Research on the Application of Artificial Intelligence Sports Goods and the Improvement of Market Competitiveness

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Abstract: Reviewing the literature to analyze the properties of artificial intelligence sports goods and define artificial intelligence sports goods. The application of AI sports goods is analyzed from four aspects: AI sports goods service sports competition, physiological monitoring, education and teaching, and skill feedback. Market and technical research can be used to analyze the problems in the application of AI sports goods and propose strategies to improve the competitiveness of AI applications: establishing a policy guarantee and guidance mechanism for AI sports development; accelerating the process of AI sports goods "intelligence"; adhereing to the "people-friendly" line of AI sports goods development. The strategy is to establish a policy guarantee and guidance mechanism for AI sports goods, and insist on the "pro-people" line of AI sports goods development, and analyze the specific implementation path. Through the research on the application of AI sports goods industry.

1. Introduction

Since its inception, artificial intelligence has been growing with the contradictions of ethics, risk theory and convenience, miracles and crises. 2017's "New Generation Artificial Intelligence Development Plan" promulgated by the State Council and the "Three-Year Action Plan for Promoting the Development of New Generation Artificial Intelligence Industry (2018-2020)" promulgated by the Ministry of Industry and Information Technology provide policy protection for the development of artificial intelligence in China. The "Health China 2030" Planning Outline clearly states that the development of wearable devices and smart health electronics should be promoted, and that AI sports products are the necessary tool to promote the development of a healthy China. In order to win long-term global competition, the United States, Japan, the European Union, and South Korea have also promoted the development of AI as a national or regional strategy.

2. Analysis of the properties of artificial intelligence sports goods

The concept of Artificial Intelligence (AI) was introduced at a seminar held at Dartmouth College in 1956 by American scholars McCarthy and Minsky, and it is now generally accepted that AI is a branch of computer science that focuses on the use of machines to imitate and perform certain thinking activities and intellectual functions of the human brain. According to Nelson, AI is the science of how to represent knowledge and how to acquire and use it. According to Winston, "artificial intelligence is the study of how to make computers do intelligent work that only humans used to be able to do". These statements reflect the following characteristics of artificial intelligence: (1) an intelligent artificial system; (2) the ability to perform human tasks; (3) the ability to simulate certain human behaviors through computers. Artificial intelligence is considered to be one of the three cutting-edge technologies of the 21st century. At present, the field of artificial intelligence is developing rapidly, and the theoretical and practical systems tend to mature. Sporting goods is the collective term for all items used in the process of engaging in sports activities. Wang Xianliang and some scholars classified sports goods into five categories: sports equipment, sports apparel, sports shoes and hats, field equipment and sports protective gear when they studied the common technology of sports goods ^[1]. The current research on artificial intelligence in sports is mostly based on the concept of artificial intelligence^[2], and the overall number of studies is relatively small, with a lack of in-depth analysis of the application of artificial intelligence in sports. Combining the theoretical basis of artificial intelligence and the definition of sporting goods, comprehensive analysis of the existing results, this study considers that artificial intelligence sporting goods are products with a certain degree of automatic recognition function, thinking function, and feedback function by adding intelligent systems on top of traditional sporting goods within the scope of computer science and sport science, or adding sporting functions to other intelligent products to form new supplies for use in the process of sporting activities ^[3].

3. Artificial intelligence sports goods application status

Sport is a cultural activity that uses physical activity as a basic means to promote healthy physical and mental growth. In the pursuit of higher, faster and stronger sports development, human beings have more diversified needs and requirements for their physical and intellectual activities. The speed, strength, posture, and coordination in sports competitions have impacted the physical and intellectual limits of human beings, causing them to transform in competition. In today's world, the increasing materialistic life has solved the problem of human survival, and the need for a higher quality of life and life process has put forth to new requirements for sports. For example, fashionable, comfortable and affordable sports clothing, shoes and hats are favored by people of all ages, and equipment with memory and analysis functions during sports activities make sports and leisure more enjoyable.

The higher level of human demand for sports in terms of competition, physiological health, education and personality development, as well as the rapid development of intelligent technology have led to the emergence of artificial intelligence sports goods. According to people's demand for sports and the current level of AI technology development, we believe that AI sports goods are mainly used in four areas: competition services, sports physiology testing, education and teaching, and competition equipment.

3.1 Application of artificial intelligence sports goods to serve sports competitions

The integration of AI into venue services will bring out the commercial value and make venue operation and management more scientific and efficient. Artificial intelligence can analyze events to achieve a certain degree of accuracy in event prediction. By collecting data related to sports competitions through artificial intelligence devices and analyzing them through computer-specific systems, the accuracy of competition referees, athletes' physical condition, training patterns, and game strategies can be evaluated more efficiently and objectively. The application of artificial intelligence to sports competitions has made a dramatic change in the performance of venue services, event operations, sports media, referee work, technical and tactical analysis, and athletes' competitive status analysis compared to traditional sports competitions. (see Table 1)

Artificial intelligence sports goods	Work Features
category	
	Working Principle: The system consists of multiple high-speed cameras, multiple computers and
Eagle eye tracking	a large screen. The computer calculation separates the three-dimensional space in the playing field
(tennis, volleyball, etc.)	into millimeter measurement units; the high-speed camera captures the basic data of the ball's
	flight trajectory from different angles at the same time; through the computer calculation, the data
	is generated into a three-dimensional image; using instant imaging technology, the large screen
	clearly presents the ball's movement route and landing point.
	Purpose: To help judges overcome the limits and blind spots of human observation and to help
	judges make accurate and fair judgments.
Tactical Analysis	Tracking and positioning analysis that can be used to assist coaches.
Athletic status monitoring	Physiological monitoring, mainly through wearable devices, and integrated analysis of on-court
	data.
	Used to assist coaches.
Sports news editorial	Classified collection and selection, high efficiency and speed, to achieve full automation of news
Competition venue	writing.
management	Integrated application of face recognition and other technologies.

Table 1 Common artificial intelligence sporting goods serving sports competitions

3.2 Application of physiological monitoring function of artificial intelligence sports goods

The application of artificial intelligence for physiological monitoring is mainly based on wearable smart sporting goods. Wearable smart sporting goods are intelligent products that can be worn directly on the body or implanted in clothing and accessories and record various data of the human body. Wearable artificial intelligence sports equipment is mainly used for exercise physiological monitoring, but also derived from social entertainment, fitness guidance advice and other functions. Product types include sports APPs and wearable devices, which make fitness more scientific and make people feel the changes of intelligent technology in the process of sports more relevant to their lives. At present, wearable smart sporting goods can calculate physical energy consumption, sleep status, etc., and can be integrated with a number of human body index changes for health evaluation, to develop a certain fitness plan or exercise prescription.

Wearable AI sports goods can be divided into mass fitness goods and competitive sports goods. Popular fitness products mainly include functions such as measuring step count, step length, pulse rate, step frequency, gait, heart rate, and changing temperature, etc. The types of products are similar and relatively single-function ^[4]. The smart products for competitive sports mainly include smart undershirts, smart helmets, boxing gloves, and smart sports shoes with more complex and powerful systems, which can record the athletes' physical status during the competitive process more comprehensively and analyze the physical data at different exercise times and completion of different technical movements to help develop more scientific and individual training plans or programs for athletes. The training plan or program can be more scientific and more suitable for individual athletes.

3.3 Educational teaching applications of artificial intelligence sports goods

The development of good sports habits is a prerequisite for lifelong physical education, which is a highly conscious personal behavior. The ultimate goal of physical education is to help students develop habits and lifelong physical education habits through interest and skill acquisition in the physical education classroom.

The development of lifelong sports goes through the stages of developing interest in sports, developing sports ability, and developing sports habits, and the lack of feedback can interrupt any part of this process. The application of artificial intelligence in education and teaching is mainly reflected in the use of wearable sports equipment or mobile sports APP to record and give feedback on the usual sports. The application of artificial intelligence in school physical education effectively solves the problem of monitoring exercise habits and helps teachers to evaluate and develop teaching plans. Currently, the use of cell phone sports APP feedback for monitoring and evaluation of extracurricular physical activities has been widely used and has good results.

3.4 Artificial intelligence application of sports equipment

The 2014 Opinions on Accelerating the Development of Sports Industry and Promoting Sports Consumption set the ambitious goal of having a total sports industry of more than 5 trillion yuan by 2025, and the Health China 2030 Plan shows China's determination to develop its sports industry, which provides more possibilities for artificially intelligent sports products to reach the masses. This provides more possibilities for AI sports products to reach the masses. The people's choice of AI sports products is becoming more and more personalized, and competitive smart wearable devices and personalized athletic equipment are also entering the mass sports market. The AI products in existing sports equipment mainly include intelligent badminton rackets, intelligent basketballs, intelligent soccer balls, etc. (see Table 2), which are generally less intelligent and have the functions of monitoring sports time and rhythm, but there is still much room for development. At present, the price of artificial intelligence products of personal sports equipment is generally higher than that of traditional related products, and their intelligent functions are not well recognized by the public.

SportingGoods Category	Intelligent working principle
Smart Badminton Racket	High-speed motion capture technology detects ball speed, allowing players to know exactly what their maximum bat speed is and whether there is room for improvement, helping to correct posture and help improve bat speed, thus catching opponents off guard in a match. With the swing speed monitoring function. It can be used as a "personal trainer" to help people improve their playing skills faster. The main purpose is "by adding a smart chip to the racket handle, using high-speed motion trajectory capture technology and data analysis technology, real-time recording of the trajectory of the playing process, hitting force, speed, so that users can clearly see their own serve curve, to understand whether their hitting force is appropriate, the line is accurate".
Smart Basketball	The smart basketball is equipped with a full range of motion recognition chip, computing module and Bluetooth module, which supports the "core" of the ball. It can get the basketball user's movement data in real time and send it to the special APP on the cell phone via Bluetooth, and at the same time use the unique core algorithm to show the data on the APP page quickly and simply, and give corresponding teaching suggestions through voice broadcast.
Smart Football	The soccer ball embedded with chip and wireless charging module allows soccer fans to connect together through APP to share, compare and even play online. The smart soccer ball enables track tracking, data analysis and online interaction. The smart soccer ball has four individual practice items: penalty, free kick, disc ball, and upside down, and will add passing, corner kick and group practice items in the future to really help soccer fans to train more deeply.

Table 2 Artificial intelligence of common personal sports equipment (except wearables)

4. Strategies to improve the competitiveness of artificial intelligence sporting goods applications

In recent years, the application of sports artificial intelligence in competitive sports and mass fitness has achieved remarkable results, and the development of sports artificial intelligence has become an important force in promoting a strong sports nation. With the fierce competition in science and technology in the world today, it is increasingly urgent to improve the international competitiveness of sports AI technology. The diversified and high-level needs of the people also require sports AI to improve its competitiveness. Improving the competitiveness of sporting goods AI applications includes the international competitiveness of high-tech applications of sporting goods AI, the competitiveness of the market compared with traditional sporting goods, and the competitiveness of intelligent applications among different intelligent sporting goods. At present, there are many problems in the application of artificial intelligence in sporting goods in China, such as imperfect policy protection, unsound management mechanism, narrow field of products, low degree of intelligence, small scope of audience, and low degree of "attentiveness". Establishing a long-term mechanism for the development of intelligent sporting goods, accelerating the process of intelligent product development, and adhering to the basic line of "people-friendly" intelligent products are necessary measures to protect and improve the competitiveness of artificially intelligent sporting goods.

4.1 Establishing a policy guarantee and guidance mechanism for the development of AI sports

Although artificial intelligence has a long history of development worldwide, it is only in recent years that this multidisciplinary field has really developed at a rapid pace, and it has only been a short time since it has had a significant impact on all aspects of society and has gradually gained attention. At the same time, concerns about artificial intelligence have existed since its inception, especially in recent years as intelligence has increased and concerns about technology and ethics, intelligence and threats, and other related topics have grown. The development of a long-term mechanism for the development of intelligent sporting goods and a regulatory system is a fundamental guarantee for the competitiveness of the application of artificial intelligence in sporting goods requires policy planning for the development of artificial intelligence in sporting goods. As a new thing with immature theoretical system, the growth and development of artificial intelligence cannot be achieved without perfect and

reasonable market supervision measures.

The national policy should give sufficient space to the development of AI industry, through the introduction of perfect quality standards, the production and application of AI sports goods management legislation, in the form of law to regulate and risk prevention. Encourage the application of AI sports goods in education, teaching and competition training, and build and put into use advanced intelligent stadiums. Strengthen the construction of new disciplines of artificial intelligence in sports, encourage the cooperation between sports and nature, engineering and technology-related disciplines of industry, academia and research, and set up special research programs for artificial intelligence in relevant scientific research projects.

In addition, the state should strengthen the management of the market, strictly implement the established management standards for AI sports goods, constantly monitor the direction of market development, predict market risks, discover new market needs, dynamically establish market supervision standards and methods, and establish a dynamic management approach to the development of sports AI sports goods in response to market needs.

Moral restraint is the first approach to legal enforcement measures. The improvement of artificial intelligence is a direct manifestation of the improvement of science and technology, and the value orientation of the developers of artificial intelligence sports goods determines the behavior orientation of the products, and the potential harm of artificial intelligence sports goods comes from the moral level of the developers. The relevant departments should strengthen the investigation and research of social and ethical issues arising from AI sports goods, and issue strong legal documents and targeted ethical behavior regulations to regulate the behavior of AI sports goods producers and developers.

4.2 Accelerate the intelligent process of artificial intelligence sporting goods

Since 2018, the development of artificial intelligence has been elevated to a national strategy. At present, the main reason for the low market recognition of AI sports goods is the single type and low degree of product intelligence. To deepen and broaden the degree of intelligence of AI sports goods is an important way to improve the competitiveness of AI sports goods market application.

Sports colleges and research institutions will take the lead in dovetailing with other disciplines related to artificial intelligence and manufacturing enterprises to form national and regional highlevel talent teams for the production and research of artificial intelligence in sports goods as soon as possible, and will be responsible for conducting in-depth research on intelligence and training highlevel talents in sports artificial intelligence. In terms of theory, we will form a sports artificial intelligence theory that integrates sports, nature, engineering and other disciplines, and in terms of personnel training, we will cultivate composite professionals who are knowledgeable, moral and innovative.

From scientific research to product production to market feedback, this cycle is a necessary path for continuous product upgrading and progress. Scientific research institutions, personnel training units, production enterprises, market sectors, and consumer groups should establish good links to open up a virtuous cycle of high intelligence under popular demand.

4.3 Adhere to the pro-people line of intelligent development

The fate of AI sporting goods is directly determined by the recognition of the mass consumer group, and the basic guarantee of its competitiveness is to solve the practical problems and meet the application needs of consumers from the perspective of their needs. Wearable devices represent the first AI sports products to enter the masses with social interaction, entertainment, and fitness guidance on top of physiological monitoring functions, and have become the most widely used AI sports products. In a survey of some users of these products, it was found that they are used less frequently for a variety of reasons. The reason is that AI sports goods are generally expensive, less functional, and less innovative.

Artificial intelligence sports goods to achieve pro-people need to achieve pro-people price, propeople function, pro-people concept. Price can be combined with product cost and market demand to produce high, medium and low price products, forming a stable technical production system to achieve quantitative production, reduce production costs, and reduce labor costs at the production stage by improving the degree of automation and intelligence in the production process. In terms of function, market research should be conducted from the consumers themselves to clarify the strengths and weaknesses of existing products and the expected product functions of consumers, and then combine the research with product design and R&D to make the products more "caring" and have "intimate" service. Function. The concept can be strengthened by strengthening the market orientation, guiding consumer demand, and strengthening the propagation of artificial intelligence knowledge. In addition, each product should be clearly targeted, not greedy for the number of functions, and the product concept should be outstanding.

5. Conclusion

The application of artificial intelligence sports goods is the direct expression and realization way for technology to change life and achieve a strong sports country. At present, artificial intelligence sports goods are used to serve sports competition, physiological monitoring, education teaching, sports equipment improvement, etc. The main problems in the application of existing artificial intelligence sports goods are single product type, low degree of intelligence and low market recognition. With the changing needs of society and the continuous improvement of technology, artificial intelligence sports goods will definitely break through the barriers and enter a new stage of development. High technology means high risk, and the departments involved in the development of AI sports goods should strictly adhere to industry standards and ethical bottom line while completing scientific and technological research, meeting market demand, and leading industry development.

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