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LOCATING THE INNOVATION AND APPLICATION OF ARTIFICIAL INTELLIGENCE IN SPORTS AND TRAINING

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Abstract

The 21st century has witnessed a significant upward trajectory in the field of Artificial Intelligence (AI). The advancements in AI have propelled the progress of human society, marked by remarkable revolutions driven by innovative theories and techniques. In this era of, computer science, cybernetics, interdisciplinary science, automation, mathematical logic, linguistics and Physical Education, Sports Journalism etc. With the rapid development of new Research and studies AI has transitioned from theoretical concepts to practical applications, emerging as a pivotal technology in modern society. Its pervasive influence now extends across all facets of people's lives, encompassing areas such as game development and sports training. The new Intellectuality acclaimed the positive impact brought by the precision of technology into sports, which continue to flourish in the sports arena. Real-time personalized training plans, player performance analysis, automated scouting and recruitment processes, match predictions, ticketing systems, and sports journalism represent highly valuable applications within the realm of the sports world. This study aims to investigate the supportive role of these applications in enhancing game and sports training methodologies.

***Key Words*:** Innovation, Artificial Intelligence, Sports, game, Sports Journalism, AI Application.

Introduction

The progression of Artificial Intelligence (AI) has significantly propelled the development of human society in our current era, characterized by profound revolutions stemming

from innovative theories and techniques. AI's growth has been substantial, firmly establishing its presence in the 21st century as an increasingly institutionalized field. In this interdisciplinary epoch, AI intersects with various domains such as computer science, cybernetics, automation, mathematical logic, linguistics, physical education, and sports journalism. One decade ago, American sports drama, Moneyball, give way to insight into the world of sports and its integration with technology. The Oakland Athletics general manager Billy Beane successfully uses statistics and statistics to build a competitive team despite being short on budget and continues to show how the team breaks all achievements (Davenport, 2006, p. 107). Using advanced computer algorithms, AI can simulate human learning, thinking, perception, and actions, and the AI system is self-learning these all are easily map with AI statistics. The effective analysis of statistics and reality provide great progress in the sports arena, obviously statistics have played a significant role in sports since its inception, AI has had a profound effect on the level of spectator engagement, the development of the game's strategy, and the way it is played today. Researcher identified that data statistics and the ingenuity of the use of sports equipment are of great value. In the 21th century use of AI in sports has become great demand in the last few years. And considering the positive impact and influence that technological accuracy plays in sports, based on the research support there is no doubt that it will continue to prosper in this field and the progressive success. At present, AI's integration into the realm of sports holds substantial potential for fostering sustainable development within physical education training. However, to harness this potential effectively, it requires a foundational theoretical framework tailored to this specific objective, harmonizing with other interconnected fields. Comparable to other sectors of society, a wealth of data is now being amassed across various physical activities, elevating the significance of utilizing AI for automated data analysis, as noted by Wei et al. (2021).

Advancements in computer science have facilitated the gradual automation of AI, enabling it to execute tasks swiftly and efficiently, often surpassing human capabilities in decision-making and data analysis. AI's prowess lies in its ability to handle vast amounts of data beyond human capacity. The examination of physical activity data deepens the assessment of sports science and augments the decision-making proficiency of sports professionals in crafting physical training regimens and competitive strategies (Lee et al., 2021).

The intersection of physical education technology with diverse fields like sports, education, and computer science is garnering increased attention in the modern era. The swift progress of science and technology significantly influences educational models and educational system types, particularly in the realm of physical education. AI stands as a prominent exemplar of scientific and technological development, showcasing its potential to effectively aid in physical education training, substantiated by research findings. Conversely, in traditional sports training without adequate equipment, the precise analysis of diverse training-generated data can pose challenges, potentially impacting individuals' physical education training negatively.

Nonetheless, AI holds promise in addressing practical challenges and facilitating advancements in physical training by fostering the development of physical education technology, as highlighted by Bishary et al. (2005). Achieving an in-depth understanding of athletes' performance in competitive sports necessitates the employment of appropriate methodologies and extensive data. Technical analysis encompasses motion capture, data acquisition, and data analysis. AI's capability to extract and scrutinize data from numerous athlete training sessions can yield valuable insights and recommendations that correspond to improved performance outcomes.

The world is progress with rich innovation and discovery in path of human cantered AI and the development within this arena AI to help sportsman and coaches analysis better progress and make apt decision in sports. For this intellectual prediction and the betterment different application and strategy are followed by the concerned domain. In the cricket with the employability of AI helps to better decision in Umpire Decision Review, System (UDRS), Dock worth Lewis, in the basketball; Home Court used for better understanding of basketball players skills and its improvements, Stats Perform which used to collect sports prediction, Box Score Statistics which use for more details level of information in food Ball play. Moreover, different wearable Ai Devices are used to understand players performance and their improvement. For the betterments of different devices with the help of AI will contribute to great concern in the sports domain such as My Swing Professional, Spot VU and many highly supportive devices are available in the development t and achievement in the sports and game field.

Influence of Artificial Intelligence in Game and Sports

Artificial Intelligence (AI) technology has undergone substantial evolution in recent years, notably impacting numerous sectors. Its influence on games and sports applications has been particularly significant, fostering a transition from conventional methods to more contemporary approaches. AI's pivotal role has been instrumental in driving this sector toward innovative and modernized paradigms.

Artificial intelligence is affecting almost every significant pro game. This is a convenient interruption of the business as media inclusion turns out to be progressively substantial as the main wellspring of income in elite athletics. Simulated intelligence is revolutionizing systems, granting fans an unprecedented sense of proximity to both the players and the game itself. As personalized experiences and interactive digital interfaces continue to evolve, there's a strong potential for increased fan loyalty and engagement. In this context, the utilization of artificial intelligence in sports aligns closely with its broader applications in media and software. Additionally, wearable technology stands out as another promising AI application within sports, holding tremendous potential for future advancements. (Toledo,Sookhanaphibm, Thawonmas & Rinaldo, 2012).

In both practice sessions and live sports events, the strategic application of AI technology enables precise monitoring of athletes' physical conditions before, during, and after games. This capability offers robust support for coaches, aiding in real-time adjustments to technical tactics. AI also facilitates the development of tailored training models and fosters the creation of more scientific and effective competition strategies. Consequently, this enhances athletes' competitiveness and augments the systematic utilization of physical education and sports in the contemporary landscape (Ding, 2019).

Researchers have observed a transformative shift in how athletes train, how their game performances are analyzed, and how coaches prepare their teams, all due to technological advancements. The integration of AI applications, which incorporate extensive data on training sessions and game performances, along with insights from numerous expert sports scientists and coaches, serves as a central repository for disseminating up-to-date knowledge on specific techniques or game tactics for professional sports coaches.

As this reservoir of knowledge on various techniques and tactics continues to expand and evolve, the AI application's knowledge base undergoes regular updates. This knowledge repository becomes an invaluable resource for training and educating sports scientists,

coaches, and athletes, ultimately refining elite performance through continuous improvement and learning (Barlow and Sriskandarajah, 2019).

From a sports concern, player tactics and strategy on the ground is highly referral context which is very accurately predicted with the presence of AI devices and its technology.

In recent years, the utilization of technology in sports or physical activities has gained popularity, engaging around 39% of the Australian adult playing population, with a continual rise in participation. Among participants, the most common technological tools used are activity tracking apps and wearable technology, with younger adults, especially younger women, demonstrating the highest affinity for these innovations. The future trajectory of wearables aims to surpass mere tracking functionalities (Barlow, 2019).

Through the integration of machine learning, upcoming applications are poised to leverage performance data to offer tailored recommendations aligned with a user's objectives, such as optimizing training/activity efficiency (e.g., focusing on biomechanics) and providing personalized nutrition and training programs. Moreover, these advancements aim to predict and identify potential future injuries and health issues, showcasing the diverse applications of AI in this domain. While these applications have initially been introduced at elite levels, they are gradually permeating grassroots levels as the technology becomes more affordable and accessible to a wider audience. (Barlow & Sriskandarajah, 2019).

The eight technological imbibe is still lag the wide establishment, developing country link India and other are still in the fancy mode to implement this sophisticate Intelligence, for instance Hockey and Kabaddi players are very proximate determination with winning score.

Basketball stands as one of the most popular sports globally, generating substantial economic benefits within its related industries. In recent years, the integration of artificial intelligence (AI) technology into basketball has garnered significant attention. Researchers conducted a comprehensive review encompassing various applications of AI in basketball games. These applications span accurate assessment of team and player performances, forecasting competition outcomes, shooting analysis and prediction, AI-driven coaching systems, intelligent training equipment, arena advancements, and sports injury prevention.

Numerous studies have showcased the potential of AI technology to enhance the skill levels of basketball players. Additionally, AI assists coaches in devising suitable game strategies, aids in preventing sports-related injuries, and contributes to elevating the overall enjoyment and experience of the game. The breadth of AI applications within basketball illustrates its capacity to positively impact player performance, coaching strategies, and the overall sports ecosystem. (Li, B., & Xu., 2021).

Different sports channels have innovated various techniques aimed at enhancing the viewing experience for audiences tuning into network and cable broadcasts of sporting events, notably networks like ESPN. These advancements result in the final televised videos containing enhancements geared towards aiding viewers in comprehending the intricacies of the game and understanding players' and teams' strategies. Some effects are integrated seamlessly into the on-air video, ensuring that advertisements and logos do not disrupt the viewer's engagement. Examples of these visual enhancements include:

1. Graphical aids that assist audiences in easily tracking rapidly moving objects or players, such as the movement of players across the ice in hockey or the trajectory of the ball in football and baseball.
2. Providing informative overlays displaying data like the speed or projected trajectories of various objects of interest, such as a golf ball, golf club, baseball, or bat, adding a layer of analysis to the viewers' experience.
3. Highlighting specific locations within the arena, such as in soccer, where dynamic lines mark the offside line—a boundary that adjusts dynamically based on the ongoing gameplay (Cavallaro et al., 2011).

These visual enhancements significantly contribute to viewers' understanding and enjoyment of the sporting event, offering valuable insights and aiding in the interpretation of the fast-paced action unfolding on the screen.

In the sports field, one of the crucial aspects gaining attention is the analysis of athletes' gaze direction, a question frequently pondered by both coaches and fans. Understanding where athletes are looking offers insights into their perception of the sport and the rationale behind their actions. For instance, in scenarios like a soccer or football player passing to the wrong teammate, gaze analysis could clarify if it was due to a judgment error or if they didn't visually perceive the correct teammate.

Recent advancements in video-based eye tracking, specifically video-oculography systems, encompass two primary methods: appearance-based and shape-based. Appearance-based methods directly map the entire eye image to determine gaze position (Pires & Kanade, 2013). High-definition referees are gradually becoming more prevalent in games like Formula 1, tennis, and soccer, promising increased accuracy and engagement. Although presently seen as a novel application, it reflects the growing accessibility of AI software and advanced camera technology (Lawrence, 2015).

Another significant utility is the Decision Review System (DRS) and Video Assistant Referee (VAR) used in sports like cricket, tennis, soccer, and hockey. These systems leverage slow-motion replays, hawk-eye, and other technologies to aid in decision-making. However, the current process involves the team or player requesting a review or when the umpire is uncertain, potentially leading to biased decisions. Consequently, additional parties may intervene to assist the main umpire in making a decision. While this process aims for accuracy, it often elongates the game duration and diminishes the excitement and flow. Despite this, such technologies significantly contribute to accurate decision-making in critical game moments.

With the continual evolution of camera technology and AI software, umpires' roles are shifting toward managing on-field player behaviour rather than solely making critical decisions during pivotal moments. Innovations in computer vision are already capable of detecting the speed and placement of tennis shots, even determining whether a ball was in or out of bounds without the need for line umpires. Envisioning the future, umpires might be equipped with AI-powered glasses and earpieces, instantly providing them with accurate decision-making guidance, thereby eliminating the need for time-consuming reviews.

However, there's a pertinent question regarding whether fans genuinely desire every decision to be flawlessly and instantly adjudicated. The human element, including the potential for mistakes made under pressure, has been an integral part of fan engagement, contributing to both positive and negative emotions. These moments of human error often spark excitement or frustration within games, adding a layer of unpredictability and drama that AI devices might significantly influence but not replicate entirely. The

involvement of AI in crucial decision-making contexts can indeed enhance accuracy, yet it also alters the dynamic between sports, fans, and the intrinsic drama that arises from human fallibility under pressure. The prediction between the before and after the invention of AI in the sports, game and the Physical Education arena is proofed in nature.

Artificial Intelligence Technology Located Applications

PIQ Robotic device

The PIQ Robot represents a highly potent sensor boasting the capability to analyse numerous data points throughout athletes' training sessions. Specifically designed for multiple sports, this wearable device offers athletes a convenient means to enhance various skills, including speed, strength, accuracy, and more.

It incorporates state-of-the-art inertial sensor technologies, BLE (Bluetooth Low Energy), NFC (Near Field Communication), pressure sensors, and an advanced microprocessor. Despite its small and ultra-lightweight build, the PIQ sensor stands out as a waterproof and flexible multisport motion sensor. It seamlessly connects to smart devices through BLE, allowing athletes to access and leverage its functionalities for improved performance and skill development.

According to researcher Bezobracy's et al (2019) the PIQ Robot was modified in specialized engineering mode to gain access to it nerve sensor data using the BLE optical connecter.

Octonion Technology developed a specialized tool for Android smartphones known as a Sensor Log, aimed at capturing and analysing sensory data for learning purposes. This tool saves a series of timestamped sensor data files in the smartphone's memory. Each sensor data file contains a service header information and is formatted with sensitive data separated by commas, enabling easy export to Microsoft Excel or other CSV processing tools.

The sensor data files encompass various fields, including:

1. Acceleration with gravity along three axes in the local reference frame.
2. Angular speed measured across three axes in the area indicator frame.
3. Quaternion for local PIQ conversion, linking to global coordinates.

Additionally, companion applications developed in collaboration with prominent sports brands like Everlast (boxing), Mobitee (Golf), Babolat (tennis), North Kiteboarding (Kiteboarding), and Rossignol (skiing) are available. These apps allow users to share their performance images on social media, share progress and results with others, fostering a sense of community and motivation. Users can also access the PIQ Robot leaderboards post-training sessions to compare their results with those of other users, adding a competitive element to their training regimen.

Sport VU electronic navigation technology

Sport-VU, founded in 2005 by an Israeli scientist and developed by Sport-VU, Ltd. headquartered in Tel Aviv, Israel, has significantly impacted the sports landscape. Since the commencement of the NBA 2010-11 season, Sport-VU cameras have been deployed in over 3000 games, and by 2013, these systems were installed and operational in all NBA arenas.

The technology uses six strategically placed cameras around the basketball court to comprehensively track the movement of the ball and each player during gameplay. This cutting-edge electronic navigation technology captures data 25 times per second, revolutionizing the way sports are perceived, comprehended, and enjoyed.

Sport-VU enables broadcasters to showcase live player performances on the field, offering viewers real-time insights into player movements and actions. The camera system meticulously tracks the location and motion of every player and the ball, generating detailed statistics using sophisticated software and mathematical algorithms. This wealth of data provides comprehensive information during live sports events, including real-time player and ball movement, as well as the referee's positioning.

Sport-VU's data delivery is highly accurate and efficient, presenting an innovative viewing experience that captures viewers' interest by offering unique perspectives and detailed insights into the dynamics of the game.

AI Referee- Video Assisting technology

In football games, Video Assistant Referee (VAR) technology plays a crucial role in making precise judgments on significant decisions, such as penalties, free kicks, and red cards. One of the most infamous incidents occurred during the 1986 World Cup match between

Argentina and England. With the score at 0-0, in the intense Mexican heat, Diego Maradona, despite being considerably smaller than the England goalkeeper, contested a cross.

Maradona leaped alongside the goalkeeper, who was the favored contender to reach the ball since he could use his arms. Surprisingly, Maradona somehow managed to outjump the goalkeeper and appeared to head the ball into the net. However, the reality was different from what initially appeared. Contrary to a legitimate header, Maradona used his hand to direct the ball into the net.

Following the goal, the England defenders were furious, vehemently protesting to the referee, claiming that Maradona had illegally scored with his hand, not his head. This incident underscores the significance of accurate officiating in football and the need for technology like VAR to prevent such controversial and incorrect decisions from influencing the outcome of important matches.

In the future, artificial intelligence (AI) will assist enterprises in solving challenges. As a result, the human-technology interaction will grow increasingly entwined. The use of artificial intelligence in football officiating has yet to be investigated. Wrong referee judgments have negative financial and psychological implications, making them problematic. As a result of the advancements in AI, there is a growing demand for this technology to be used to improve the precision of referee decisions.

Scouting and recruitment

In today's technology-driven world, sports teams are integrating Artificial Intelligence into their toolkit for scouting and recruitment purposes. Every movement on the field - whether it's a swing in baseball, running in soccer, or blocks in basketball - is meticulously tracked, resulting in teams amassing massive amounts of data in terabytes. Computer simulation in sports involves tracking players' movements and postures during gameplay, achieved through video tracking of objects.

For instance, in soccer, teams utilize data labelling tools equipped with key points to train models, enabling the prediction and tracking of player movements. Machine learning algorithms leverage this aggregated data to assess players' skills, strengths, and performance rankings in various positions, like forward attacks in the NHL or point

guards in the NBA. Moreover, computer vision is employed to identify specific features, such as soccer skills, that could serve as indicators of future performance

Scholars have emphasized five pivotal stages in the talent scouting process: detection, identification, confirmation, selection, and development (Vaeyens et al., 2008; Williams & Reilly, 2000). Traditionally, the detection and identification phases - uncovering potential performers not yet engaged in sports and identifying promising talents - are considered the most critical in predicting the success of young athletes. These stages serve as crucial pillars in identifying and nurturing emerging talents within the sports arena.

The information data gives teams allows them to make the best selection of forward-looking hotspots that ensure they build a successful team for the game in Advance.

Computer Vision Applications in NASCAR

Argo AI / Ford Motor Company has used in-depth learning to improve self-driving cars and is now expanding its use of in-depth learning to help improve safety practices in the world of motor meg. Specifically, found that its in-depth learning network was able to identify specific vehicles using images. The design initially used a database containing thousands of images to train the neural network. It is not yet clear how much the network has done but it is particularly noticeable in the case of blurry images. The decrease in visibility of vehicles is due to the high speed at which the vehicles arc moving. As the network gains expertise, it reportedly provides more accurate results than people in its ability to identify specific race cars. The specific application ability to quickly identify and access a car with a malfunction during a race is essential; a minor malfunction can quickly lead to serious problems like fire, which puts the driver at risk. As similar different application and its intelligence technology driven Artificial intellig0ce mechanism avail for the betterment of human enhancement.

In the realm of applying AI technology to sports, numerous studies have delved into the fusion of computer technology with human body movement, aiming to enhance training methodologies and performance assessment. Here are a few examples:

1. Lei developed a badminton technical feature statistics and pace training system utilizing a badminton action recognition algorithm. This system achieves two significant functions: technical statistics for badminton games and players' pace training. The results indicate an impressive accuracy rate of 96.7%, demonstrating

the system's ability to accurately measure athletes' pace information, thereby aiding in the swift improvement of their pace levels (Lei, 2018).

2. Liang applied Support Vector Machine (SVM) to establish an evaluation model for assessing taekwondo teaching effectiveness using AI algorithms. By identifying taekwondo movements, techniques, and characteristics, this model correctly assesses students' actions and instructs them scientifically through simulation methods, ultimately enhancing their performance (Liang, 2021).
3. Du created a youth physical exercise system based on AI technology comprising an object inspection module, a data analysis module, and a body posture determination module. This system estimates human posture by establishing posture-assisted indicators. Experimental results illustrate the positive impact of this AI-based system on enhancing teenagers' physical qualities and providing scientific training methods (Du et al.).

These studies highlight the efficacy of AI integration in sports, offering precise technical statistics, performance evaluation, and tailored training methods, thereby enhancing athletes' abilities and refining training programs.

Conclusion

Significantly the world is witnessing, the use of Artificial Intelligence will continue to change sport in more ways than we never see, AI is extensively applied in the field of game and sports. AI now defines all aspects of the game from all possible possibilities level, which empowers statistics and analysis to redefine how games are organized again used in the arena. As the typical representative of the progressive of science and technology AI can effectively assist people in game and physical education domain. AI improve sport accuracy from points, player movements, attempt prediction and fan behaviour can be easily predicted recent technology with the help of Al. AI technology is rapidly evolving and growing is very important to the ability of the sports organization to win games, better coaches and players, to administer their duties and nurture, serve, lid retain their followers. In contrast, the important that sports teams can simply use the same AI technology but rather admittance to an arsenal of advanced AI technologies their capability to produce and do things with sensitive information even fans involvement, talent identification, pm -prepare for a game or entry - real game time easy.

However, invention of AI in the sports made great influence in the new generation scenario which always help to predict and support accurate decision, better performance in the game and sports field as well as innovative applications share better experience and satisfaction in the decision-making.

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