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Analysis of the Development of Sports Intelligence From the Application of "Intelligent Robot Dogs" in Competitive Sports

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Abstract. The 19th Asian Games, hosted in Hangzhou, China, have been described as a large-scale event of sports intelligence, with high-tech technology such as "digital torchbearers", autonomous buses, 5G information networks, meta-universes, and intelligent robots on show. This paper will use the "intelligent robot dog" as the research object and will use the literature method, case study method, logical reasoning method, and other research methods to describe the concepts of digitalization and intelligent robots and analyse the positive effects that the combination of sports and intelligence brings to sports competitions. Using the application of an intelligent robot dog in sports competition at the Hangzhou Asian Games as a starting point, this paper will analyse the current state of sports intelligence, present the problems encountered as well as the solutions, and finally forecast the future market development of the combination of sports and artificial intelligence applied in competitive sports.

Keywords. artificial intelligence, sports events, sports management, sports industry

1. Introduction

The 19th Asian Games will be held in Hangzhou in September 2023, with a new "Chinese characteristics, Zhejiang style, Hangzhou flavour" of sports and celebrations, as well as a science and technology feast. It drew the attention of a huge number of viewers at home and abroad from the opening ceremony, programme competition, and closing ceremony, and news about the event's progress was broadcast by major media sites. Intelligent has become the "city business card" of Hangzhou as early as in the Asian Games preparations before artificial intelligence, cloud computing, unmanned vehicles, 3D technologies, and so on. The official small programme users of the Hangzhou Asian Games exceeded 100 million people.

The small programme integration of all kinds of urban services and use of the scenario, the opening ceremony of the digital torch bearer, is the fusion of cloud computing, blockchain, and other types of information technology. The State General Administration of Sports' Fourteenth Five-Year Plan for Sports Development [1] emphasises the importance of accelerating the process of sports informatization, which is required to achieve the goal of a strong sports nation, and the Plan specifies the goals of digital transformation, intelligent upgrading, and the construction of infrastructure and big data platforms with the help of the development of a deep fusion between technology and sports. with the field of sports. The digital era has been ingrained in people's lives and is no longer a mystery. Digitalization,

networking, and intelligence are emerging as hallmarks of the next wave of technological transformation [2].

The development of the social economy has been moving towards the data-driven, intelligent era of everything being interconnected, the deep integration of smart technology with the construction industry, the financial industry, the service and tourism industries, and so on, and the combination of today's sports industry and artificial intelligence has also become a new trend. The first appearance of the artificial intelligence robot dog at the Hangzhou Asian Games garnered acclaim and shouts from the audience, and reports in domestic and international media have peaked the public's attention.

Electronic dogs are a subset of "four-legged robots" in artificial intelligence robotics, including 44 consumer-grade robot dogs and 5 industrial-grade robot dogs playing in the Asian Games. The regular operation of the event organisation is assured by working as a "promoter" outside the stadium and engaging with people, as well as as a "cheerleader" and "groundskeeper" within the stadium to serve the whole sports event and secure the organisation's correct operation. By searching the relevant literature on the CNKI and WOS platforms, it is clear that some scholars are interested in artificial intelligence, while others are interested in the application of robots (mostly in the fields of logistics, transportation, and factory manufacturing), while those interested in sports and the application of robots are less interested [3].

In light of this, the purpose of the research, the use of the electronic dog at the Asian Games in Hangzhou, China, a more in-depth investigation into the application of quadrupedal robots in athletic sporting activities, the beneficial influence on the event, the good influence and weaknesses of the event, and building a future vision on sports intelligence by merging the truth.

2. Methodology

By searching the relevant literature on the CNKI and WOS platforms, This paper will use the "intelligent robot dog" as the research object and will use the literature method, case study method, logical reasoning method, and other research methods to describe the concepts of digitalization and intelligent robots and analyse the positive effects that the combination of sports and intelligence brings to sports competitions.

A Conceptual Explanation of Information Digitization, Digitization and Artificial Intelligence, and the Marriage of Artificial Intelligence and Sports

2.1. The Fundamental Meaning of Information Digitization

The notion of digitalization refers to the application of digital information processing technology in all parts of a sector. The concept of digitalization started in the economic sphere and has gone through three stages: digital conversion, digital upgrading, and digital transformation [4]. The digital revolution has had a significant impact on people's decision-making. Previously, people's judgement of something was based primarily on experience accumulated over a long period of time, which is susceptible to personal subjective consciousness; now, people's judgement of things is based primarily on information technology platforms to collect big data, and there are more perfect screening, processing, basic analysis, and other system settings. This type of conventional experience judgement for big data analysis and mode of change judgement is to demonstrate the accuracy of information digitalization, objectivity, and other benefits.

2.2. Digitalization and Artificial Intelligence in Tandem

Digitization and artificial intelligence are distinct ideas, yet they are so intertwined that they might be defined as complimentary and interdependent. Digitization refers to the conversion of all old physical modes of communication to digital form, whereas artificial intelligence refers to the processing of acquired data using computer algorithms to approximate the level of human intellect. The vast amount of information acquired by digitization for a certain business is what gives artificial intelligence its distinct benefits in terms of accuracy and efficiency. In the sector of manufacturing, digitalization can first gather actual machine and personnel operation data and then use artificial intelligence to analyse and process the data in order to more efficiently enhance production efficiency and minimise production costs.

2.3. Sports-Related Applications of Artificial Intelligence Technology

The combination of sports and artificial intelligence has been widely used in international and domestic large-scale events, but research is still in its early stages, and information-based stadiums and sports event live broadcasts, as well as other application scenarios, have enormous opportunity to develop the market.

As a result, artificial intelligence may modify the laws of the game in the sphere of sports [5], becoming fully interwoven into people's lifestyles. Artificial intelligence technology, which is directly tied to the introduction of the digital information era, may be widely applied in a variety of sectors. Artificial intelligence is currently being used in situations such as facial recognition, autonomous driving, intelligent customer service robots, logistics robots, and so on. Sports are to carry the hope of the development of the cause of national health; at this stage, the integration of sports and artificial intelligence technology in China is promoting the process of sports intelligence and all kinds of sports intelligent wearable equipment to meet the needs of the public. In addition to popular sports, competitive sports are currently the most widely used field of artificial intelligence, accompanied by 5G communication, cloud computing, regional chains, and other computer technology. Intelligent training, intelligent governance, intelligent refereeing, intelligent participation, intelligent dissemination, and other ways have been integrated into the public's daily lives and have all been praised.

3. Result and Discussion

3.1. Sports-Related Applications of Artificial Intelligence Robots

Hangzhou Asian Games is known as the "intelligent" Games, with unmanned, automated technology based on digital artificial intelligence scenarios visible everywhere, including the machine dog running on the track and field. The machine dog belongs to Yu Shu Technology Co., Ltd.'s independent research and development of quadrupedal robots. In track and field sports, as 'field service' personnel, the machine dog in a discus project competition can run 7200 metres, according to Asian Games officials. A wireless network-based artificial intelligence robot has also been used in the training and teaching of badminton.

The robot is pre-programmed with code that allows it to collect user data for self-learning and problem solving, and the user selects the teaching mode or training mode in the intelligent system. The badminton robot will serve the ball according to the difficulty level set; beginners will only serve the ball in a straight path, while expert players will serve the ball in an erratic pattern all over the court. The use of robots can significantly increase athletes' physical condition, rapid response time, and specialised ability in technique and tactics [6]. In recent years, the use of intelligent robotics in football has been confined to certain events, but it is becoming increasingly common to use intelligent robots in all types of major, medium, and

small football matches. Football is one of the most popular sports in the world, with over 200 countries and regions participating. Europe is the largest market for football, and revenue from broadcasting rights, commercial sponsorships, and event tickets is an important economic source. The appeal of football events to sports fans around the world is not only the exciting two sides of the duel. But the referee's fairness and impartiality have a direct impact on sports fans' belief in the football organiser. VAR clever technology is used by World Cup referees to catch the trajectory of high-speed football, and the intelligent system precisely captures the foul action to assist the referee in making the correct penalty judgement [7].

3.2. Sports Applications of Artificial Intelligence Equipment in China

In the field of competitive sports, Dell and the Chinese Rowing Association, the Chinese Canoe Association, and the Centre for Human Performance and Health Development have established a joint laboratory of big data and artificial intelligence, which helps to focus on the athlete's training level, sports injuries, nutritional intake, and other data. Artificial intelligence relies on data to conduct a full analysis in order to provide effective improvement approaches to assist players in improving their game performance. By 2020, the number of people who regularly participate in physical exercise in China will be more than one-third of the total population, and the total scale of the domestic sports industry will be more than RMB 2.74 trillion, with online APPs and smart wearable devices based on technologies such as artificial intelligence, cloud computing, and 5G being widely used, which promotes the overall health of the population.

The digitalization of the sports industry has also ushered in a wave of development, with intelligent gymnasiums and intelligent sports equipment, such as heart rate monitoring instruments, intelligent bracelets for aerobic intake, and 3D indoor virtual sports user scenarios, prompting the public to participate in sports in a more convenient, safer, and efficient manner.

3.3. The Use of an AI Robot Dog at the Asian Games Improves the Audience Experience

A successful sporting event consists of three components: first, the athletes' exceptional abilities and tactics; second, the mobilisation of the emotional performance of the audience at the game site; and finally, the event organiser's orderly coordination of the process. Nowadays, it is quite popular to watch sporting events live, and you may get tickets to watch the game live on the Internet. People prefer to focus on the athletes while ignoring the subjectivity of the audience. Because the emotions of the audience have a partial influence on the performance of the athletes, it is also important to consider the audience's experience of the event.

The Hangzhou Asian Games are held on a grand scale, with a variety of sports, track and field events, a short cycle of competition, and repetitive characteristics.

Both the audience in front of the TV set and the on-site audience of such single sports are watching and cannot maintain a long attention span. The first appearance of the AI robot dog gave the audience on-site surprises and indirectly relaxed the audience's attention. The appearance of the AI robot dog changes the psychological state of all personnel on the field; the tension of the athletes on the field of competition is relaxed for a short period of time, which is more helpful to play a good level of technical and tactical competitions; and the audience's attention is shifted for a short period of time, which is helpful to watch the game in the second half of the game more attentively. As a result, the sight of an AI robot dog has a good influence on both the mental and physical well-being of competitors, spectators, and volunteers.

3.4. The Asian Games' Use of AI Machine Dogs Lowers the Risk of Referee Injuries

Sports such as discus, javelin, and chain ball competitions are unpredictable, and the referee must walk back and forth on the field to monitor the throwing results. In high-risk sports like shuttle walking, accidents cannot be prevented. In the Hangzhou Asian Games' chain ball game, an athlete's mistake caused the ball to smash open fractures, drawing attention to the AI robotic dog's safety and security in the discus. The referee and the event organisers only need to be stationed in a fixed position; the game site needs to shuttle around the risk of transferring to the AI electronic dog, thereby reducing the chance of injury to the referee, the referee, and the event organiser. The game site serves as a 'field service' staff member and is responsible for transporting the discus back and forth. A game-AI electronic dog can run 7200 metres. By shifting the danger of going back and forth to the AI electronic dog, the referee's physical burden is lessened, the walking distance is shortened, and the probability of harm to the referee is directly decreased.

3.5. The Asian Games' Use of AI Robot Dogs Lessens the Amount of Labour That Volunteers Must Undertake

For the first time, a domestic AI robot dog was used at the Hangzhou Asian Games. By itself, Yu Shu Technology Co., Ltd.'s Unitree Go2 model robot can be ruled over long distances; when AI and robots work together, it can be more effective and help make the right choices. The Go2 is equipped with 4D LiDAR, intelligent obstacle avoidance, 360-degree ultra-wide-angle perception ability, ultra-low blind spot, all-terrain perception, and a maximum running speed of 5 metres per second. Before the game, an AI robot dog outside the stadium may engage with passing fans and make dog-friendly gestures like a handshake or a roll, which will draw kids over. The robot dog is also capable of serving as a "guide dog" by helping those with special needs. The AI robot dog serves as a "cheerleader" to lighten the mood at halftime and travels around the stadium to deliver discus and javelin throughout the game. During the curtain call of the event, the AI robot dog puts on the last display and engages with the spectators. The aforementioned series of occurrences in traditional sports events require staff arrangements to be made; however, the AI robot dog can now do these responsibilities, freeing up human resources at sports events and allowing for a more fair backup security personnel distribution structure.

3.6. The Asian Games' Use of AI Machine Dogs Aids in Event Publicity for the Media

In the past, the news media's coverage of sporting events focused primarily on the athletes' competitions and medals they won. However, these days, new technology is used in large-scale games, such as unmanned vehicles, information technology, digital human torchbearers, AI machine dogs, etc., not only to enable the news media to report on more rich material but also to receive positive feedback from the public and national netizens who are present on social media platforms. This will directly draw attention to the new technology. The domestic Shake Shack platform's hotspot data report reveals that 400 billion hotspot videos are played each month. When the AI robot dog was first implemented during the Asian Games, it quickly rose to the top of the Shake Shack hotspot list, and within a week of its release, people were still actively searching for relevant content. Apart from the official media reporting, the spectators who watched the games from off-field also shared a video of their encounter with the AI robot dog on social media. The interactive audience may give directions to the robot dog, and it can comprehend them. It can precisely carry out the motions, such as rolling, jumping,

sitting, and shaking hands. This wins over people's affection and quickly becomes popular on social media.

3.7. The Asian Games' Use of AI Robot Dogs Encourages the Growth of Sports Intelligence

The AI machine dog made its debut at the Asian Games, and that same day, it shot to the top of the jittery voice short video platform's popularity list. The public is very interested in the machine dog, and searches for "AI machine dog" focused on "which company developed it?" "How much is the price of the AI robot dog?" "AI robot dog simulation degree: how?" The terms "Asian Games technology" and others. Facts show that the public's high level of concern will directly affect the use of AI robots in competitive sports. The Global Tennis International Open, which concluded this week, took place in Jiangxi as planned, and according to the official spokesman, the tournament's use of AI machine dogs—the first of its kind at the Asian Games—was primarily responsible for picking up balls for transportation. In order to achieve the informationization of sports events, the intelligent transformation of large-scale sporting events will directly impact sports training, sports event administration, sports event media, and other disciplines [9].

3.8. Issues With Data Security

Many high-tech enterprises have entered the market as a result of advancements in computer technology, including 5G technology, area chains, digitalization, and the Internet of Things. Research and development is done on intelligent mobile devices, robots, artificial intelligence (AI) systems, etc., and then they are put into the market for use. A good cycle of research and development, market launch, feedback, and product improvement is formed by gathering user usage data and uploading it to the background for analysis. People are loving the 360-degree, no-dead-angle, no-delay game broadcast, but they are also concerned about the protection of the enterprise's powerful personal information.

The domestic Intellectual Property Law has not yet made more comprehensive additional amendments to the AI segmentation due to the complexity of data capture and algorithms of technology formulas, as well as the intellectual property rights attribution of smart technologies and whether the reasonable use of personal information big data by enterprises is supervised. When an enterprise's data platform is attacked unlawfully, resulting in information leakage issues, the illegally obtained personal information will flow to where the present public is most concerned about the situation. As a result, two solutions are proposed for consideration.

The first is to establish a monitoring system, with the government acting as a supervisor. Personal privacy data endorsed by the government can put the public at ease, but it also prevents the enterprise intelligent system from collecting big data arbitrarily. Second, the establishment of industry norms, clear responsibility, and power [8] means that with enterprise technology innovation and the development of space, personal privacy data should be used reasonably and correctly; once a company risks personal privacy data to other illegal areas, it should be in accordance with the "Data Security Law" to bear the corresponding responsibility. As a result, on the issue of data security, it is necessary to allow enterprises to innovate while also strictly monitoring and cracking down on illegal information leakage behaviour, and the resolution of these issues will bring the road to the integration of high-tech and sports, such as artificial intelligence, one step closer.

3.9. Sustainability Concerns

The enterprise's high-tech R&D and innovation must be sustained in order for goods to be updated iteratively. Opinions on Promoting National Fitness and Sports Consumption to Promote the High-Quality Development of the Sports Industry clearly state that the sports industry should be integrated with high-quality and new technologies such as big data and artificial intelligence in the future, which should be applied to actual stadiums, sports competitions, and public fitness [9].

Driverless, robotic arm, intelligent customer service, unmanned delivery, and other technology application scenarios can be realised using 5G technology, digital technology, blockchain, and other integrated technology models in conjunction with the digital economy, which has given birth to a number of innovative technology companies. Unlike the manufacturing industry, high-tech requires a large amount of R&D funds to maintain normal operation; the time to produce research results is uncertain; and there is a constant need to constantly invest in human and material resources to update the first generation of technology products. Government support for high technology is expressed in legislative subsidies, tax incentives, and exemptions, as well as the encouragement of SMEs to actively develop. The development potential of intelligent sports fields is enormous, and market demand is also increasing.

As a result, local governments should increase financial support for high-tech enterprises [10], pay attention to the construction of local high-tech industrial parks, absorb and reserve the power of talents, and the government should do a good job in the role of supervision to provide the market with sufficient space for development. The sustainability of company high-tech R&D and innovation, but also the problem of professional and technical people reserve To begin, it refers to R&D talent. Due to various situations and diverse equipment, such as wearable equipment, we must target the user's workout and heart rate changes to monitor the probable hazards of sports; sports field games that make use of the Internet of Things "Eagle Eye" system, artificial intelligence algorithms, and data collection to fully address the issue of quick movement in the position movement, data gathering, system analysis, and processing output findings.

Second, it refers to the actual application of the technical operators' site at sports competitions. Technical operators are responsible for the debugging and maintenance of equipment to solve technical faults generated by the sports intelligence equipment, and referees and other staff training are provided to ensure that the artificial intelligence sports equipment can be operated in an orderly manner. In order to be able to enjoy the real game in real time, digital technology in the sphere of sports has caused a great number of changes in media reporting [11]. Based on 5G information dissemination technology, technical operators will utilise drones to cover the arena with full wide-angle coverage of the live broadcast of the live game, allowing the audience to experience the true ambiance of the game.

4. Conclusion

The merger of competitive sports with AI has emerged as the primary development trend. Yu Shu Technology Company's AI machine dogs have previously appeared at the Spring Festival Gala, the Lantern Festival Gala, the China Winter Olympics, and the Super Bowl. The large scale of the Hangzhou Asian Games event, media coverage, and the spontaneous spread of many young people who actively participated in the games put the AI machine dog back on the global stage.

Soon after the Hangzhou Asian Games, the International Open Tennis Championships will be held in Jiangxi as planned, with players from 27 countries taking part. The tennis stadium will actively introduce high-tech, with the "Hangzhou AI machine dog" responsible for picking up the ball in the game. The "Eagle Eye" instant replay technology is in charge of recording data from tennis ball flight trajectory in order to assess the particular position of the tennis ball, ensuring game fairness. Wearable technologies have been employed in various tournaments to improve contestants' athletic performance and real-time health. When sensors on wearable devices are combined with artificial intelligence algorithms, they can better recognise the complexity of movement. For example, in golf, using artificial intelligence algorithms to analyse whether the wrist movement and power posture are optimal or not, coaches and researchers can improve the athlete's performance based on the results of the resulting data [12]. The competition environment has a direct impact on the personal safety coefficient of the driver, as in Formula Racing professional-level competition, the use of artificial intelligence equipment to detect the dynamics of the driver and the vehicle is particularly important. The output of relevant data compared to staff paper records and analysis is more accurate, from race car pit stops, changing tyres, and checking the service life of the parachute. Data-driven mode and tactical collaboration [13] According to a related market survey, the economic growth of the sports AI industry will exceed \$5.4 billion between 2022 and 2026, and the development of finance, automotive, healthcare, services, sports, and entertainment industries will all show a growing trend based on the continuous innovation of AI technology.

References

- [1] Notification of the General Directorate of Sports of the State Council concerning the issuance of the "Fourteenth Five-Year" Sports Development Plan [EB / OL]. (2021-10-25). <https://www.sport.gov.cn/zfs/n4977/c23655706/content.html>
- [2] Xi Jinping, "Digital, Networked, Intelligent" New Generation Information Technology Focus Point [J]. *Scientific Chinese*, 2019, 415(7): 38-39.
- [3] Zhao Shinhui, Shelleywe, Juyaje, etc. Analysis of the research hotspots, evolution and development trends of smart sports in China by Zhao Xinhui [J]. *Hubei Sports Technology*, 2023, 42 (04): 311-319.
- [4] Chen strong, Yang Wang Pool, on the flight. Ecological synergy in digital transformation Innovation Strategy: a strategic study based on Huawei Enterprise Business Group (EBG) China [J]. *Qingdao Management Commentary*, 2019, 72(6):23-27.
- [5] Glebova E, Desfontaine P. Sport et technologies numériques: vers de nouvelles expériences spectateur[J]. *Economica*, 2020: 245-270.
- [6] Gao S. The Application of Wireless Network-Based Artificial Intelligence Robots in Badminton Teaching and Training[J]. *Computational Intelligence and Neuroscience*, 2022, 2022.
- [7] Rathi K, Somani P, Koul A V, et al. Applications of artificial intelligence in the game of football: The global perspective[J]. *Researchers World*, 2020, 11(2): 18-29.
- [8] Jiansuang. Risk Identification and Regulation Path of Competitive Sports Intelligent Arbitration System_Jingsuang [J]. *Wuhan Sports Institute Journal*, 2023, 57(03): 29-36, 44.
- [9] Liu Suzui, Zhao Yulin, Zhang Shogun, etc. Digital technology promotes the mechanism, challenges and path of high-quality development of large sports events. *Journal of Sports Education*, 2023, 39 (04): 33-39, 95.

- [10] Ding P. Analysis of artificial intelligence (AI) application in sports[C]//Journal of Physics: Conference Series. IOP Publishing, 2019, 1302(3): 032044.
- [11] McGillivray D. Digital cultures, acceleration and mega sporting event narratives[J]. Leisure Studies, 2014, 33(1): 96-109.
- [12] Ghasemzadeh H, Loseu V, Jafari R. Wearable coach for sport training: A quantitative model to evaluate wrist-rotation in golf[J]. Journal of Ambient Intelligence and Smart Environments, 2009, 1(2): 173-184.
- [13] Noble, J. How Red Bull plans to take AI in F1 to the next level. Motorsport. 15 April 2021.