behavior. Documents are concrete materials in which facts or ideas are recorded, newspaper articles, government records and websites. The aim is to analyze the documents systematically and make a verbal description of the phenomenon being investigated. (Skillsyouneed 2018)

4.3 The articles and publications used in the study

Qualitative data is mostly verbal, textual and visual and therefore qualitative research method was selected for this study. This study analyses several articles from the Internet which were selected with the following keywords: "AI in sports?" "AI in sports production" "AI in sports industry "AI+sports highlights". The aim was to select reliable sources and articles. The articles used in the research are listed below in a random order.

AI Will Soon Bring Huge Changes to Live Video Production. Alamares, M. 2017
IBM's Watson Will Dish Out Customized Highlights For The Masters. Booton, J. 2018
Super Intelligent Soccer Chatbot Targets Traditional TV Analysts. Booton, J. 2018
Sports: The most disrupted of all industries? Dellea, D. 2017
Deloitte's sports industry starting lineup. Deloitte. 2016
The next generation of sports data. FcBusiness. 2017.
How AI Powers Sports Sponsorship. Foreman, S. 2018
AI sport, it's in the game. Inbenta. 2018
Fan Manager's New AI Platform Helps Clubs Improve Fan Outreach. Lemire, J. 2018
Artificial Intelligence may help detect long-term concussions in athletes. Maynard, C. 2018
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AI – Where are we now, and where are we headed? Thebroadcastbridge 2018

5 RESULTS OF THE STUDY – AI IN SPORTS

In this chapter the articles of the study will be presented, and the content of the articles will be discussed. Sports as a whole will be studied in this chapter but also how individual athletes can utilize AI, and also how organizations and sports production can be evolved with the help of AI will be shown.

5.1 AI in sport organizations and sponsorship

Typically, data and analytics talks in sports have concentrated on player scouting and development, but the business side can also benefit from the data that teams have in use in the present. It is extremely important for a sports organization to have the best possible players, but also to create better fan experiences, to drive more revenue and to create more value are as important. Different business departments, finance, marketing and sales try to improve their strategy and operations with the help of the data they have access to. The return of investment (ROI) for a sports organization can be dramatically improved by data, on the field, in the stands, and in the front office. (Deloitte 2017)

AI can help teams to provide psychological profiles of the hundreds of scouted players. Formerly psychometric tests, such as Myers-Briggs were carried out to study the player's mental strength, but now teams can use better tests with the help of AI that deliver better results than standard psychometrics. (Axios 2017)

To get the best possible result, today's sports clubs has to mix human intelligence and artificial intelligence. All athletes have historical trends and these trends can be collected and analyzed to predict the future. Knowing what your opponent might do is the best way to maximize player performance and can mean the difference between a win and a loss. (Usercompanies 2018)

Stats – a Chicago based company uses advanced technology to accumulate data. Stats technology gathers 2700 data points of a single football game and this data can be given to coaches to provide better analyzes of the game. Coaches can show players how to turn a failed movement to a successful one by taking a different approach in a game. The use of AI will open new dimensions for the success of teams and organizations. (Sportswearable 2018)

A sales department can use analytical approaches to find out on who is likely to buy, what they are likely to buy and when they are likely to buy. Marketing departments can make more customized and targeted

campaigns for possible consumers and finance department spends more time on analyzing data and results. The end goal is to improve interactions with consumers and to enhance sponsorship opportunities, all thanks to data available for sports organizations. (Deloitte 2017)

Fan Manager, an AI based platform helps clubs to improve fan outreach and is used by iconic teams such as NBA's Boston Celtics, NFL's Baltimore Ravens, NHL's Buffalo Sabres and other well-known sports teams. Fan Manager uses machine learning algorithms that runs more than five million fan transactions daily. Fan Manager is said to increase one's efficiency by 80 per cent and it can improve the annual ROI by a factor of eight. (Sporttechie 2018)

IdenTV uses automated content recognition (ACR) system which is capable of facial and object recognition but is also able to track the movement of people, brands, logos and targets in a video-movement. Technology gives marketers information about their marketing campaigns, for example how many times a brand logo appears in NBA footage over a season. Companies and teams can show the sponsors exactly how much they get visibility with their logo sponsorship in a single season for example. In the U.S 76 per cent of upper-income men reported they follow at least one team and 60 per cent of the Americans described themselves as active sports fans. Sports sponsorship is a massive business, and sports fans are one of the most passionate customers there are. In-stadium and shirt-sponsorship are as valuable sponsorship methods as TV, if done right. New technology enables to determine the actual value of on-screen time and the real ROI (return of investment) can be properly calculated. (Theinnovationenterprise 2018)

It is clear that sports organizations see the benefit of artificial intelligence. AI, when exploited sensibly, generates profit for the sports organizations. AI helps teams to find better players, but also optimize marketing campaigns and get better sponsorship deals. Marketing, finance and sales departments can all make better business decisions with the help of AI.

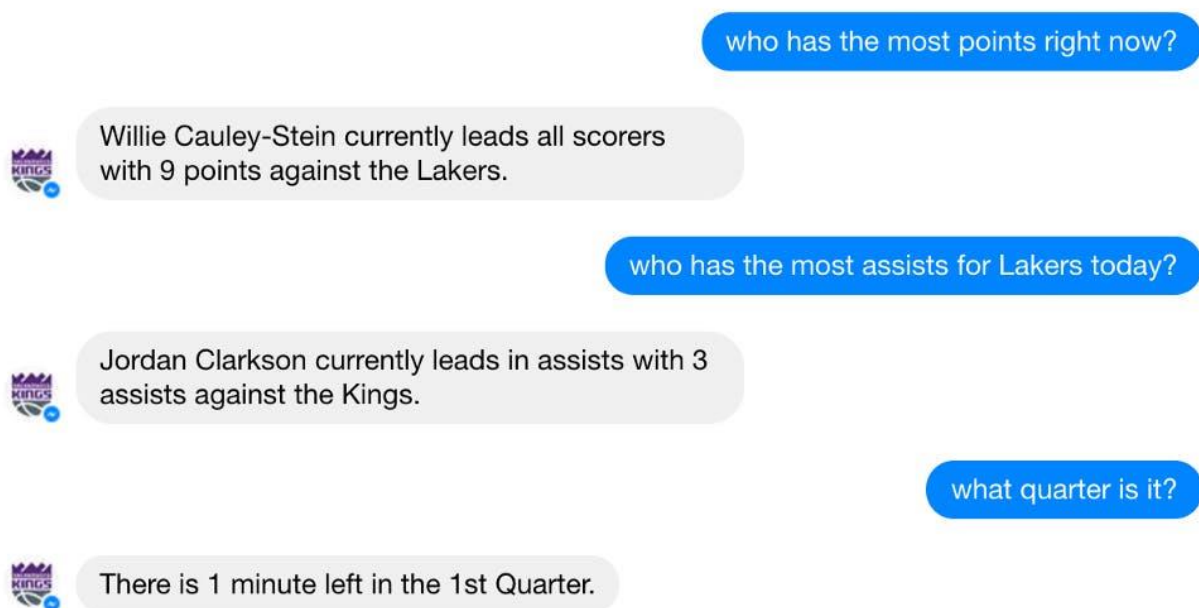## 5.2 How AI can help in fan engagement?

This chapter discusses how AI can make the spectator experience better with the new technology, some of the new technology is already in use, but also some possible future developments will be discussed.

5.2.1 Spectator experience

AI helps to enhance the spectator experience in sports. Chatbots, computer vision, automated journalism and wearable tech are the four major categories enhancing this experience. Chatbots are used to answer fan questions live, computer vision is used in motorsports to identify specific cars at high speed, AI automated sport journalism is also used by media outlets to expand their sports coverage and wearable tech are used to optimize training and performance. (Techemergence 2018)

Chatbots are used by the NBA team Sacramento Kings and the NHL team Tampa Bay Lightning. The chatbot of Sacramento Kings is named KAI (Kings Artificial Intelligence) and it answers questions through Facebook Messenger. KAI is trained to answer inquiries about franchise history, current team statistics, the team roster and details about the Golden 1 Center, which is the home arena of Sacramento Kings. The chatbot of Tampa Bay Lightning can respond to questions about their home arena, general parking information for the game day and questions about the match day tickets.

In NASCAR safety is a primary issue year after year. Races face fatal crashes which are both tragic and costly. AI and neural networks help to quickly identify and access a car that experiences a malfunction during the race. With the help of this new technology drivers are not in such a big danger than before. Automated journalism is well suited for sports, since sports-statistics are numbers-based which makes automated articles easy to write. Wearable tech helps consumers to track performance data, help with nutrition and make custom workout programs. (Techemergence 2018)

FIGURE 8. Sacramento Kings KAI chatbot in action. (Adapted from techemergence 2018)

Sportradar together with MOCAP Analytics produce player-tracking data products for NBA, NFL and other sports fans. "Sports storytelling is an area where machines and humans can work together to enrich the fan experience and stir conversation, "said Arian Forouhar, the Co-Founder and CEO of MOCAP Analytics. "The goal is to change the way people and fans think about, and view, sports. (Sportradar 2017)

AIBALL is the world's first AI-driven football chatbot. The masterminds behind this artificially intelligent chatbot say that their technology may one day replace traditional TV commentators. AIBALL uses natural language processing and deep learning to understand fan questions and to grow more intelligent over time. Most chatbots are mechanical, but AIBALL can learn about the users and keep learning to find information the users really want. AIBALL will be available via iOS and Android apps during the 2018 FIFA World Cup, which is held in Russia in June and July 2018. (sporttechie 2018)

At the moment chatbots are used by organizations and companies to enhance the spectator experience, but I think that chatbots are not the big thing in the future. I think that chatbots are maybe a thing for a few years but are replaced with some other technical innovation in the future.

5.2.2 Highlights

In a football match there are many situations a human eye cannot see or process or fully understand for example player speed, acceleration, angles, trajectories and distances. Fcbusiness, a UK based company provides all this information with the help of AI to create more data for the sport and to enhance more sport innovation and experiences to drive more revenue for the clubs and leagues. Fcbusiness uses the existing cameras that are already available, and no extra cameras or radars are used in the process. The platform is trained to have a football intelligence and gives insights that human eyes cannot see. Fcbusiness platform does not need any human workforce and all the data is processed and analyzed by a computer in real-time. Computer vision technology can deliver the information within a second from the action of the pitch, and without human workforce fewer errors are made. (Fcbusiness 2017)

Reely, a California based company uses machine learning and AI to generate automated sports

highlights. Reely can generate automated highlights in real-time, which gives teams and leagues a possibility to use the content all across different media platforms with a single touch of a button. The company currently uses the technology in football, soccer, rugby, hockey and basketball. Reely recognizes audio excitement, trajectory mapping, player tracking, goal post detection and sentiment analysis to create sports highlights in real-time. Content owners can use the new technology to enhance fan engagement and monetize content more efficiently. (Prnewswire 2017)

US Open tennis tournament is the highest attended sporting event in the world. At the US Open, eighteen matches can be going on at the same time. In the 2017 tournament AI was used to analyze and curate the video footage that was produced during the two-week event. IBM Watson was used to identify highlight worthy material with the help of cognitive algorithms. Watson was taught by the researches to understand the content of a tennis video for example how does a player look like when celebrating, audio is being analyzed to notice high levels of crowd noise and Watson also understands tennis statistics such as; game points, set points and match points. Once the data from the match was analyzed by Watson, it used meta-data to automatically generate the graphs and ease the storytelling of the match. Hence, the highlights were shared to US Open platforms such as, YouTube, Facebook and Instagram. (IBM 2017)
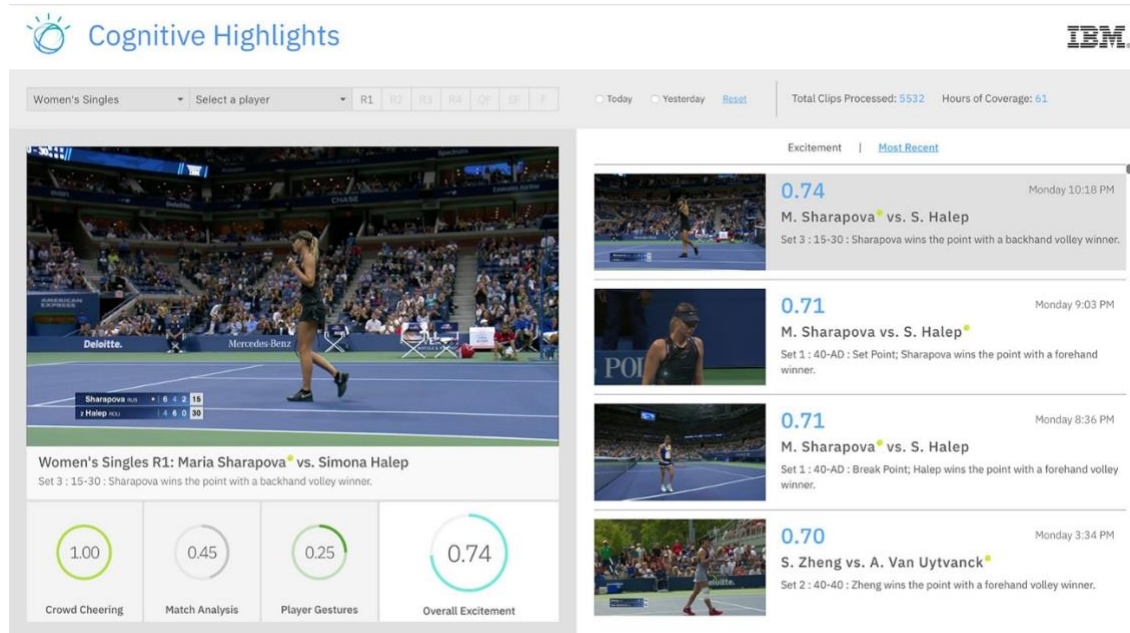

FIGURE 9. Cognitive highlights. (Adapted from engadget 2017)

In the next few years AI, deep learning and natural language processing will change live video production by companies and technologies by Google Cloud Video Intelligence, IBM's Watson, Nvidia DLA

and Conviva's Video AI Architecture. AI will help the production workforce behind the camera. Soon AI will be able to track speakers, athletes and entertainers without the use of any additional sensors or hardware. Technical director for live events will be replaced in the future by deep learning algorithms. Deep learning algorithms will automate the editing and video creation process. The intelligent software will select optimum camera shots and angles based on the content of the stream by using facial, gesture, emotional, body, color recognition, clothing and other imaging data and cues. A neural network can iden-tify target objects or people with facial recognition. Facial recognition could also generate graphical statis-tics on a particular player on the field. Cognitive technology will be common in everything; sports, eS-ports, corporate communications, education, and live events. (Streamingmedia 2017)

In the Masters 2018, IBM will introduce an automated and personalized highlight reel called "My Moments" for golf fans for free of charge. The service gives fans access to receive highlights from their favorite players. Watson uses the sound of the crowd and the tone of the commentators, as well as player and crowd gestures, such as fist pumps, to determine a particular shot's overall excitement level. It then clips and rates these moments against other highlights to determine the best overall moments of a match. (Sporttechie 2018)

Chatbots are used to enhance the spectator experience live, but I think that the way we consume highlights now will be completely different because of the changing way of producing highlights in the future. Highlights are likely to be a vital part of the live video streaming as well in the future. There is much a human eye cannot see or understand and highlights are going to change that with more understandable content.

5.3 AI in sports production

AI and machine learning applications have already improved sports production processes and efficiency and will do so in the future. AWS Elemental, a US based software company can track and identify players in a sports game with an 84-94 per cent accuracy and is able to do speech recognition and speech-text translation too. Mobile viewpoint, a company from the Netherlands uses AI-based camera systems to create content without the use of camera crews and other production facilities. The AI camera system of Mobile viewpoint uses a mixture of sensors, including depth, video and audio which automatically points the cameras to take the best shot. Cameras will automatically point towards the one who is speaking for example in an interview. AI systems have also reduced the bandwidth requirements, and better quality can be produced to customers with less Internet bandwidth speed. (Strategyanalytics 2018)

Football stadiums widely are using new cameras which are revolutionizing football. These cameras are able to produce detailed data never perceived before: what part of the body contacted the ball, whether the team is playing the formation prescribed by the manager, and even the true potential of a player. Combining these two elements allows for a much greater knowledge of what interactions are taking place on a pitch, their effect on the desired outcome of a victory and how to alter determinants of that to the advantage of a team. (SAS 2018)

AI can take over the repetitive and automated workflow and human workforce and editors can focus more on creative activities and concentrate more on social media content. Video quality monitoring, where people watch live streams to spot technical problems employs hundreds of people inside the industry, and this is one job AI could replace easily and reduce costs. AI-based video analysis is predicted to be more common in the media industry within the next six to eighteen months. (Strategyanalytics 2018)

In sports production humans still mostly perform better than AI technologies. AI technologies are not fully capable of replicating the experience of traditional systems and viewers spot this difference. Viewers do not criticize AI technologies though, as there are no other alternatives and the quality is usually good enough. A critical point is when AI-systems replace human-operated camera systems and production fully. At that point we see the possible outcomes. AI surely improves the efficiency and delivers more high quality and improved content, and some human roles may not be required anymore, but this should not be a surprise as the industry has evolved and matured just as any other industry in the past 80 years or so. (Strategyanalytics 2018)

AI can automate the quality control of sports production and error-prone and time-consuming tasks are operated by AI. The price of sports rights is high, and broadcasters are looking for anything that can reduce their production costs while attracting maximum number of viewers. AI reduces costs and helps broadcasters to produce better content and that is why AI based platforms are likely to change the sports production technology in the coming future. (Thebroadcastbridge 2018)

I think that AI will change the whole concept of sports production and TV production in general. Companies invest heavily in sports production and want better content for the consumers and this way of thinking will change the whole production industry, including sports production.

6 CONCLUSION

In conclusion, this paper helped me to understand artificial intelligence more widely, but also other related matters connected to AI. It is strange to think that artificial intelligence has been around since the 1950's because it has only been discussed more widely in the last five to ten years. In the last five to ten years the technology has taken major leaps and that is for sure one main reason for why artificial intelligence is such an absorbing topic at the moment. In the present the new technologies grow more rapidly than ever, and artificial intelligence has been described as revolutionary an innovation as electricity in the 1800's. Taking a closer look on artificial intelligence in this paper I think that the comparison is very accurate.

Looking at AI investments one can clearly see that in the last two years companies' have started to understand the possibilities and benefits of artificial intelligence. At the beginning of this decade investments on artificial intelligence were really small and that is rather surprising. However, when we think how much smartphones have changed in the last ten years and the smart technology in general, it is not so surprising anymore. The biggest revolutions and investments will be seen in a few years. It is no surprise that China and the United States are leading the competition and I do not see any other country to be able to truly give them a hard competition. Finland and other EU countries have stated that they want to be the leading countries in the AI race, but that is more of a fantasy than reality.

The future of work will change, but there is no certainty how it will change. AI generates both threats and opportunities for the future of work. Creative work will stay the same, as humans are still more creative than machines. Repetitive and routine-based jobs are in the line to be taken by machines and I think it is a very good thing. Even my nearest grocery store has a self-service checkout. In the future humans can concentrate more on creative work and assist machines and work alongside machines, which will create unknown possibilities and new professions.

Already today algorithms run by AI and machine learning can be more accurate when making medical decisions and it is going to revolutionize the medical field. It is a wonderful thing that with the help of AI people's lives can be better and safer. People who fear AI will take their job need to be more educated and look at the technology from a different point of view: how the new technology can enhance their current life situation, not how it might ruin their job. As AI is becoming more common in the society at a fast pace it is really important that governments take action as the old life models do not apply anymore. The whole environment is going to change, and people, cities and countries need to make sure they are ready for the new era.

In sports everyone wants to be the best and the biggest. New technologies which can improve performance are the best news an athlete or sports organization can think of. AI brings all the advantages for a player or an organization if it is utilized in the best possible way. Organizations want better results from players but also more annual revenue, and in my opinion this thesis shows how organizations use AI at the moment but also how AI can change the whole industry. To us, as a spectator I find it really interesting how much impact AI will have in the short-term future, as the live video production evolves to new dimensions.

In my opinion this thesis gives the reader a versatile thought of AI but also shows that, when talking about AI, nothing is certain. Short-term future predictions are credible, but the predictions are still more or less guesses. How the world will look in two, five, ten, or fifty years is uncertain, but I believe AI will have a major effect on it.

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