

## **The public perception of AI affecting the sports industry**

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<p>The goal of this thesis work was to identify how does Artificial Intelligence affects the sports industry.</p> <p>Theoretical background about AI and AI in the sports industry has been collected from books, academic articles, scientific blogs. Based on the theory gathered from various resources the author has created six different hypotheses and a questionnaire. Hypotheses claimed that AI is impacting on daily life and sports industry, particularly in Basketball and Football.</p> <p>The quantitative research method was selected for this thesis. The questionnaire consisted of twelve questions about AI and the impact of AI in the sports industry. The target groups were students and teachers from Vierumäki, sports campus of Haaga-Helia University of Applied Sciences, Finland. The survey has been sent to 103 people, 78 people have responded to the survey, response rate over 70%. A few limitations of the chosen method have been discussed during research work.</p> <p>Results have been analyzed carefully within each categorized section: Demographics of respondents, Awareness of AI, Impact of AI in the sports industry. The first section of the survey allowed the researcher to get a better perception of the people answering the survey and defined the audience responding to the study. The second section helped to state the awareness and understanding of respondents of AI. Finally, the third section enabled us to determine the impact of artificial intelligence on the sports industry and the consumers.</p> <p>A comparison of hypotheses built from theory and data collected from the target group led to a correct and accurate assessment of the thesis conclusion.</p>	
<b>Keywords</b> Artificial Intelligence(AI), Machine learning, Quantitative research.	

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## ■ Introduction

“Anything that seems to require human intelligence” Lisa Rau

Nowadays Artificial Intelligence is becoming more and more present all around us, we as humans, have to find a way to live among it without losing control over it. Artificial intelligence is one of the most interesting things in this world, that already is and will continue to revolutionize our everyday life. I have always been amazed by this powerful tool that has the capacity to program, think, analyze, learn and make his own decisions. The usage of knowledge to solve problems is basic but is the most important feature of intelligence. That is what defines artificial intelligence, becoming more and more close to a human being. The long-term goal of artificial intelligence is to reach the human level. (John MacCarthy 2005)

For us, AI is a way to make our everyday life easier, the implementations of AI are numerous, one of the first ones was the autopilot in airplanes at the beginning of the 19th century. Now being able to use the location data of smartphones via Google Maps, the development of numerous autonomous vehicles or even the software used to detect plagiarism are all different parts of AI. The artificial intelligence revolution goal would be to replace the work performed by human civilization by AI.

We're going to focus our research on how Artificial Intelligence is affecting the sports industry now and in the future. Nowadays big companies such as PIQ which is a well-known French start-up in sports created AIs that are able to gather real-time data about players on the field, analyze it, and used it to increase their performances. We will try to define the new possibilities and outcomes of AI in sports throughout this research.

## Research Questions

The two main research questions would be:

- How AI can be utilized in sports? (Football & Basketball)
  - What is already on the market?
  - What will be in a few years?
  
- What is the influence of AI on consumers?
  - Is AI changing how the fans are consuming sports?
  - What accomplishment has been done yet?
  - What will be done in the future?

With the first question, I would like to identify how far AI has been utilized until now in various sports, particularly in Football and Basketball. The evaluation of the current AI system would be beneficial to draw a general picture of what is happening right now, the benefits of AI utilization, the outcome of usage as well as further upcoming possibilities in near future.

The second main question is critical to assess consumer behavior towards AI. The key is to get the description of consumer experience from AI. It covers a massive amount of data that could be used for further development of the current AI system. Whether AI could be used as an attraction in the sports industry, whether it would build more value in specific areas of sports or whether it would cause a negative effect, the answer lies behind the second question.

Most people get overwhelmed by the hard topics in surveys related to technical innovation, technological development, Hi-tech topics, inventions, etc., so in order to avoid such issues and get clear answers, questions were made in the simplest manner.

## ■ Artificial Intelligence

The concept behind Artificial Intelligence has been discovered decades ago, but the creation, implementation could not be done without a large amount of data which is closely linked to the Internet. Before the Internet, people would not take projects related to AI development with a vast hope, because a few decades ago it would sound almost like a fantasy. The system that would induce cognitive learning behavior to machines, for example, the vacuum cleaner that would be able to clean any kind of house, the complete of control of the device with your sound, auto-driving cars, etc.

In this chapter, we will try to get a better understanding of artificial intelligence, starting by defining how it began with the background history of AI. Further, we would be describing the different aspects and forms of artificial intelligence.

### **History of artificial intelligence**

The mathematician Alan Turing was the first person to approach the notion of artificial intelligence in 1950. The experiences done by him were destined to determine if a machine could have a “conscience” and has been called the test of Turing.

In 1956, the American Marvin Lee Minsky defined Artificial intelligence as “the construction of computer programs that can perform tasks, that is, for now, done well by human beings. Because they require high mental processes like perceptual learning, the organization of memory and critical reasoning.” I admire that definition and it was during the same year that the world “Artificial intelligence” was created by another American computer scientist, John MacCarthy during the Dartmouth Conference. At this point “Artificial intelligence” was researching topics like symbolic methods or problem-solving. (Coheris 2019)

Later on, in the 1960s, the US started to train computers to mimic basic human reasoning. For instance, The Defense Advanced Research Project Agency (DARPA) managed to complete a street-mapping project in the 1970s. And in the early 20th century they had intelligent personal assistants, much longer before Alexa, Siri and others. (Goodnight, J. 2018)

According to (John McCarthy 1998, 2) Artificial intelligence is the science and engineering of making intelligent machines, especially computer programs. To understand human intelligence by using computers, but it doesn't stay into methods that are biologically observable.

AI will always demonstrate behaviors associated with human intelligence such as planning, learning, problem-solving, emotion, creativity. AI can be divided into three broad types, the narrow, the general and the super AI. (Nick heath 2018)

### What is artificial intelligence?

Artificial intelligence is a part of computer science that highlights the creation of machine learning able to think and react like humans. Nowadays, computers with artificial intelligence include methods like learning, planning, and problem-solving. Knowledge engineering is an essential part of AI research. For the machines to be able to act like humans, they need a tremendous amount of information relating to the world - Big Data. Making it possible for the machines to use this information, reasoning, and problem-solving is a troublesome task. (Deloitte 2017)

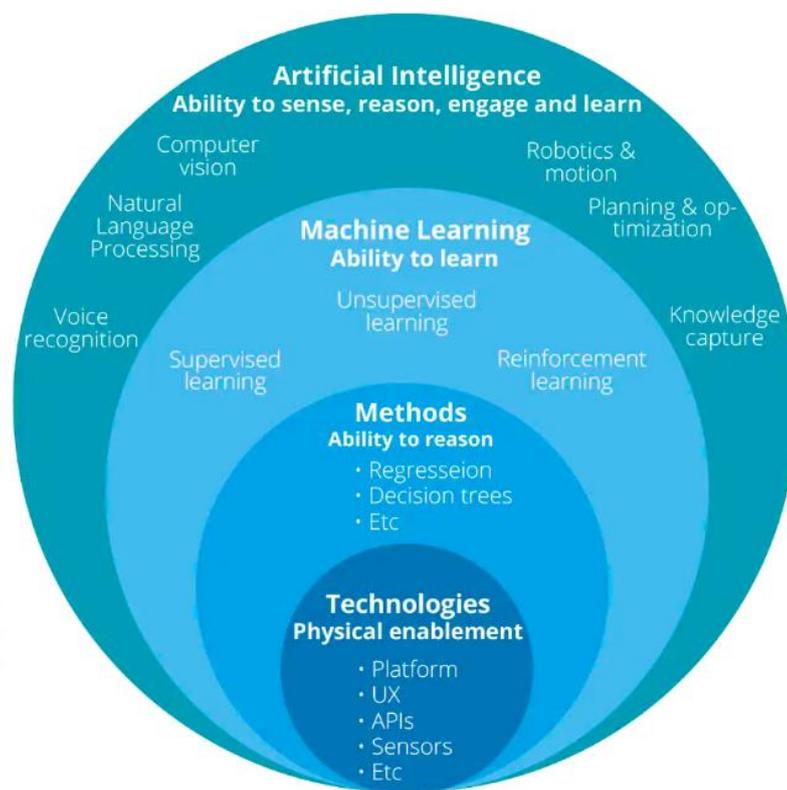


Figure 1. Artificial intelligence (Deloitte 2017)

As can be seen from Figure 1, Artificial Intelligence is explained in a circle layer manner. Each of four circles describes a characteristic that is related to AI and circles are interrelated, starting from the biggest and ending with the core circle.

The first circle answers to a question on what AI is and how does it work. In general, there are two types of AI. Narrow AI – applications that are used for the accomplishment of a single task, for example: playing chess, translation, face recognition, etc. Narrow AI is

made from a specific algorithm that used for solving only one task and can not be used for another activity. General AI – a super application that could be utilized to solve different tasks simultaneously. General AI application could easily beat anyone in a chess game, solve any calculus and accomplish other tasks as well.

The second circle presents an integral part of all AIs – the ability to learn or Machine learning. Machine learning is a simple application with a built loop that has a correct answer integrated within. When the application receives a big amount of data it will learn how to select a correct answer based on an integrated answer and ability to learn from mistakes it has made previously. For example, emails that are sent to spam boxes if they are spam. The only disadvantage is that a person should insert a correct answer, the application does not recognize what is wrong and what is correct, moreover, it does not care.

The third circle, the cognitive ability of AI or in other words ability to reason. The cognitive ability of AI is quite similar to humans, with a slight speed difference. The cognitive ability is the capability to extract the required information from unstructured data, again the big amount of data is required. The cognitive ability will improve from observing the interaction between humans and feedback received by the application. A great example of cognitive ability recognized in a real-life is a call center used for customer service, the application could easily respond to any question answered by the unknown customer.

The last circle represents the areas where AI is currently utilized. AI is a very broad application and it is extremely tricky to narrow it for a certain industry like automation, business, tourism, etc. It could exist in almost any industry because the main components required by AI exist everywhere.

Artificial intelligence has several underlying technologies, and for most of those technologies, there are several alternative functions they can perform. That is why the AI researcher Kris Hammond proposed a "periodic table" of AI. (Table) (Thomas H. Davenport 2019)

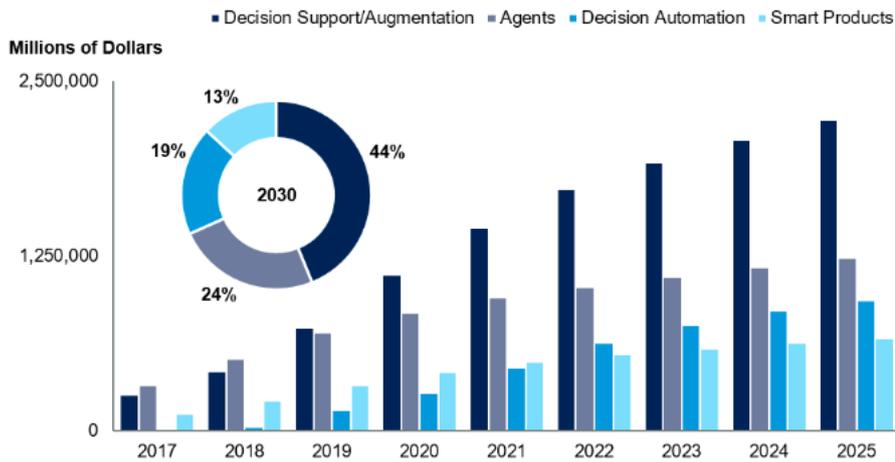
Technology	Brief Description	Example Application
Statistical Machine Learning	Automates the process of training and fitting models to data	Highly granular marketing analyses on big data

Neutral networks	Uses artificial “neurons” to weight inputs and relate them to outputs	Identifying credit fraud, weather prediction
Deep learning	Neutral networks with many layers of variables or features	Image and voice recognition, extracting meaning from text
Rule-based expert Systems	A set of logical rules delivered from human experts	Insurance underwriting, credit approval
Physical robots	Automates a physical activity	Factory and warehouse tasks
Natural language Processing	Analyzes and “understands” human speech and text	Speech recognition, chatbots, intelligent agents
Robotic process Automation	Automates structured digital tasks and interfaces with systems	Credit card replacement, validating online credentials

Table 1. “Periodic table” (Thomas H. Davenport 2019)

The global business value of artificial intelligence is presumed to reach \$2.9 trillion in 2021. "As AI technology evolve, the combined human and AI capabilities that augmented intelligence allows will deliver the greatest benefits to enterprises." Said Svetlana Sicular, research vice president at Gartner. Gartner produced a business value forecast by AI types, where you can see that decision support/augmentation is the most significant type of AI (FIGURE 2). As you can see the business value of AI is expected to grow significantly. (Gartner 2019)

## Business Value Forecast by AI Type



Source: Gartner  
ID: 386366

Figure 2. Business value forecast by AI type. (Gartner 2019)

### 2.1.1 The base of machine learning

Machine learning is a field of study concerned with giving computers the ability to learn without being explicitly programmed. We can define learning as a process of acquiring knowledge, obtaining experience, that improves performance adapted to the environments. (FIGURE 3) shows a simple learning model with the four basic elements. The environment provides all the needed external information. The learning unit process that information and stores it into the knowledge base. The performing unit will achieve the task based on the knowledge acquired. Then send the results to the learning unit through feedback. This cycle enables the machine to learn by themselves, gains knowledge and intelligence, by showing signs of thinking and learning. (Zhongzhi S. 2011)

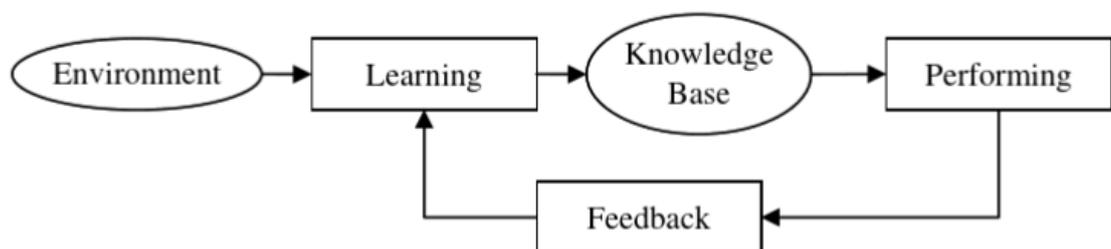


Figure 3. The simple model of learning (Simon, 1983)

### 2.1.2 Different forms of artificial intelligence

Most artificial intelligence specialists agree on the fact that it can be divided into a three-level typology. First of all, we have an Artificial Narrow Intelligence (ANI). It is AI that can outperform humans in a narrowly defined task. Software capable of beating the best

players of "GO" in an (ANI) solution. ANI is capable of doing only one activity: drive cars, automatic translation, or play go. During the past five years, most of the invested money has been in ANI application, and it starts to give results. The company DeepMind is the one that developed the AI that beat the European champion of GO, which is a very strategic and complex game. Google Translate has been for many years now, helping people to understand and translate languages. But since 2016 Google started a new automatic translation built on AI called Google Machine Neural Translation (GMNT). This software created an artificial language by itself to ease future traditions. (Louis Naugès 2017)

Next comes Artificial General Intelligence (AGI), which is an AI capable of producing many activities at the same time almost as a human being. That would mean thinking and learning from experience as humans do. At this time, there is no functioning AGI, and we still need to wait many years before we get to that point. Some startups have specialized themselves into AGI, but they are most of the time bought by the pioneers the web like Microsoft, Google, Facebook... Those pioneers hold all the necessary components to develop the AI: unlimited storage, infinite calculation, enormous database, and billions of customers. (Louis Naugès 2017)

Finally comes the Artificial Super Intelligence (ASI), an intelligence that would outdo any human capabilities. What will happen when the gap between human knowledge and ASI gets too wide? Many "super intelligent" people such as Elon Musk, Bill Gates or Stephen Hawking have been warning people about artificial intelligence. There is a "potential" danger linked to the arrival of ASI, and it's essential to reduce the probability that humankind gets destroyed by the ASI solution. (Louis Naugès 2017)



Figure 4. Timeline (Frank Diana 2017)

### 2.1.3 Fields and application of artificial intelligence

Now, after we have introduced ourselves with AI, let's go deep into the different fields in which AI is applied.

Artificial intelligence is described mainly as a simulation of human behavior, where we can observe various disciplines:

- Thinking
- Listening and speaking
- Understanding language
- Remembering things
- Seeing
- Moving

To showcase the capabilities of AI let's breakdown its algorithm. Most of the current popular AIs collect the information with a speech recognition system. Speech synthesis techniques convert data into recognizable sounds. A clear example of such an application could be a Google translator. The process of understanding language for an AI is called natural language processing (NLP). Remembering function is taken as facts from the world and categorized into ideas of our societies. In order to think, AI must use an expert system. The modulization network is built by block created in the brain. Those blocks are called neurons transmitted within a neural network. To turn on the vision of AI, the creation of machine vision techniques is fundamental to learn about our environment, for instance, the capability of face recognition. Final functions are the ability to move and feel, which are natural things for humans, but an extremely challenging task for computers. For

AI those fields are covered by robotics and control theory, in other words, control of own movement based on feedback gathered from your surroundings.

## ■ Artificial intelligence in sports

In this chapter, we will try to get a better understanding of artificial intelligence in our sports industry. Starting by describing the diverse application in sport and more specifically in Football and Basketball.

### **Existing application in sports.**

Nowadays, we can find artificial intelligence in pretty much every domain, finance, healthcare, entertainment, marketing, and there is more. It's easy to find AI usage in the areas stated earlier, but what can we say about sport?

The North American sports industry is producing billions of dollars in revenue each year in entertainment, art, and recreation. In 2019, the North American sports industry is projected to reach more than \$70 billion in revenue. For now, the applications of Artificial intelligence in sports are more help based. It can be for arbitration, the training, or the player tracking, but currently, we won't be seeing robot games without mistakes. For any "physical" sports, artificial intelligence is not autonomous yet; it is not ready to analyze and make the right conclusions. (Kumba Sennaar 2019).

Now let's get into a few different implementations of artificial intelligence in sport:

- **Augmented arbitration:** For many years, Tennis was using the hawk-eye technology to know for sure if the ball had touched the line or not. In football, the goal-line technology appeared in 2017. The referee's watch vibrates as soon as the ball crosses the goal line.
- **Coach application:** In the boxing field, a French company called PIQ, developed a program that can analyze all the boxers' movements. Even the tiniest variations are taken into consideration to study them and determine what should be changed to become more productive. The application is taking the coach's place for all the technical side of coaching but cannot yet develop his mental qualities. In a few years, a virtual coach could take place on the bench of the biggest football or basketball teams.
- An agency called AKQA started this project with the idea of creating a new sport. By giving to artificial intelligence, the data of 400 sports with different fields, balls, and rules. The AI offered many games; some were eccentric, but finally, one game

came out of the lot: The Speedgate. (FIGURE 5) A sport played with an oval ball as in rugby with no contact like in volleyball but with football goal. (Fabrice Auclert 2019)

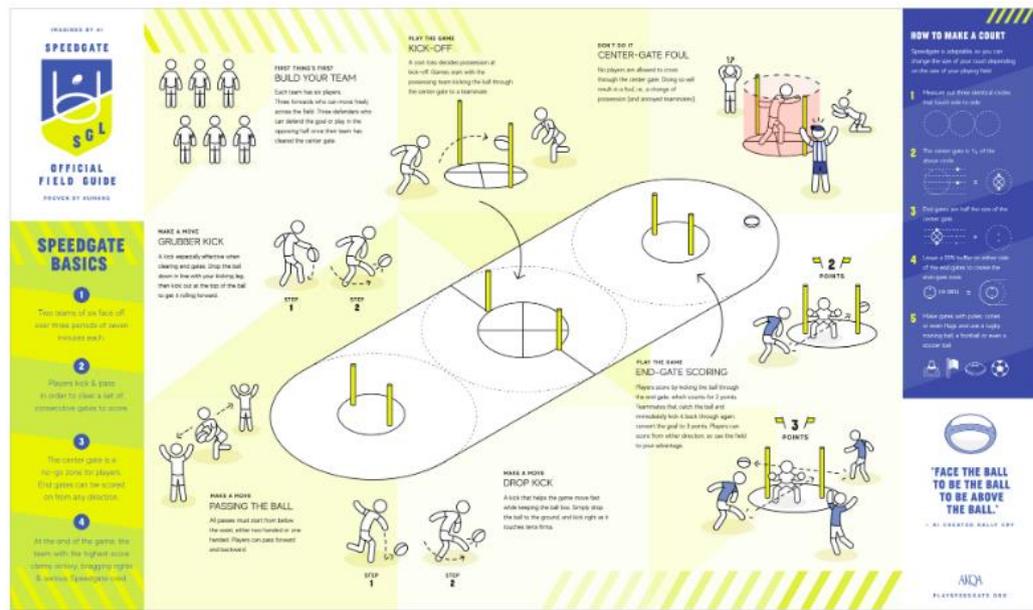


Figure 5. Mark Wilson. Speed gate. Courtesy AKQA. (Fast Company 2019)

- Chess, poker: The place where artificial intelligence made the most progress is in cerebral sports. In 1997, Garry Kasparov (the World champions of Chess) got defeated by DeepBlue, which was the first significant progress of AI. In 2017, the Deepstack program managed to beat all his opponents in poker. Poker is a game where tactics are not all. You have to be able to bluff and decrypt the player's movements as well.
- The supporter's experience: Sports teams are using chatbots, operating through Facebook messenger to respond to fan's requests on the price of the tickets or the composition of the team before the game. (Co-marketing 2018)

### Football implementation

Football has always been the most popular sport with a fan base in the billions. It brings excitement and passion to sports lovers and even the common mass around the world. Football always had the strongest popularity in comparison to other sports.

The football World Cup organized by FIFA is known as the biggest football event. Every country is competing to host this major event with all the tourism and business opportunities associated with it. A study showed that in some countries, six out of ten children want to become a footballer. The popularity of Football and the World Cup is still growing around the world. (Utpal Chakraborty 2018).

### **3.1.1 Role of data in Football.**

Nowadays, in our sports industry, player and game statistics play a Significant Role in how the industry functions. Stats is the base of the recruitment of the players. The distance traveled the sprint speed, the number of passes, or the number of shots. This data is then used by the coaches to decide which players will play and what plays will he use on the field. Football is a sport where a considerable amount of data can be collected but was slow to adapt to technological advancement. (Frankie Wallace 2019)

It was only until recently that Football started to open their sport to technology, with the implementation of tablets on the field to get some real-time data analysis. It shows that FIFA is willing to take a step towards AI programs in Football. AI has the potential to change a lot in the players and coaches in-game decisions. With fast data analysis, the coaches could make changes to his game plan, knowing exactly what wasn't working well. (Frankie Wallace 2019).

### **3.1.2 AI technologies used in Football.**

The first main application of AI in Football is the "Goal Line Technology" (GLT), which can precisely catch human errors and mistakes. This technology will notify the referee if the ball has crossed the goal line by sending a vibration to the referee's watch. (Utpal Chakraborty 2018)

During the FIFA World Cup 2018, Telstar introduced a "Near Field Communication" (NFC) chip powered with AI. It allows the users to interact with the ball using a smartphone. (Utpal Chakraborty 2018)

Computer Vision, which is one of the main Artificial intelligence branches, was also used in many different applications during the World Cup. Smart ticketing, automated video highlights, precise and more efficient control of cameras and security many applications. It was the first time that so many advanced AI technologies were in use for Football. (Utpal Chakraborty 2018)

Finally comes the "Video Assistant Referee" (VAR), which is reviewing decisions made by the referee with the help of video footage and a headset connection with a video operation room. It was during the FIFA World Cup 2018 that VAR was implemented for the first time.

VAR is now used in every Champions League game, which gives a faster and much efficient way for the referee to make decisions. (Utpal Chakraborty 2018)



Figure 6. Sebastian Osea. 2019. The controversial Video Assistant Referee (V.A.R) in Soccer.

### Basketball implementation

Basketball is also a prevalent sport in our society, with billions of fans, it's the third most popular sport in the world. Within the past ten years, the content for NBA fans has improved exponentially. Now we can measure the pass distances or the player's speed, for example. The technology we have currently is completing the work of coaches, players, commentators to produce a broad understanding of the game. Artificial intelligence is allowing us to gather so much new information, which wasn't feasible for us as humans a few years ago. (Dominic Lau 2017).

#### 3.1.3 Role of Data in Basketball

The advance in artificial intelligence in Basketball arrived earlier than for Football. In 2010, a sports company called Stats was the first to install a SportsVu camera system in NBA arenas. These cameras, tracking the player movement and the Basketball got established in every NBA arena by 2013. The collection of information became way more accessible, the player's position and speed, but also who scored the bucket, for instance. With the abundance of data, it is sometimes difficult to extract useful knowledge to help coaches and players to develop.

That is why NBA teams started to use machine learning and artificial intelligence. Combining these techniques with this massive amount of data can change the way pros play Basketball. Getting insights about their teams, their opponents, and, most importantly, the players, can improve the overall experience. (Marcus Woo 2018)

Previously we talked about NLP, which is the capacity for a computer to process our language and replicate the human ability to understand it. NLP is allowing a new way for the fans to interact with the teams and the league. As more and more players come from abroad to play in the NBA, the language barrier is something that can be modified with NLP. Fast and effective translation could allow coaches and players to remove those language barriers. One of the most recent examples is the Sacramento Kings' application: "King's Artificial Intelligence" (KAI). The "chatbot" program answers the questions associated with the team and their stadium. (Dominic Lau 2017).

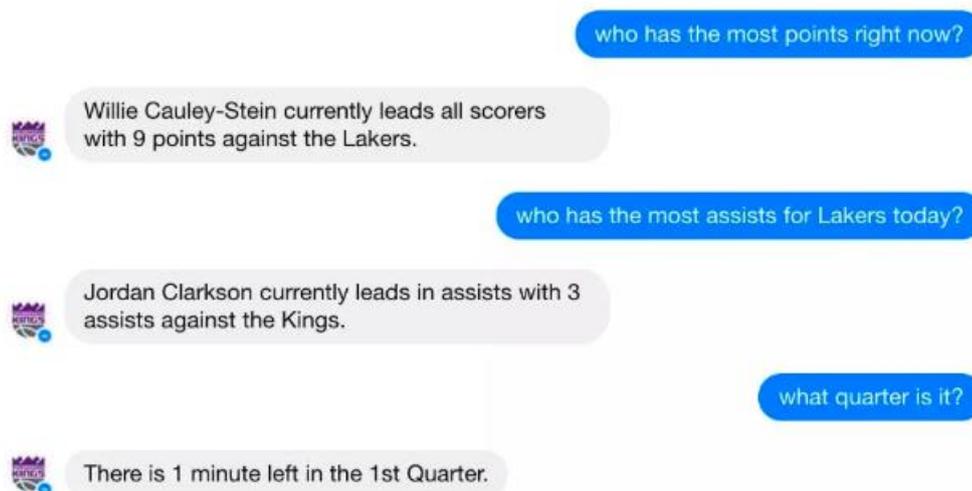


Figure 7. Sacramento Kings KAI Chatbot (Emerj 2019)

In Basketball, shooting is almost the most crucial skill, and analyze the shot ability from a player was done by evaluating a considerable amount of shots. Now algorithms can predict the player's shooting ability based on around 30 shots. The data gathered will be enough to provide an accurate estimation of their shooting skills. Another study conducted by Panna Felsen on Stephen Curry, had for goal to analyze the shooter's body positions. What position have the feet on the moment of the shot, and how it affects a 3-point shot. (Markus Woo 2018)

#### **3.1.4 The importance of Computer Vision in basketball.**

When it comes to computer vision (CV), the computer is earning the capability to gather and analyze the data that they see and reproduce human understanding. For instance, the company Second Spectrum, gather and codes a vast range of increasing data for all 30 NBA teams. The cameras are tracking and recording 3D spatial data for every player and ball movement. It can, for example, help the coach identify if a player is tired. That data can also produce interactive visualizations, which allow the teams to analyze their performance and achieve improvement on the court.

(Paul Luu Van Lang 2019)



Figure 8. Computer Vision on a Basketball court. (Dominic Lau 2017)

Finally, Time Series (TS) uses chronological data to find patterns, statistics, characteristics, and insight among data points. It's mainly used to predict the outcomes of the games to a certain level of certainty. TS is developing and will grow more in the coming years. (Dominic Lau 2017).

## ■ Methodology

In this chapter, the main objective is to explain my choice of quantitative research to gather the data needed to answer my research questions. But before getting into the research methods, we need to understand what quantitative research is and what are its advantages for this thesis. We cannot talk about artificial intelligence if there is no data. Data is essential for AI to develop and grow, that is one of the reasons why I chose quantitative research.

Quantitative research is an investigation by the gathering of quantifiable data and producing statistical techniques. Qualitative research gathers information from a large number of people/customers by using surveys, questionnaires, etc. That data can afterward be transformed into numbers and allow me to make conclusions with numerical results. In this case, I will use survey research, which is an essential tool for quantitative analysis. Thanks to it, I will be able to ask multiple questions and collect data from a large group of customers. For this thesis, I chose to target the students and teachers of the Vierumäki sports campus to get a better understanding of what is known by the people studying or teaching in the field. (Anup Surendran).

Why choose questionnaires over interviews? First of all, surveys are more cost-effective in terms of time and money because they can be emailed. The poll tends to increase honesty because it is anonymous, which makes it more reliable. (Cohen & Manion & Morrison, 209.)

## **Thesis structure**

This thesis is divided into four sections, where each section has its importance for the overall understanding of my project.

- Background information explaining why I chose this subject and how Artificial Intelligence can be what is it today.
- Theoretical part: proper introduction to what is artificial intelligence, what are the implementation in sport. Get knowledge from books and research papers.
- Methodology: what method has been chosen, why exactly this method, how it will be implemented.
- Results section: The gathering of data on Artificial Intelligence, coming from sports teachers and students I will be able to get answers on the impact of AI in the sports industry.
- Discussion section: I will discuss the overall process of this research work, a method that has been applied, discoveries, limitations, and recommendations for further research.
- Conclusions: The last part of the thesis, where I will recapitulate the overall subject, make sure answers have been given to the research questions.

The reason why my thesis has been written in such a way was to make sure that I would acquire the right amount of knowledge to make conclusions about AI's importance in our sports industry.

## **Data analysis process**

### **Hypotheses:**

For the sake of getting better answers and to answer our research questions, six hypotheses have been created and will be analyzed during this study:

- H1:** Artificial Intelligence is already impacting our everyday life.
- H2:** The future of AI is in sports but also in other fields.
- H3:** Artificial Intelligence is already impacting sports.
- H4:** The AI applications in Basketball are known.
- H5:** The AI applications in Football are known.
- H6:** Artificial Intelligence will always be controlled by humans.

The first goal of the questionnaire was to collect the maximum answers coming directly from people having some knowledge of Artificial intelligence. The survey is based on the information collected on the theoretical framework and theory.

Here is the role of each question:

<b>Question</b>	<b>Goal</b>
Question 1, 2 and 3	Demographic data
Question 4	Be sure that the respondent knows AI
Question 5 and 6	Measure the knowledge of AI
Question 7	Prove or disprove hypothesis 1
Question 8	Prove or disprove hypothesis 2
Question 9	Prove or disprove hypothesis 3
Question 10	Prove or disprove hypothesis 4
Question 11	Prove or disprove hypothesis 5
Question 12	Prove or disprove hypothesis 6
Question 13 and 14	Define the advantages and disadvantages
Question 15	Prove or disprove hypothesis 2
Question 16	Can humans push AI towards destruction?

Table 2. Research questionnaire

## Results and data analysis

In this section, the results of quantitative research will be presented. The main goal of the questionnaire was to answer the research questions and get a better understanding of how Artificial Intelligence is impacting sports consumers, now and in the future. The survey has been distributed to 103 people and 78 people completed the survey, which makes a bit more than 70%.

The analysis is divided into three sections, the first part of the survey allows us to get a better perception of the people answering the survey and will define the audience responding to the study. The second section helps us define the awareness and understanding of respondents, artificial intelligence has been around us for more than half a century, but what do people know about it? And what is their general opinion about it? Finally, in the third section, we will be able to determine the impact of artificial intelligence on our sports industry and the consumers.

### Demographic data

The first three pie charts will allow me to know my audience, get some demographical knowledge. Who answered the questionnaire? What kind of person are they?

Please indicate your gender

78 responses

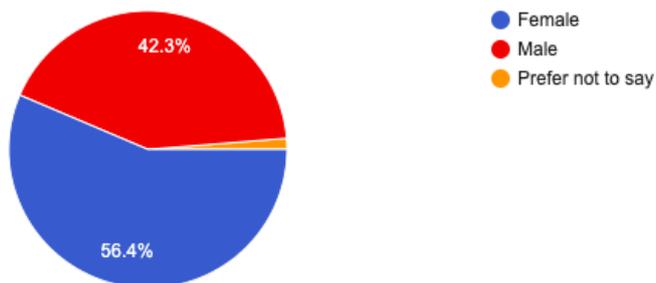


Figure 9. Questionnaire Results – Please indicate your gender

How old are you?

78 responses

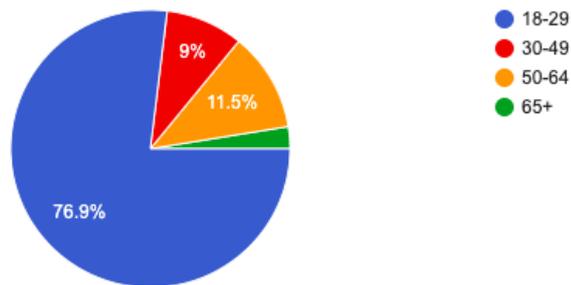


Figure 10. Questionnaire Results – How old are you?

What is your current employment situation?

79 responses

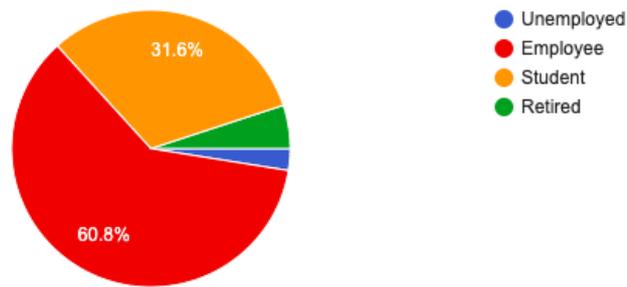


Figure 11. Questionnaire Results – What is your current employment situation?

All the respondents are adults, and the vast majority of the respondents are between the (18-29) age gap (81,8%). Without surprise, most of the participants have an active life, either from their work (57,6%) or as a student (33,3%). They are the people who have been growing in a world with new technologies and seems to have a better understanding of Artificial Intelligence. They have the will to use AI, trust the modern applications of it, without showing massive concern about the negative impacts that could appear from it. When talking about AI, gender is not something that will show considerable differences in the divergence of opinion.

## Awareness and understanding

Have you ever heard of Artificial Intelligence?

79 responses

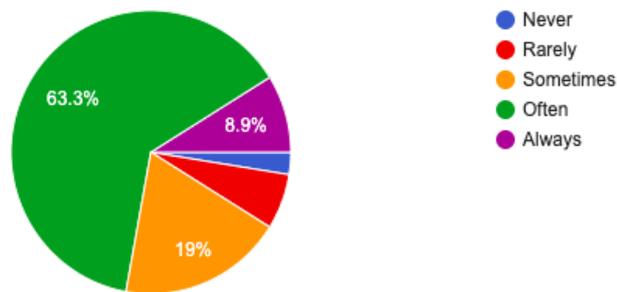


Figure 12. Questionnaire Results – Have you ever heard of Artificial Intelligence?

From the 79 participants, only 2,8% Never heard of AI, which shows that nowadays, Artificial Intelligence is everywhere around us; 63,3% of the participants often hear about it and 8,5% always hear about AI.

What comes to your mind first when you hear "Artificial intelligence"?

79 responses

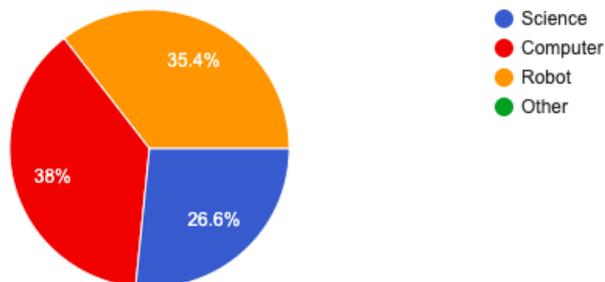


Figure 13. Questionnaire Results – What comes to your mind first when you hear “Artificial Intelligence”?

The fifth question is showcasing what defines AI for my audience. Approximately 40% of the respondents think about a robot when 30% connect to science or computers when they hear AI. I do believe that movies such as Terminator, I robot, Stars Wars, gave that robotic impression of AI to most of the people. But the improvements on AI during the recent years started to link AI to computers and science.

Did you know that some/all of the following apps use Artificial Intelligence style technologies? (Choose all that you are aware of)



75 responses

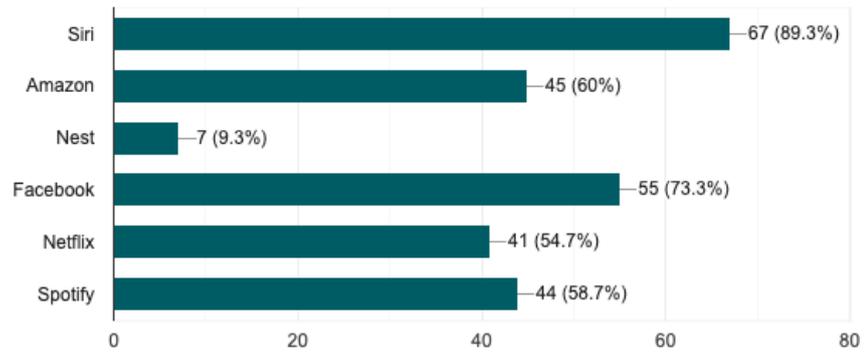


Figure 14. Questionnaire Results – Artificial intelligence applications.

Now, thanks to this graph, we can define that even though most people often or always hear about artificial intelligence (72,2%), (Figure 12) People are not aware of where is AI used. For instance, 30% of the Facebook users, 50% of the Netflix users weren't aware of the usage of AI in those platforms, which shows that the awareness of AI is still growing for the public.

In how many years Artificial Intelligence will have a noticeable impact on your daily life?



79 responses

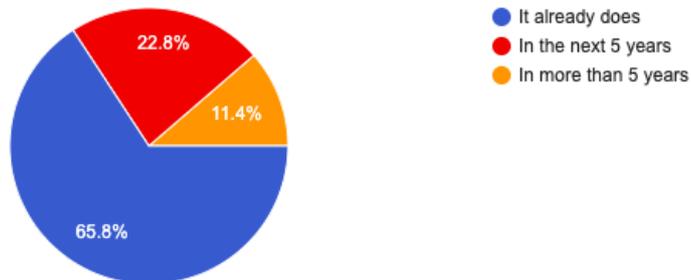


Figure 15. Questionnaire Results – When will Artificial Intelligence start impacting your daily life?

Question 7 is proving the first hypothesis. The result gathered here shows that the majority of the respondents (65,8%) are already aware and think that AI is impacting their everyday life. The democratization of personal assistants such as Siri, self-driving vehicles, or Alexa proves it. But we can also showcase that 11,4% think that AI will only impact their daily life in more than 5 years.

What would be the most appealing applications of Artificial Intelligence in the future?  
(choose two minimum)

79 responses

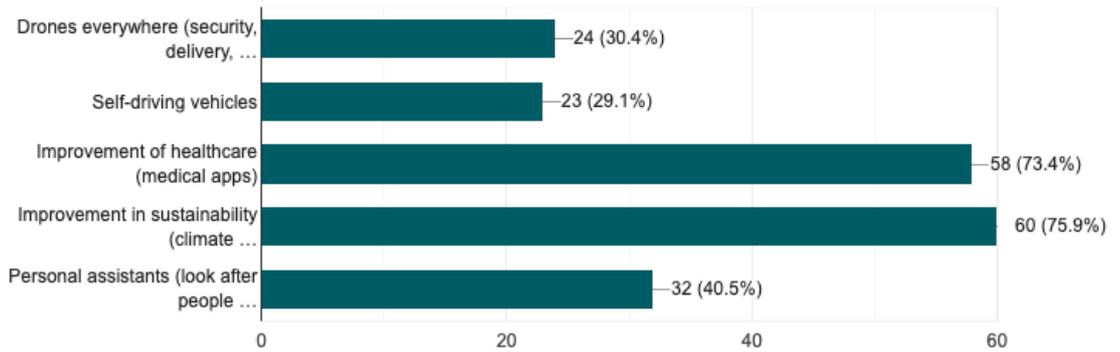


Figure 16. Questionnaire Results – Most appealing applications in the future?

The results of this graph will have a significant place to answer one of the leading research questions and showcase what could be the most appealing AI applications in the future. For (75,9%) of the respondent, the main focuses for the future of artificial intelligence are improvements in sustainability and healthcare. This shows that AI will be utilized in the sport with healthcare implementations but also that, with global climate warming, more and more people are showing commitment to fix environmental issues with sustainability improvements.

### Impact on sports

How do you think Artificial Intelligence is implemented in sports?



79 responses

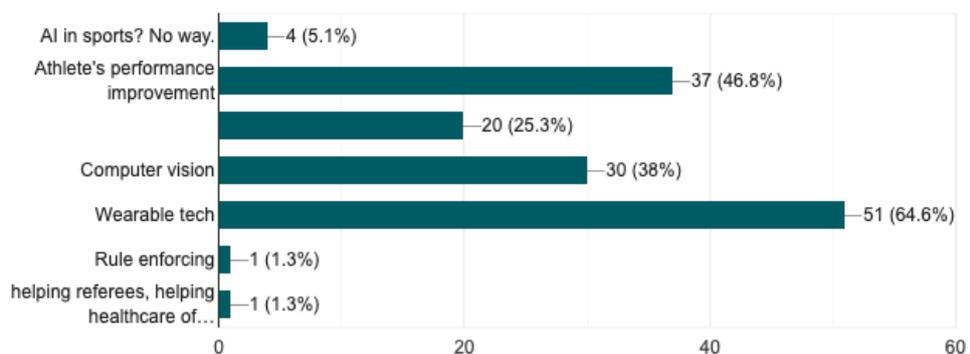


Figure 17. Questionnaire Results – AI sports implementations.

When it comes to AI in sports, the answers gathered by question 9 are proving the hypothesis 3 by showing how AI is implemented in sports. Only (5,1%) of the respondents weren't aware of any AI application in sports. We can conclude that wearable tech and athlete's performance improvement are leading the sport applications for (46,8%) and

(64,6%) of the responses. With all the new ways of gathering data, we can presume that most of the people know AI implementations in sports.

Do you know any Artificial Intelligence implementations in Basketball?



79 responses

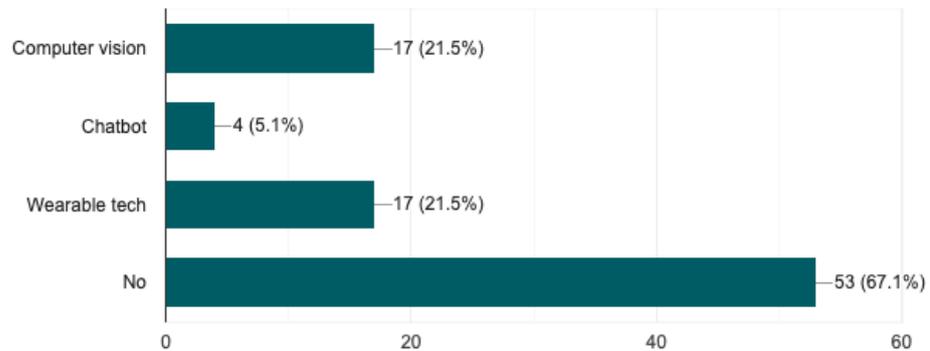


Figure 18. Questionnaire Results – Basketball implementations?

We needed to know more about the respondent's knowledge of basketball AI applications. Surprisingly, (66,2%) of the public didn't know about any use of AI in basketball, which disproves our hypothesis 4 and shows that the existing AI implementation of basketball is still not well known by the respondents.

Do you know any Artificial Intelligence implementation in Football?



79 responses

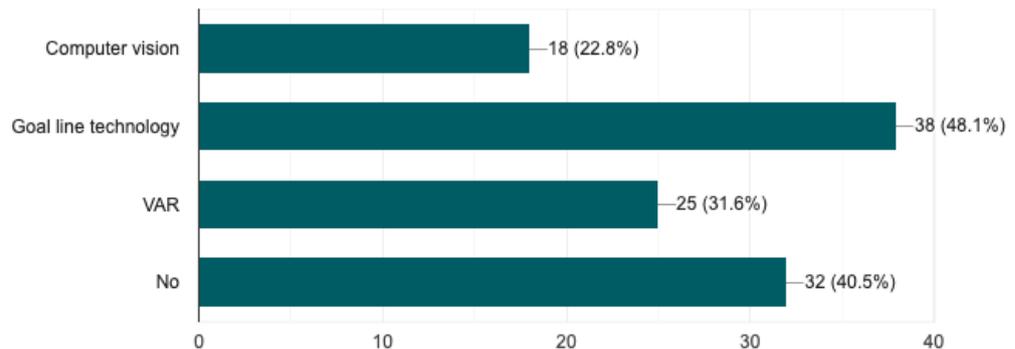


Figure 19. Questionnaire Results – Football implementations

When it comes to football, (50%) of the respondents were aware that the goal-line technology existed. But (38%) had no clue about any AI implementation in football. The percentage for soccer is lower than for basketball, thanks to the appearance of goal-line technology in 2012 and the fact that football is still the most-watched sport in the world.

One day we will be able to watch machines playing football or basketball?



79 responses

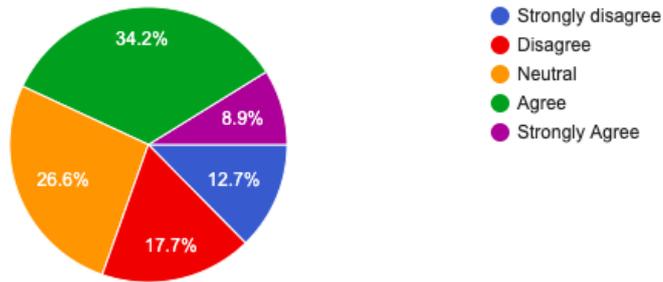


Figure 20. Questionnaire Results – Will machines are able to play football or basketball?

The goal of question 12 was to know if one day, humans could be able to watch robots playing football or basketball. With a significant percentage of neutral (25,4%), (45,1%) Of the public think that it will be possible in the future, (36,6%) agree and (8,5%) strongly agree. When (29,6%) Think that it won't be possible, (16,9%) disagree and (12,7%) strongly disagree. With the answers gathered, I cannot prove or disprove hypothesis 6, but it shows that the opinion is really mixed.

According to you, what would be the advantages of AI in sports?

79 responses

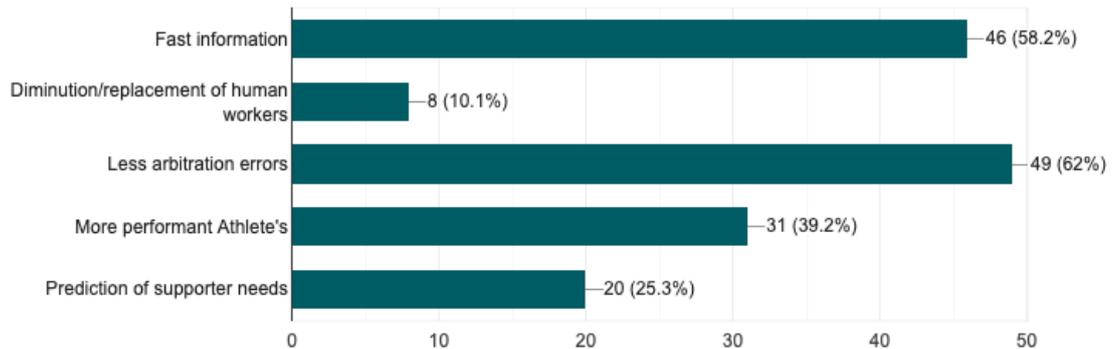


Figure 21. Questionnaire Results – Advantages of AI in sports.

The question 13 had the goal of finding the advantages of AI in sports, for (62,8%) of the public, AI in sport would lead to fewer arbitration errors, but would it be for the best? (25,3%) of the respondents think about the improvement in the prediction of supporters' needs which shows that there are already things input into motion.

### And what about the disadvantages?

75 responses

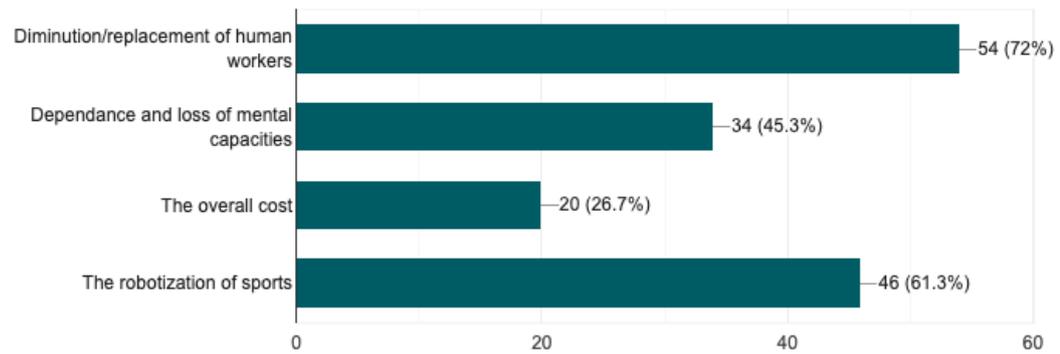


Figure 22. Questionnaire Results – Disadvantages of AI in sports.

The overall feeling of the answerers shows how much people want to see humans playing their favorite sports and not machines or robots. For (72%) the main disadvantage of AI in sport would be the diminution or the replacement of human workers and (61,3%) believe that the robotization of sports would not serve sports in general.

### How do you think Artificial Intelligence will improve/change the way we consume sports?

79 responses

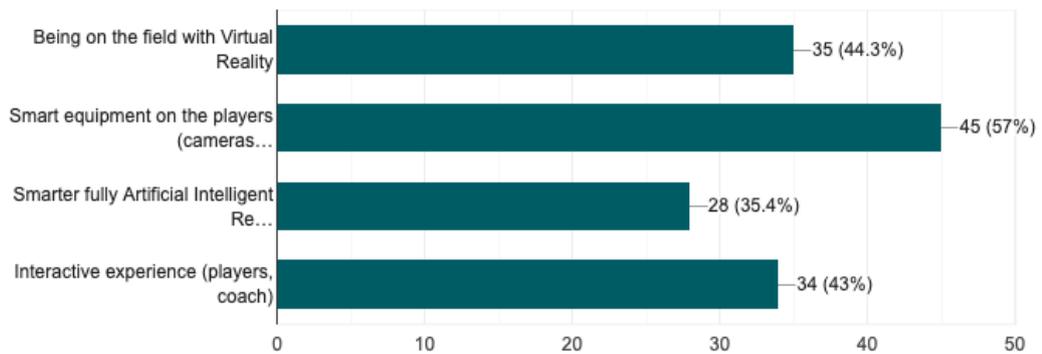


Figure 23. Questionnaire Results – Impact on fans' way of consuming sports.

The goal of this question was to understand the impact of AI in the fan's way of consuming sports and prove or disprove the hypothesis 2. Many different AI applications were cited in this question, some already existing, and some will be implemented in the future. But (57%) of the answerers think that smart equipment on the players (cameras, safety equipment) would have the most significant impact on the way fans are consuming sports. But being able to live the game on the field with Virtual Reality (44,3%), or an interactive experience with the players of the coach (43%) are not too far behind. Those

results show how much fans want to be closer to players or coaches on the field and demonstrate again how much Artificial Intelligence has its place in our sports industry.

Knowing that you already live in a world full of Artificial Intelligence, do you fear that in the future, if put into the wrong hands, it could lead to destruction?

80 responses

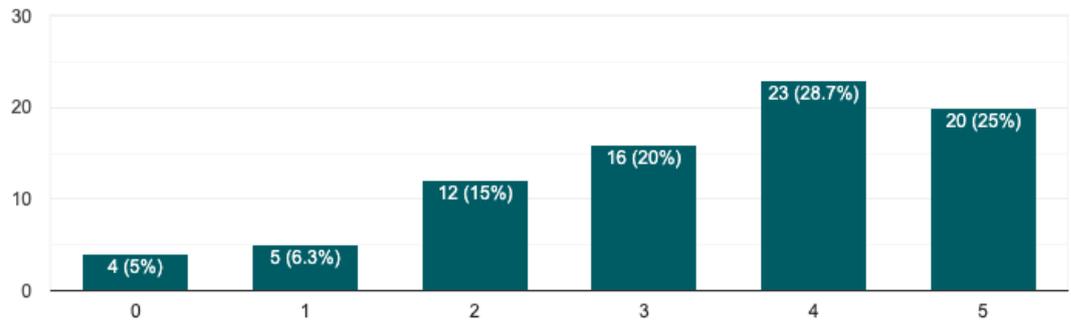


Figure 24. Questionnaire Results – Knowing that you already live in a world full of Artificial Intelligence, do you fear that in the future, if put into the wrong hands, it could lead to destruction?

This question was added to get an answer about the overall feeling about the future of Artificial Intelligence, and if put into the wrong hands, could it lead to destruction? Would humans always control it, and even so, would it be the right ones?

The answers to this question fluctuate from not at all (0) to totally (5), and the results demonstrate that more than (50%) of the answerers (28,7%) for 4 and (25%) for 5 think that AI could lead to destruction if put into the wrong hands. The results displayed here are proving that there is still a lot to discover about Artificial intelligence and people as scared of the unknown.

## Discussion

The goal of this research paper was to identify the impact of Artificial Intelligence (AI) in the sports industry. The theoretical framework for research, the data about AI and AI in sports were collected in the second and third chapters, respectively. The information was gathered from different resources: articles, books, journals, etc.

The researcher has underlined two main questions to find the answer to the research goal.

1. How AI can be utilized in sports?
2. What is the influence of AI on consumers?

The quantitative research method has been implemented for further investigation. Six different hypotheses were built prior to launching the online survey. The online survey form contained sixteen different questions and has been launched via Facebook and Email. For the accuracy of research work, research questions have been divided into three different sections:

- Demographics of respondents – despite the awareness of the target group's background information researcher wanted to avoid out of scope respondents
- Awareness of AI – the overall knowledge of respondents about AI
- Impact in the sports industry – the feedback from respondents to AI in sports

The target groups were students and teachers from Vierumäki, sports campus of Haaga-Helia University of Applied Sciences, Finland.

The survey has been sent to 103 people from the Vierumäki campus, 78 people have responded to the survey, response rate over 70%. Results have been analyzed carefully within each categorized section.

**Data on demographics:** All the respondents are adults, and most of the respondents are between the (18-29). The majority of participants have an active life, either from their work (57,6%) or as a student (33,3%).

**Data on awareness of AI:** 98% of respondents are aware of AI, however interpretation of AI is diverse. 89,3% of respondents believe that the current example of AI is Siri – device application. As Kris Hammound proposed in the "periodic table" of AI "Artificial intelligence has several underlying technologies" and Deep learning has been implemented in Siri

application, which has generated enormous popularity in voice recognition functions. 65,8% of respondents believe that AI is already impacting our daily life. Over 70% of respondents assume that AI applications will be mainly utilized in health care and climate sustainability.

**Data on the impact of AI in the sports industry:** Only (5,1%) of the respondents weren't aware of any AI applications in sports. Respondents believe that wearable tech and athlete's performance improvement is leading the sport applications of AI with (46,8%) and (64,6%) rates, respectively. Focusing on particular sports, in basketball, surprisingly, (66,2%) of the public didn't know about any use of AI in basketball. Only about 5% of respondents knew about computer vision or chatbot highlighted by Dominic Lau, which disapproves of my hypothesis and his excitement. In football, (50%) of the respondents were aware that the goal-line technology existed and (31,6%) about VAR previously mentioned by Utpal Chakraborty, but (38%) had no clue about any AI implementation. For generic questions as an advantage of AI (62,8%) of the public believe that AI would lead to fewer arbitration errors. As disadvantages of AI, (72%) of respondents assume the diminution or the replacement of human workers. Concerns of Louis Naugès about a "potential" danger linked to the arrival of Artificial Super Intelligence (ASI) have been proven by this question in survey. The probability that humankind gets destroyed by the ASI solution is quite high. (61,3%) believe that the robotization of sports would not serve sports in general. Kumba Sennaar believed that AI will be mainly utilized for arbitration, the training, or the player tracking, but pessimistically referred to seeing robot games in near future. Other questions have received a diverse response.

Two hypotheses out of six did not coincide with data gathered. Within the target group, the AI applications in Basketball are not known and artificial Intelligence will not always be controlled by humans.

The following limitations have appeared during this research work:

1. Some of the research questions could not be covered by a quantitative research methodology, especially questions that have received a diverse response. It would be more accurate to have a discussion on questions that focused on further improvement in AI or AI in the wrong hands.
2. The number of questions and responses will always be an inevitable limitation for one researcher.
3. The topic itself. AI is a trendy topic, which is developing extremely fast. The data which has been received today might be slightly inaccurate in the near future, especially with General AI type applications.

My suggestions for future researchers would be to focus mainly on a particular type of sport or technique and make a case study for AI application, dive in for detailed utilization of AI application. Also, to use mixed research methodology, quantitative and qualitative simultaneously.

## ■ Conclusion

Artificial Intelligence is affecting on sports industry tremendously fast and in various ways. Essential components of each sport such as arbitration, training, tracking methods improving with implementation of AI. The big data received from the amount of activity allows AI applications to sort, filter and suggest augmented solutions for further development.

Theoretical background about AI gathered from different articles, books, scientific blogs played a major key in investigation. The knowledge obtained from different resources on AI existence and impact in the sports industry assisted in the creation of hypotheses, which later were compared with data gathered via an online survey.

Based on my research work, the data I have gathered via survey using a quantitative research method applied to a group of students and teachers from the sports campus of Haaga-Helia University of Applied Sciences – Vierumäki matched my hypotheses. All six hypotheses were built prior to online survey launch and were claiming that AI is impacting everyday life, particularly in the sports industry. Four out of six have matched exactly in accordance with the gathered data. Only assumptions on awareness of people that AI is impacting Basketball heavily and ultimate control of AI by human beings were wrong. However, responses did not claim complete unawareness of AI impact in basketball neither control of AI in general. Moreover, it might be due to the limitations of the research methodology and other important factors mentioned in the discussion chapter.

In conclusion, AI is impacting the sports industry positively and expected to move it to a new level in the near future.

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## Appendices

### Appendix 1. Questionnaire

Link: <https://forms.gle/dDow3a9g3nWWndc6Z>

### Appendix 2. Questionnaire Data.

Link: [https://docs.google.com/spreadsheets/d/1-lk0Zzuaqp\\_jZXSxKxJOtNALvekkjTq0kQofuFTXPm-c/edit?usp=sharing](https://docs.google.com/spreadsheets/d/1-lk0Zzuaqp_jZXSxKxJOtNALvekkjTq0kQofuFTXPm-c/edit?usp=sharing)

### Appendix 3. Question/Goal table.

Question	Goal
Question 1, 2 and 3	Demographic data
Question 4	Be sure that the respondent knows AI
Question 5 and 6	Measure the knowledge of AI
Question 7	Prove or disprove hypothesis 1
Question 8	Prove or disprove hypothesis 2
Question 9	Prove or disprove hypothesis 3
Question 10	Prove or disprove hypothesis 4
Question 11	Prove or disprove hypothesis 5
Question 12	Prove or disprove hypothesis 6
Question 13 and 14	Define the advantages and disadvantages
Question 15	Prove or disprove hypothesis 2
Question 16	Can humans push AI towards destruction?