ARTIFICIAL INTELLIGENCE IN THE SPORTS SECTOR
INTELIGENȚA ARTIFICIALĂ ÎN SECTORUL SPORTULUI

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Abstract

Artificial intelligence (AI) is a unique computer system that can replicate the cognitive functions of the human mind, such as learning, reasoning, or decision-making. Its application in various aspects of life, including sports, is a fascinating development.

In our paper, "Artificial Intelligence in the Sports Sector", we delve into the practical implications of AI, exploring how these technological advancements significantly enhance athlete performance in both training and competitions, reshape the rules of sports, and present a brief research overview of AI's influence in sports.

Keywords: *fans, sport, AI, technological innovations, risks*

JEL classification: M30, M31, M37.

1. Introduction

In the world of sports, innovations and technology have had a profound impact, transforming the way games are played, watched, and understood. Many new technologies, including AI, have enriched the sports sector, benefiting athletes and fans alike. Among these innovations, we highlight the eye bird system, sharing platforms [1], electronic refereeing, mobile apps, etc. [17]. This technological revolution has not only changed sports dynamics and strategies. Still, it has also elevated the fan experience, making it more immersive and engaging, sparking a new level of excitement among sports enthusiasts.

These innovations have enriched the visual aspect and interactivity of sporting events and increased the accuracy and fairness of refereeing decisions, ensuring fairer play. In addition, performance monitoring and tracking technologies have revolutionized athlete training, allowing

coaches to customize training programs to fit the specific needs of each athlete, thereby improving performance and reducing the risk of injury. These technological advances necessitate sports managers to proactively embrace the environment of technological advancements, seeking the best technology for their organization [11, 4].

2. Literature review

2.1 About Artificial Intelligence

We live in a world where Artificial Intelligence (AI) is starting to be used in all fields, including sports. Statistics and computational algorithms help optimize athletes' training recovery and recruitment processes.

There are already consistent efforts to involve AI in estimating the transfer costs of athletes and the impact of new players on increasing club revenues through related commercial activities. Against this backdrop of automation, sport is changing. It becomes more efficient but also more impersonal. Club traditions, namely their history, track record, and brand, become commodities that can be bought or sold together with athletes and coaches.

Artificial Intelligence enables predictive analysis and detailed suggestions, optimizing a strategy or a technical decision. It is an innovative and fascinating approach, combining technology, qualitative analysis, and entertainment to enrich the sports experience [6]. AI has also become an indispensable tool in the "early" discovery of talented players, athletes who can contribute to a given team and whose proven versatility can make them effective in various roles on the field.

Today, big clubs turn to Artificial Intelligence to find the best players for their needs and style. To do this, they turn to companies and databases that inform them which players are statistically the best fit for what they are looking for.

These programs use descriptive data from the past, what is known as Big Data, and, starting from this data, try to contextualize the performance that a particular athlete can give in a particular environment.

AI can help professional athletes train more efficiently, prevent or recover from injuries, analyze data and statistics about opponents or their performance, and optimize game strategies and tactics. Athletes can use AI to study the movements and behavior of the opposing team or receive personalized feedback about their playing style. Using artificial intelligence and data analysis can help predict likely overuse injuries. Thanks to the new technologies developed by the IT industry, athletes can maintain their optimal performance as long as possible.

The most significant advantage of AI is the real-time analysis of your team's play and that of the opponent. Adjusting the team's play and replacing the underperforming nodes is done based on graphical interpretations.

Open areas in defense or uneven distribution of own players on the field can be identified. Last but not least, open areas in the opponent's defense can be identified and exploited, and the team can advance or retreat depending on the opponent's device.

In the build-up to matches, analysis of opponents' play can identify passing and advancing/defending patterns, allowing for more effective defending/attacking.

AI will also allow an accurate assessment of each player's level of effort and the aspects that need to be improved from a physical and technical point of view [10]. Paradoxically, the democratization of AI will complicate the lives of trainers. In a world where machines can identify play patterns, creativity and breaking the routine in attack and defense become more critical than ever.

On the downside, these digital tools always trap us into forgetting to look at the football field from the grass. We must not forget that a major difference exists between soccer with a ball and soccer with a console.

Beyond the players' physical training, it is very important to analyze, ideally in real-time, how well the team works in training and during matches.

This is where network analysis comes in, which turns every player on the same team into a node. This allows the real-time creation of both individual and collective statistics. Reports can be created like this:

The quality of passes sent (the chance that a particular pass becomes decisive) according to the type of pass, the length of the pass, and the area in which it is received;

The quality of shots (the chance that a particular shot becomes decisive) depends on the quality of the received pass, the shooting angle, the distance from the goal, the Average distance between players, step density and length, pass sequences, and ball possession.

Regarding statistics, AI can analyze players' movement speed and estimate the defense zones for which each player is responsible [7].

2.2 Innovations and Technology in Sports: How They Change the Rules of the Game

The attention surrounding the development of artificial intelligence (AI) technologies in sports is often overlooked, but they have the potential to change an athlete's experience drastically.

The use of virtual reality (VR) in the training of top athletes has opened up new perspectives on how athletes prepare and improve their performance [5]. This innovative technology allows athletes to experience various game scenarios in a controlled environment without the physical risks of intense training or real competition. Virtual reality provides a unique platform for simulating game situations, cognitive training, and performance visualization, fundamentally transforming how athletes prepare for competition.

One of the most valuable applications of virtual reality in sports is the ability to faithfully recreate specific game situations, allowing athletes to practice strategies and make decisions in real-time. For example, goalkeepers in soccer can use RV to face a series of shots from 11 meters, adjusting their positioning and reactions to different execution styles without being at risk of injury. In team sports such as basketball or American football, virtual reality allows players to work on tactical aspects, such as reading opposing defenses or better understanding their team's play schemes, in a virtual environment simulating field conditions. real game.

Improving sports performance is not just limited to the physical aspects; the cognitive component plays a crucial role in an athlete's success. Virtual reality provides an excellent environment for developing cognitive skills such as reaction time, distributed attention, and quick decision-making. By immersing themselves in realistic game scenarios, athletes can improve their ability to process visual information and make strategic choices under pressure, which are vital aspects of high-level competition. For example, racing drivers can use RVs to familiarize themselves with circuits, learning to navigate complex turns and anticipate opponents' moves, thereby improving their racing strategies.

Virtual reality also provides a valuable platform for performance analysis and visualization. Athletes and coaches can review training sessions in VR, observing technique and positioning from various angles, allowing detailed analysis of movements and identifying areas for improvement. This form of visual feedback is particularly useful in technical sports such as gymnastics or ski jumping, where precision of movement is essential [9]. By visually repeating the ideal performance, athletes can internalize the correct techniques more effectively, accelerating the process of learning and improvement.

One such recent development comes from Intel, which now has 3D Athlete Tracking (3DAT) technology piloted by EXOS, one of the leaders in enhancing human performance. The new technology aims to train aspiring professional athletes to maximize their performance skills by using AI to gain insight into important factors involved in sprinting, such as speed, acceleration, and biometrics.

One of the key aspects of 3DAT is that it allows coaches and athletes to access previously non-existent or inaccessible data, which then provides crucial performance insights. The technology relies on simple video to provide accurate skeletal analysis and performance measurements, allowing deep insight into the body during performance.

3DAT relies on cameras to film athletes during running exercises, meaning it's completely hands-free for athletes. They don't have to worry about sensors or other wearables that could alter performance.

Following the analysis, coaches receive reports and charts that provide a detailed overview of performance, which can then be used to adjust accordingly. Intel indicated its intent to continue working with EXOS to provide coaches, athletes, and other performers with valuable information through the technology.

Integrating artificial intelligence (AI) into sports performance analysis has opened new perspectives on how athletes and teams evaluate and improve their skills. By collecting and analyzing massive data, AI enables a deep understanding of sports performance beyond what the human eye and traditional ratings can perceive. This data-driven approach fundamentally transforms training, game strategy, and recovery in elite sports by providing a detailed and personalized insight into each athlete.

One of the most prominent applications of AI in sports is the ability to analyze player movements and behavior during games. Using advanced algorithms and tracking technologies, AI systems can evaluate the efficiency of movements, field positioning, fatigue level, and many other critical aspects.

This information allows coaches to adjust tactics, optimize team formations, and develop more effective game strategies tailored to each player's abilities and weaknesses.

In addition to strategy and tactics, AI is crucial in optimizing training and recovery regimens. By analyzing physical performance and biometric data, AI-based systems can identify patterns and trends specific to each athlete, allowing the creation of personalized training programs that maximize performance and minimize injury risk [16]. This personalized approach ensures that each athlete can maximize their potential by adjusting the intensity and type of training to their specific needs.

Furthermore, AI is being used to improve recovery and injury prevention techniques. AI systems can anticipate vulnerabilities and recommend personalized recovery and prevention programs by analyzing the athletes' historical data and identifying risk factors. This proactive approach helps keep athletes in top physical shape and reduces recovery time from injuries, ensuring a faster and safer return to peak performance.

AI is also used in sport management. Extensive data analysis generated by social media interactions with fans [2, 3]- can be performed more efficiently, contributing to better brand management [12]. In turn, fans are using all sorts of sports apps that generate a lot of potential data to be analyzed with AI [14]. Broadcasting technologies improve fans' experience, leading to increased levels of sports consumption [15]. AI is used to enhance spectators' experiences at a sports facility, in the presence or not of a sports event [13].

3. Findings and discussions:

In this study, we sought to know people's opinions about the technologies that are currently used and/or that will/will be able to be implemented shortly; to examine the challenges and opportunities posed by AI and related technologies in sports; to examine how AI can contribute to the growth, resilience, and strengthening of sports. This study was carried out over 4 weeks on 128 respondents, all former or current athletes, in which various aspects of AI were debated, which, with time, begins to take on as much scope as possible.

The first questions followed the demographic description of the respondents. Thus, the vast majority of 64% are male, and 82% live in the urban environment. As for completed studies, 18%

have only secondary education, 53% have attended a college in the sports field, and the remaining 29% have post-secondary education.

The first question related to the theme of this study: What is the respondents' opinion regarding the benefits of using AI in sports competitions?

Thus, as shown in the figure below, the answers differ from the fact that AI improves the visualization of competitions, protects athletes, assists them in training, or develops equality between athletes.

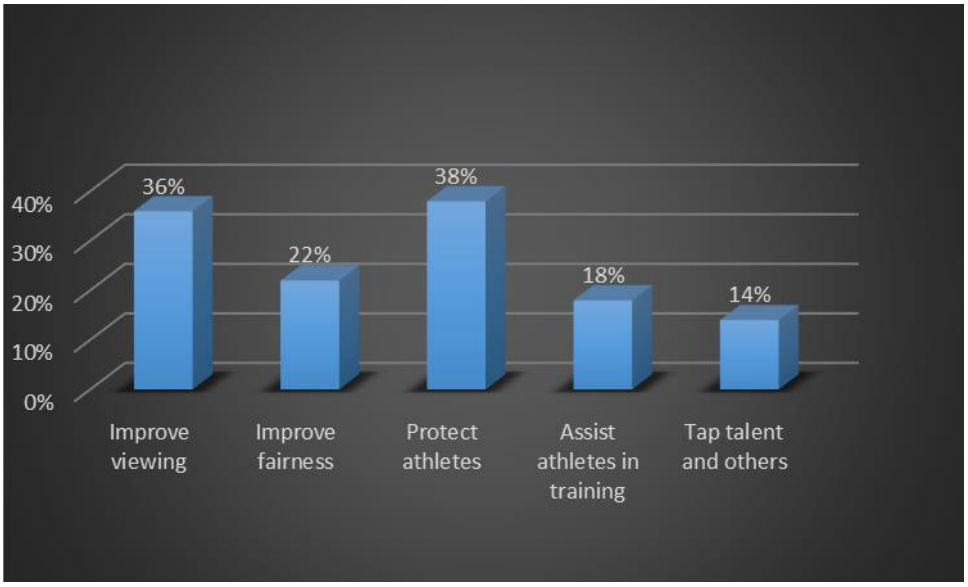

Fig. 1 The benefits of using AI in sports competitions

Source: own interpretation with the help of the Excel program

Next, we wanted to know some of the concerns or risks that our respondents consider AI can bring to the world of sports.

The vast majority believe that it will affect the employment rate in sports, either by replacing athletes or coaches or reducing the games' drama and spectacle.

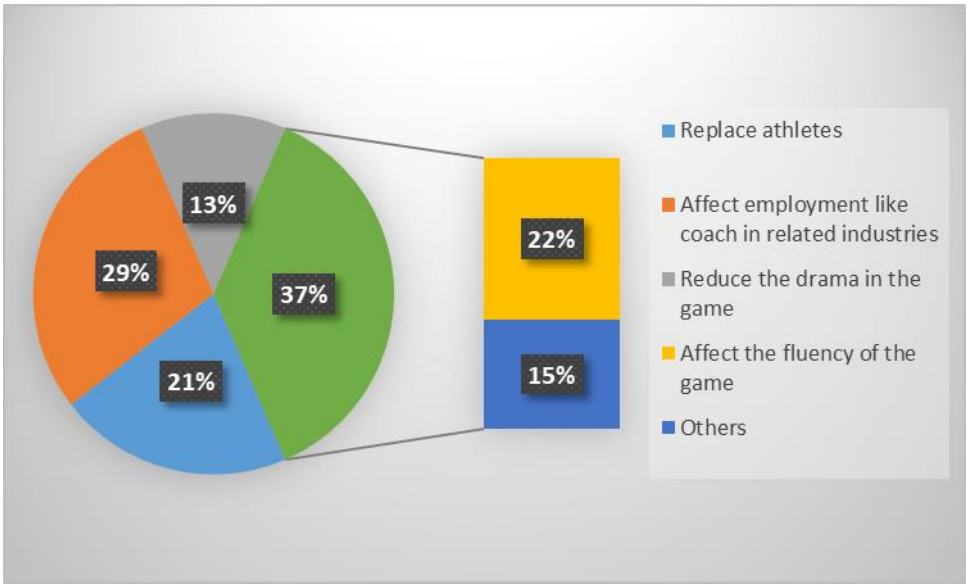

Fig. 2 The concerns or risks of using AI in sports competitions

Source: own interpretation with the help of the Excel program

Continuing to discuss the risks involved in using AI in sports, 65% of the respondents believe these risks can be easily controlled and eliminated, as opposed to 27% who believe they cannot be controlled. In comparison, 8% do not believe there is any risk in using these technologies.

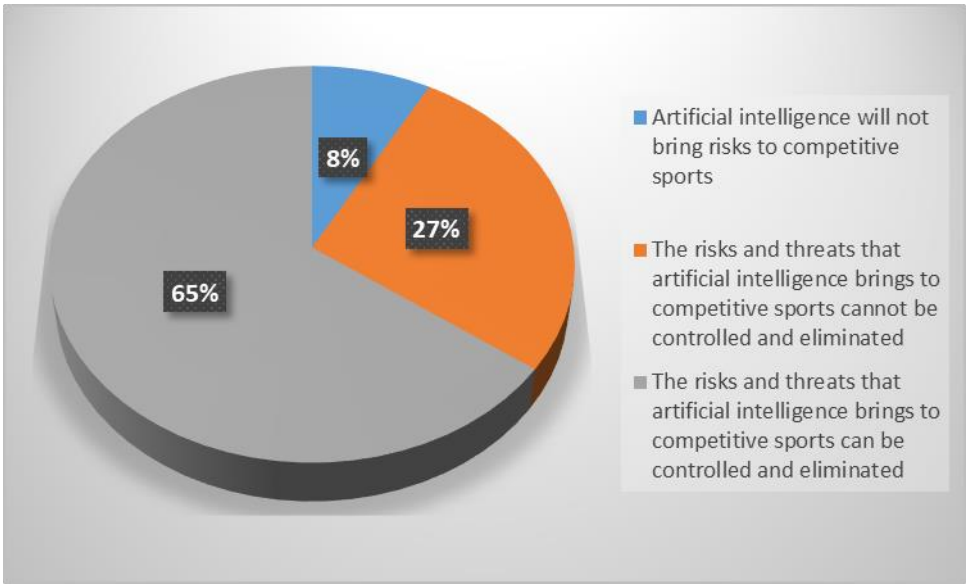

Fig. 3 The degree of control of the risks of using AI in sports competitions

Source: own interpretation with the help of the Excel program

Based on the answers received regarding the advantages brought by AI in sports, our respondents wanted to specify the other side of the coin, namely that every advantage comes with a disadvantage.

Thus, AI may contribute to the improvement of training, but it may lead to the loss of entertainment aspects; AI can contribute to finding various strategies, but it can lead to the replacement of athletes or coaches in the future; AI can protect athletes from various injuries, but that doesn't mean it can't bring other risks with it.

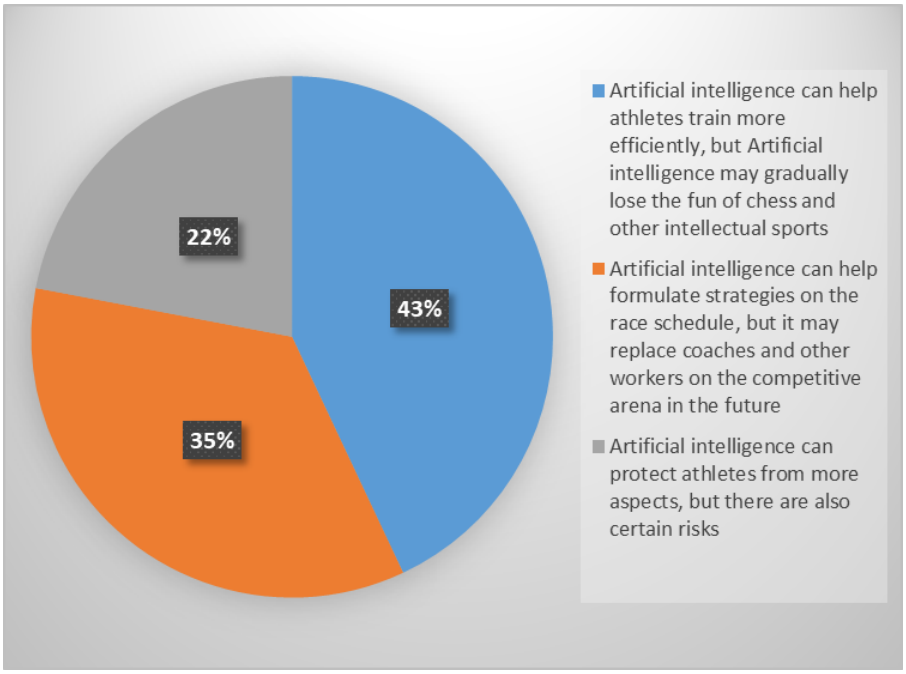

Fig. 4 The various impacts of using AI in sports competitions

Source: own interpretation with the help of the Excel program

The last question in this study sought to determine the respondents' degree of knowledge regarding various technologies used in various sports. Their answers are presented in the figure below.

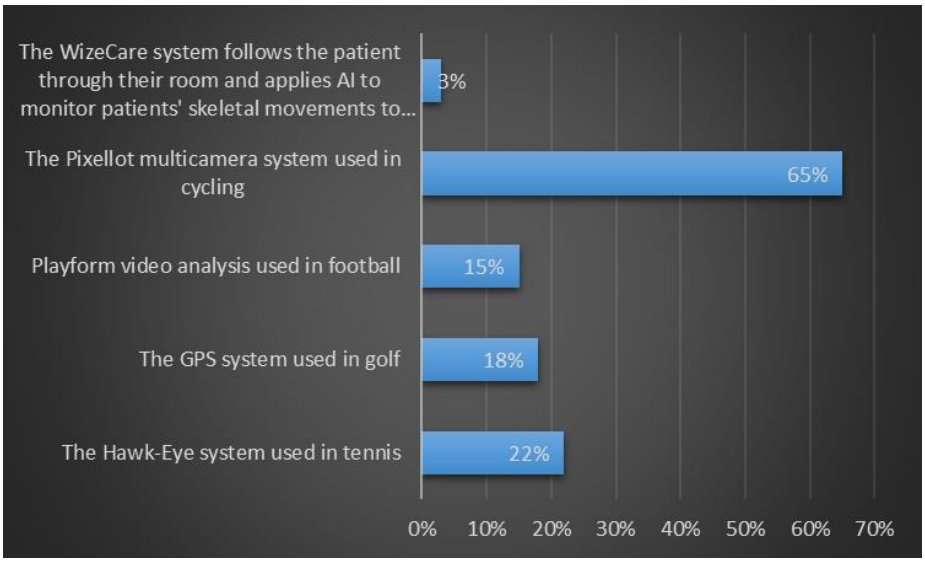

Fig. 5 Various technologies used in various sports

Source: own interpretation with the help of the Excel program

4. Conclusions

The contemporary sports landscape is deeply influenced and shaped by technological advances and equipment innovations that redefine performance standards and enrich the experience for athletes and fans alike. From virtual reality, which offers immersive training scenarios, to advanced data analysis through artificial intelligence and innovative sports equipment, technology is opening new horizons in improving sports performance and making sports accessible.

Artificial intelligence is an increasingly influential phenomenon in the world of sports, both for better and for worse. AI can be an ally for professional athletes who want to improve their performance and prevent injuries, but it can also be a rival that threatens their integrity and fair play. AI also raises some ethical challenges related to defining sports performance and respecting the spirit of competition [8].

AI is here to stay and to improve the sport, but it will never replace the human factor. The sport will continue to be shaped by passion, intuition, strength, and courage. In all this, artificial intelligence gives humans a decisive advantage in decision-making. It constitutes an increasingly decisive and applicable value in different areas of society, not only in sports but also in industry, marketing, economics, and medicine.

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All authors contributed equally to this research.

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