



REVIEW ARTICLE

The Role of Artificial Intelligence in Enhancing Sports Analytics and Training

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ABSTRACT

The impact of artificial intelligence (AI) is clear and highly influential in many areas of sports, helping to improve team and player results. Not only that, but AI has been introduced into the areas of training and analysis of data and results, emulating and presenting potential hypothetical scenarios through the capabilities employed in AI to enable accurate and effective training in emergency and critical situations. Another major benefit of using AI in sports is to analyze data and game stats to improve team performance in future games. Improved good decision-making capability has made using AI applications gain huge popularity and attention in both academia and industry, especially in the sports industry. The main problem associated with using AI applications in sports is that the usefulness of AI for many sports viewers, experts, coaches, team managers, and policymakers is not clear, especially when they are not particularly familiar or experts in the field of AI. Similarly, for many, the reasons for employing AI and machine learning models for mathematical analysis in areas such as sports remain lackluster or unclear. In this research paper, the authors present a review of the importance of using AI applications in sports for the people involved in the sports industry in general and especially for the Iraqi academic staff and those working in the sports field. The stakeholders and the parties involved need to learn how to use the principles of AI knowledge and conduct research to improve the performance of Iraqi teams and players.

Keywords: Artificial intelligent, sport, video assistant referee, heart rate player monitoring, data visualization

INTRODUCTION

Artificial intelligence (AI) is a major evolving scientific branch of computer science and software engineering. AI is any human-like intelligence displayed by a computer, robot, or other machine.^[1] AI is interested in building machines or developing software that can perform tasks that normally require human intelligence. AI allows machines to learn from experience, adapt to new inputs, and perform human-like tasks. To further clarify, AI derives from mimicking human behavior and other abilities such as thinking and learning. This includes the idea of designing intelligent agents or machines that can simulate, acquire, and employ knowledge, analytical skills, and specialized skills alike for the overall purpose of problem-solving.^[2]

The implementation of AI in sports represents a major step forward in how we measure and understand the vast amounts of data available. AI's ability to process and understand sports data with incredible speed and accuracy finally allows us to dig into the details and use it to improve team and player performance.

The benefits of AI in sports are clear and far-reaching. In addition to the obvious benefits that participants will gain

from learning more about their own abilities and limitations than ever before, coaches will be able to make data-driven decisions about training and performance, and fans will eventually be on stage as well. You can be part of the action behind the scenes.

ARTIFICIAL INTELLIGENCE IN THE SPORT FIELD

AI has been introduced to all types and areas of every sport these days. The utmost goal of each team manager and

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administrator is to evaluate the performance of the team and each player to make a correct decision on the future of the team and the player. This can be done by employing the tools of AI and machine learning (ML) in analyzing the huge data acquired from training sessions and actual games. In sports, winning is the goal that every team is after and they are ready to invest a lot of money to be a winning team. The best investment for any team is to have a system that can rely on AI to improve training sessions for the team and the players to make them ready to win.

AI is used in all areas of sports, such as training, scouting, game analysis, game predicting, and refereeing. It is also used in exercises at the individual or team level. The following is showing some applications of using AI in our life activities and sports:

AI in Fitness Activities

Over the years, AI has become an important part of the fitness and wellness industry. It uses AI to help track your health and repetitive motion patterns. It also uses data from body-worn devices such as smartwatches to guide users toward their fitness goals, as shown in Figure 1, the diagrams such as exercise duration and steps. Especially when AI and ML solutions are connected to applications on smartphones, users get accurate results, ultimately providing them with healthier and smarter results.^[3]

AI in a Football Game

A football game is a highly dynamic, fast-paced game where the details can make the difference between winning and losing; yet, the human eye may not be able to capture those details. This is where AI comes into play. In recent years, football has seen the beginning of its AI application, but the extent of AI application is still unknown. Those involved in the game should also know the limitations of AI. In this study, we examine an unknown aspect of AI in soccer games.^[4]

Video assistant referee (VAR) system

VAR stands for VAR; VAR is one of AI's image processing applications to evaluate suspicious cases during games. Teams of three or four work together to investigate the referee's decisions, as shown in Figure 2a. they watch video footage of relevant events. Crew consists of the main VAR, usually the current or former referee, his assistants, and a replay operator. In a video operating room that contains different monitors displaying different camera angles.^[5] VAR can be used to review four types of decisions:

Goals,
The abuses that precede them,
Red cards,
Penalties,
The wrong identity when awarding a card.

Under certain circumstances, the Head Judge's decision may be overturned. However, it should be an "obvious error"

Reviewing decisions typically selected one of two ways:

The VAR team can recommend a review, or the referee can request a review after making a decision [Figure 2b]. In

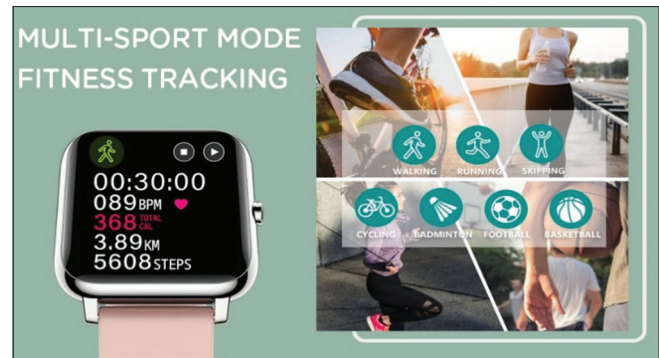


Figure 1: Smartwatch

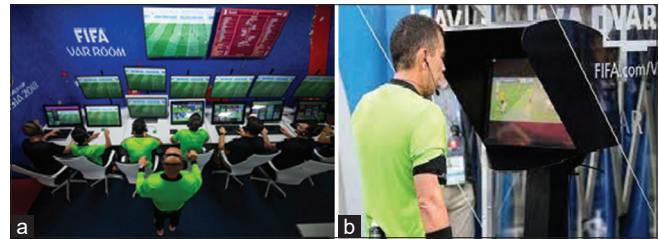


Figure 2: (a) Video assistant referee (VAR) team. (b) Main referee with VAR



Figure 3: Portable heart rate monitor

the first case, if the VAR determines that there has been a clear error, the VAR must inform the Referee.

Once this has occurred, the referee has three options:

1. The referee can immediately overturn the decision based on the VAR's advice
2. The referee sticks with their initial decision
3. The referee asks to review the incident himself or herself on a monitor on the side of the pitch.

Real-time portable heart rate

The reason for using wearable heart rate monitors in sports has its roots in cross-country skiing in Finland in the mid-1970s. Since then, monitors have become ubiquitous in individual sports such as long-distance running and in team sports such as soccer, where some athletes run more than 6 miles in a

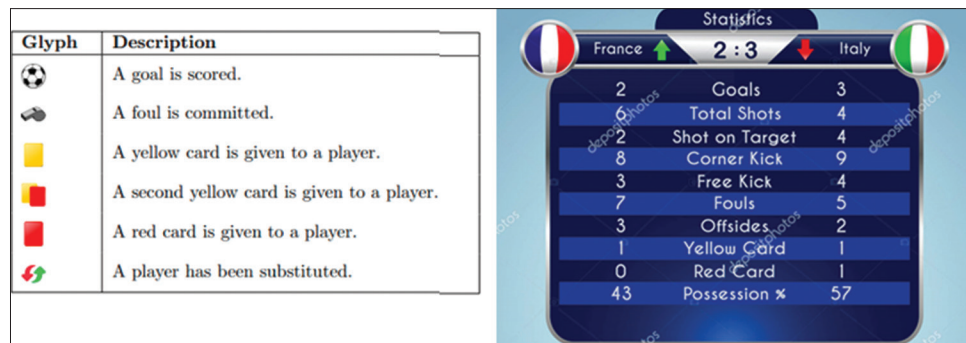


Figure 4: Game statistic

90-min match.^[6] Comprehensive monitoring of fitness, fatigue, heart rate monitors, blood pressure, blood oxygenation, and performance is critical to understanding player responses to training to optimize planning training and recovery strategies. Figure 3 shows the device connected to the main player. Resting and exercise-related heart rate measurements have been of increasing interest over the past decades and have potential in the context of multivariate response monitoring as they provide non-invasive and time-efficient insight into the state of the autonomic nervous system and aerobic fitness.

Using a heart rate monitor while gaming allows you to track important information, except for how fast your heart is beating. The higher your heart rate, the more calories you burn. Monitor blood pressure and track blood oxygen to help your heart avoid. Attack when the player reaches overload and exhaustion. This also gives the couch information about the player's performance and allows it to replace the player.^[7]

Data visualization

Data visualization is the repetition of translating information into a visual context. The purpose of data visualization is to make that large volume of information simple and to facilitate the identification of patterns, trends, and outliers in large datasets. The term is often used to discuss with others, including information graphics, information visualization, and statistical graphics.^[8] Today, sports analysts rely on recorded information presented during and after the game. This includes scores, team-related vital stats, and other personal stats for individual players. Figure 4 shows some important statistics (goals, fouls, yellow cards, red cards, balls in his possession, etc.).

Current sports visualization research stems from a passionate and often distributed community working to analyze and communicate sports data. Given the interest in sports visualization from both sports practitioners and visualization researchers, there is a need to document and analyze these efforts. Our review identifies three types of sports data used in sports visualization.

Box score data (data that contains statistical summaries of sporting events such as games), tracking data (data about actions and trajectories within a game), not necessarily a specific game (like the participants in the diagram).^[9] Using these three types of data, we compose a collection of 98 papers by space scientists and practitioners, presenting future opportunities and challenges in this fascinating subfield.

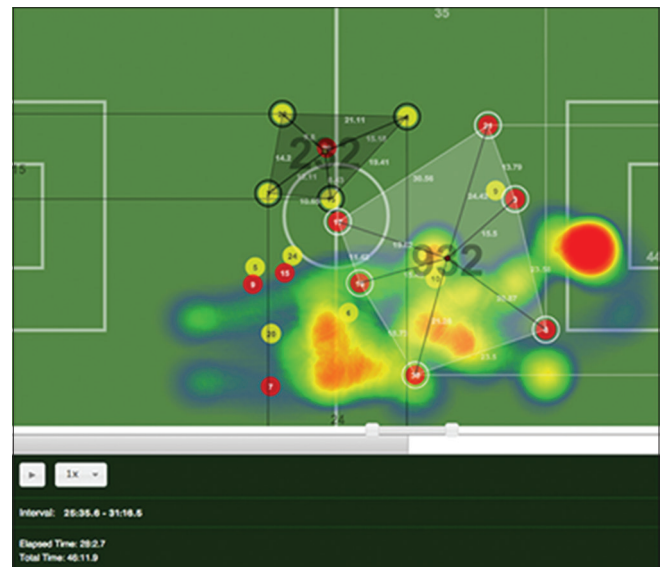


Figure 5: Tracking data

Visualization of realistic sports data has become a research direction and is becoming increasingly important in the field of information visualization. It is also an important basis for the study of sports skills, behavior, and activity. In the field as shown in Figure 5, we classify mathematical data visualization and, in this case, summarize the research from three aspects: Data type, main task, visualization method, and visual analysis, as shown in [Figure 6]. Hence, first, the sports data he divided into two categories. Combining spatiotemporal (position, time) and statistical information, he proposes three main tasks for the visualization of competitive sports data. Feature presentations, feature comparisons, and feature predictions. Furthermore, he categorizes competitive sports data visualization techniques into five categories based on the characteristics of the data. Visualizations such as high-dimensional data visualization, time-series visualization, graph (network) visualization, and glyph visualization are performed, and the relationship between main tasks and visualization methods is analyzed. It also introduces research on visual analysis of competitive sports, proposes characteristics and limitations of competitive sports data, and summarizes multimedia. We discuss visualization in competitive sports and finally the evaluation of visual analysis.

Sports data visualization methods are classified into five categories based on data characteristics.

1. Visualization of high-dimensional data
2. 2 Time series visualization
3. Diagram (network) visualization
4. Glyph visualization and
5. Other visualizations depend on the type of game and the user of this data visualization (referee view, coach, player.etc.).

It helps analyze the relationship between key tasks and visualization techniques, presents a research paper on visual analysis of competitive sports, proposes characteristics and limitations of competitive sports data, and discusses hypermedia visualization in practical sports to summarize.^[10]

THE AI-BASED SYSTEM THAT AUTOMATICALLY SCORES GYMNASTIC GAMES

An AI-based system that automatically scores gymnastics exercises has solved many of the problems that plagued the sport's scoring process. On the flip side, the development process has never been easier.^[11]

The AI system contains a scanning unit to generate the database. The system transmits laser pulses at 2 million pulses per s to the gymnast, obtains the 3D coordinates corresponding to the body position, and then performs AI processing to generate the gymnast's frame determine the joint position and create three coordinates: Routine dimensional (3D) rendering. This data is then compared to a database of exercise programs to determine what type of program was being performed. Next, the items subject to surcharges and deductions are specified according to the applicable codes, and the results are displayed as scores Figure 7 Overview of the evaluation support system).^[12]

A laser scans the gymnast to obtain the (3D) coordinates [upper left of Figure 7]. The system determines the gymnast's body position and creates a (3D) representation of the movement (top right). The system identifies the elements used in the routine (his two frames at the bottom left). Routines are identified by comparing them to database records (bottom right).^[13]

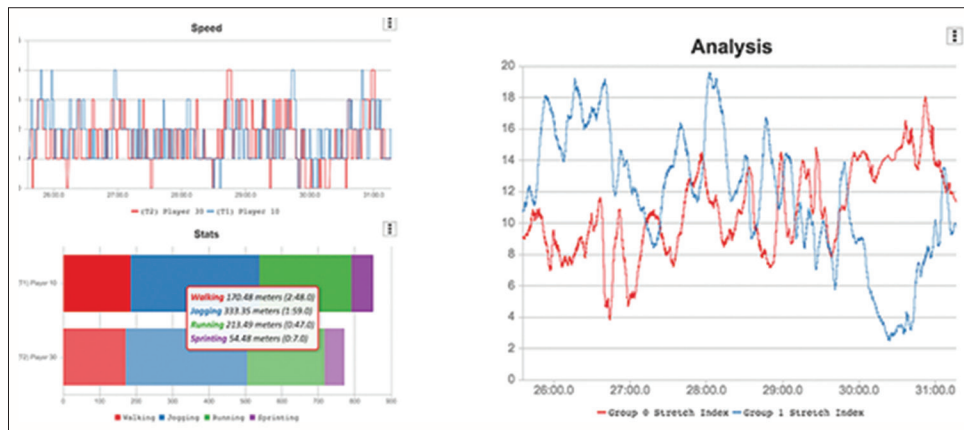


Figure 6: Data tracking and analysis



Figure 7: The artificial intelligence system scanning and determine and score

EXTRA SYSTEMS SUPPORT FOR ARTIFICIAL INTELLIGENCE IN SPORT

Here the list of electronic systems supports AI to collect data to get accurate results.^[11]

1. Radio frequency identification for players
2. GPS wearables
3. Camera network (In-venue tracking systems). Like volleyball, basketball, tennis, and track and field games
4. Radar for some games like (golf).^[8]

In recent years, AI has been extending its impact on the field of science and, more specifically, in the realm of sports; however, there remains a lack of clarity regarding the specific areas, sports, and athletic professions that have been reaping the benefits of AI, as well as the overall knowledge gains from its application. This chapter aims to provide a comprehensive review of published articles on AI in sports, with the goal of identifying and categorizing common research topics, and synthesizing emerging trends in this area.^[14]

CONCLUSION

The AI is a science applied in all fields in our life, it deserves a lot of serious work and respect from all other departments and fields of work, especially in the science of sports field and their programming of study or at least learning the principle of work of that system. Preparing a team or a player for winning is an important task for every team and it has become a complicated task because of all the variables involved from training to team quality of members and playing plans.

This research paper is an attempt to establish the great role of AI in finishing games successfully and improving the performance of teams and players. This is an important step in convincing team managers to employ AI-based applications. This is correct for the teams and clubs in Iraq to improve on the international stage. Finally, the importance of using AI applications in sports for the people involved in the sports industry in general and especially for the Iraqi academic staff and those working in the sports field. They need to learn how to use the principles of AI knowledge and conduct research to improve the performance of Iraqi teams and players.

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