




Integrating the Internet of Things and Computer-Aided Technology with the Construction of a Sports Training Evaluation System

Yan Zhang¹ and Jiajia Zhao^{2,*}

¹School of Sports Science and Technology, Wuhan Sports University, Wuhan 430079, China, haimian0804@163.com

²School of Physical Education, Central China Normal University, Wuhan 430000, China, zhaojiajia@mail.ccnu.edu.cn

Corresponding author: Jiajia Zhao, zhaojiajia@mail.ccnu.edu.cn

Abstract. By using the research methods of literature, case analysis, expert interview, and field investigation, this paper analyzes the development background of digitalization of the sports industry in the digital economy era and Connotation, explains its action mechanism from the aspects of resources, elements, industries, enterprises, etc., and take the digital Hangzhou Marathon and Wisdom created by Ali Sports Group as an example Hui venues, World E-sports Games, etc. are taken as cases to analyze the practice scenes of digitalization of sports industry. It is believed that the digitalization of the sports industry lies in numbers. Under the background of economic times, the essence of the development process of integrating digital technology with the sports industry and improving industrial efficiency lies in the number of sports enterprises' operation modes. Word transformation; The digitalization of the sports industry is conducive to optimizing the allocation of sports resources, improving the total factor productivity, promoting the cross-border integration of the sports industry, and giving birth to new industries. And improve the competitiveness of sports enterprises; Ali Sports Group promotes the innovation and development of a sports industry chain based on digital economy thinking, and becomes a model "online+offline" sports business model, providing a reference for sports enterprises to promote digital transformation and development; Improve the top-level policy design and consolidate the figures. Infrastructure, training digital economic talents, building a digital open platform, and cultivating and expanding market players will promote the digital development of the sports industry in the future The only way.

Keywords: Internet of things; Computer; Sports; System

DOI: <https://doi.org/10.14733/cadaps.2023.S2.89-98>

1 INTRODUCTION

Under the background of big data, the traditional news media industry has also begun. Applying the method of data visualization, we began to transform to data news. "Data news" refers to the use of data in news reports to reveal, Better explain or present a news story. In short, "number According to "news" is the news told by data. In many news posts In China, sports news has always been the focus of public attention, whether it's the Olympics or the Olympics. Games, the World Cup, and other major competitions, or national basketball and football, etc League matches. Sports competitions will produce a lot of data, and sports data will be visualized. It is an important tool of "data news" in the sports field. Besides, sports Education data visualization can also help professional analysts to analyze effectively. The competitive state of the players and the team in the game makes it beneficial to the team. Decision making. The data generated in sports competitions can be divided into simple one-dimension. Statistics, as well as the multidimensional combination of statistics and Spatio-temporal attributes. Data, etc. The visualization of sports data not only faces the media field. Yes, including "data news" and live broadcast and playback of matches; There are also. Professional-oriented, providing data analysis function. According to the existing Work, the field of sports data visualization can be summed up as some canon. Methods: From the perspective of time and space of data, according to technical statistics According to the combination of spatial and temporal data, many different methods can be derived. From the perspective of players, it can be divided into single-player visualization and multi-player. Visualization of players, etc. Visual analysis of sports data can also be rough There are several typical methods: an analysis based on statistics, and analysis based on feature detection. The purpose of application in physical education teaching is to make up for some shortcomings in teaching, complement each other and complement each other. For students and even students [1]. Neumann et al. [2] studied virtual reality (VR) technology increasingly used by athletes, coaches, and other sports-related professionals. Lisenchuk et al. [3] made a dynamic analysis of relevant indicators. The recorded data are compared at the beginning and end of the study. Stein et al. [4] proposed a visual analysis system that closely integrates the video recording of team sports with the abstract visualization of the underlying track data, and applies appropriate computer vision technology to extract the track data from the video input. Kaczanowski [5] put forward the concept of a computer decision support system for sports talent identification. The purpose of this study is to systematically review the literature on machine and deep learning using inertial measurement units (IMU) and or computer vision data input for specific motion recognition [6]. A development framework for a decision support system was presented, which is specifically used for high-performance sports [7]. The growth of OTT internet and mobile video streaming services is a significant development in the distribution, transmission, and consumption of media sports in the world [8]. Mencarini et al. [9] selected 57 papers as corpus and analyzed the man-machine interaction of wearable motion systems through grounded theory. In Alhadad's thesis, they studied a new immersive environment for analyzing human exercise performance [10].

2 SPORTS DATA ATTRIBUTE

There are many kinds of sports data available and the data processing steps are shown in Figure 1. Different sports generate different data, such as basketball, football, and tennis, as shown in Figure 2. Due to the differences in the competition venues and forms, each form of sports data is also very different. As a large ball game, although there are differences between basketball and football in specific data forms, is that their overall data have certain similarities, such as the basic statistics of players' matches, the and number of tracks of football or basketball. According to the time and space data of players' movement on the court, etc. In addition, net Ball games such as soccer and ice hockey also have similar data. At present, these Several kinds of sports have become more and more popular in the field of sports data visualization. Research on maturity.

Other ball games, such as table tennis and feathers Although there is less visualization work in other projects, but about the player's position, the trajectory of the ball, and other data are similar to the above movements, Therefore, we can learn from the existing work to carry out the visualization of these projects. Research. Other sports, such as track and field, shooting, gymnastics, weightlifting, Swimming, etc., and the statistics they generate can still be used in conventional. The visualization method realizes the expression. However, according to the differences between these movements Demand, we should design suitable visualization methods to realize professional Visual analysis. Given the lack of professional knowledge and data acquisition. The difficulty, in addition to some professional tools, is the current academic community for these. The visualization of the project is almost blank. Therefore, this paper discusses Sports data mainly referring to the data produced by the first two kinds of ball games.

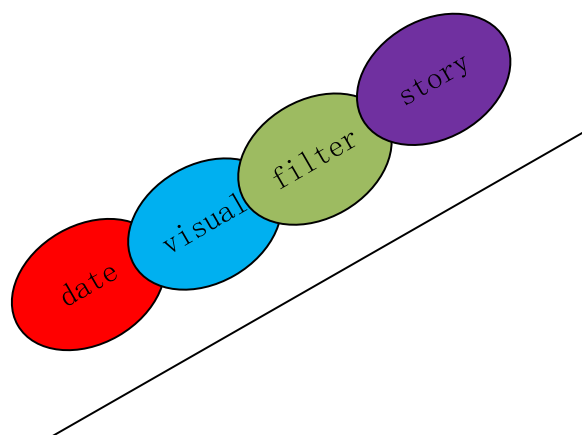


Figure 1: Data processing step.

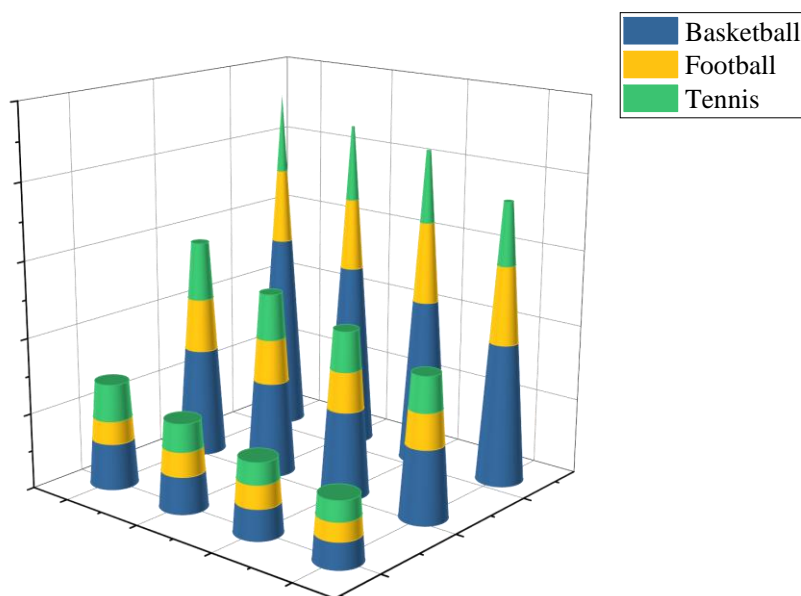


Figure 2: Comparison of different sports data.

3 READING SPORTS: FROM PAPER TO SCREEN

From the Rome Gazette, the earliest official gazette in the world, the modern European newspaper era started with the Gutenberg printing press, and then to the 20th century. Before the popularity of television, the most important medium of news dissemination was words, especially its printed words. Chen Lidan pointed out: "The appearance of characters is the progress of human beings. A sign of entering a civilized society. Words constitute a relatively independent world. World, its function is reflected in the diachronic, even though times have changed, with words the performance of the world can be recorded or reported in history for a long time. Information. As a medium, the spread of words is more explicit. The purpose of communication, so relative to the use of language, should be serious and serious. More. "The rise of movies and radio has not changed the behavior of text reading. The facts of the most important way for students to get news and all kinds of information. 20th century After the 1970s, TV entered thousands of households, and screen media began to be true. Form a challenge to orthographic reading behavior. In the past 20 years, computers, high-speed mutual the rapid development of networking and smartphones have completely changed the traditional pattern, and several Almost all new media are inseparable from the screen, an information display interface, and people Children's reading behavior also shifted from paper to screen. Fifteenth National Congress The results of the national reading survey show that in 2017, China's adult citizens were digitized. Reading methods (online reading, mobile phone reading, e-reader reading) Reading, Pad reading, etc.) was 73.0%, and books, newspapers, and periodicals The reading rates were 59.1%, 37.6%, and 25.3% respectively, as shown in Figure 3. Screen reading has completely surpassed paper reading and become the mainstream of the times.

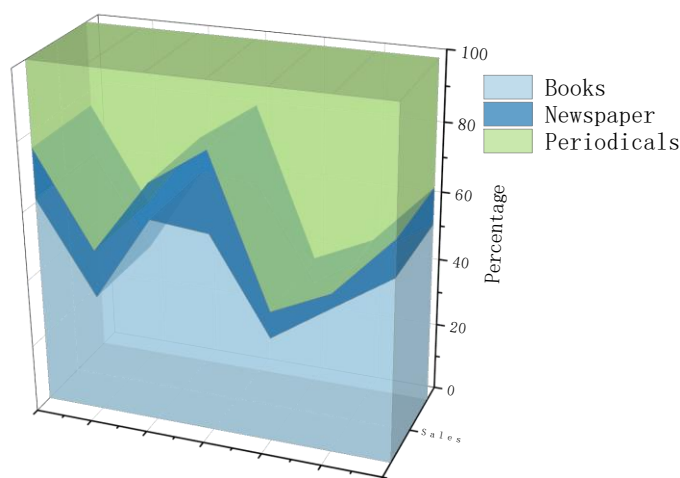


Figure 3: Proportion of different media for watching sports programs.

4 SPORTS MEDIA

4.1 Characteristics of Media Research

Compared with the meso and micro research referred to by empirical research, the media research generally corresponds to the macro of social change, globalization, and commercialization, as shown in Figure 4. The theme, so it belongs to macro research and has an interdisciplinary open vision. Horn. Use Shava Generally speaking, media research can make people go deeper. Understand how the media contributes to cultural and social changes. Cross-disciplinary research methods. It is pointed out that media is an upgraded version of previous media research, because What is presented in the past research is a de-contextualized social reality, and suddenly

Depending on its connection with history, culture, and society, it inevitably leads to technology. Technological determinism and media theory focuses on human nature in the process of social media. To avoid technological determinism from the perspective of media ethics. From the perspective of media archaeology, this paper points out three stages of media wave: Mechanization, electrification, and counting Word (digitalization), and put forward the deep media and diversification. The way of presentation. Hep et al It is believed that deep media is a long-term Process, had to use German sociologist Elias. theory of structural sociology to observe the ever-changing media ring. Environment. Help further systematically explained the concept of deep media, recognizing that This is the development of digital media and deep social infrastructure to a certain extent. After the degree and the society are everywhere connected to the advanced stage of media, and connected are algorithms, data, and digital infrastructure. In in-depth media Times, the main problem faced is not the emergence of a certain medium, but it is the diversity of media, that is, in the current media environment, we are faced with all kinds of Interrelated media. These may be medialization in the new media era. Study the realistic problems that have to be faced. At the same time, Dai Yuchen also pays attention to the actor-network theory and the relevance of media confirms the openness of media theory. Today, the media research is developing in-depth, accompanied by the whole The tortuous development of globalization and the international economic and cultural development is complicated. Pattern, media research also began to lower the "figure", from the macro level. Gradually extend downward. Italian scholar Gianpietro Mazzoleni). It is pointed out that the process of social media is irreversible, the influence of media has penetrated many societies such as politics, economy, and culture. The influence and effect derived from mechanism and media logic are visible. photo Should be, Swedish scholar Miyase Christensen, etc. Put forward the concept of "disintermediation", and think that the contemporary social medialization has something to do with the world The re-embedding of meaning is a tortuous process, in which It is inevitable to disintermediate or even disintermediate. A critical review of the development process of media research in Europe is made, and excessively advocating media logic and simplifying the interaction between media and society. Research tends to reflect. It can be seen that the media research is global. The influence of macro-factors of social economy and culture such as industrialization, commercialization, and urbanization, also reflects the evolution of media technology and people's adaptation to these technological changes. The evolution of many meso and micro factors in the process. Therefore, researchers should not only pay attention to the effects of different forms of media on communication activities. Force, we must jump out of the cognitive paradigm of media as a communication tool. Examine the process of media from a more comprehensive and interdisciplinary perspective, whose specific steps are shown in Figure 5.

4.2 Characteristics of Media Research

Figure 6 shows the process of sports video action recognition. the pattern of media sports in the world reconstruction If the in-depth sports media represented by major sports events Is the product of the advanced stage of globalization, then with the COVID-19 epidemic in 2020 The outbreak of love has begun to have a far-reaching impact on the whole world pattern. English scholar Holne is based on Palkin, a scholar of the Society of Political Affairs. Frank Parkin's three-layer meaning system theory and Hall's Stuart Hall's coding and decoding theory put forward the interpretation of major sports events Including the dominance of believing that you can profit from major sports events. Interpret, doubt the controversial interpretation of major sports events, and, challenge the importance of sports. There are three stages in the antagonistic interpretation of ideological rhetoric of big events. Scholars After completing the first two stages of interpretation of the surface phenomena, you will involuntarily Enter the third stage of confrontational interpretation.

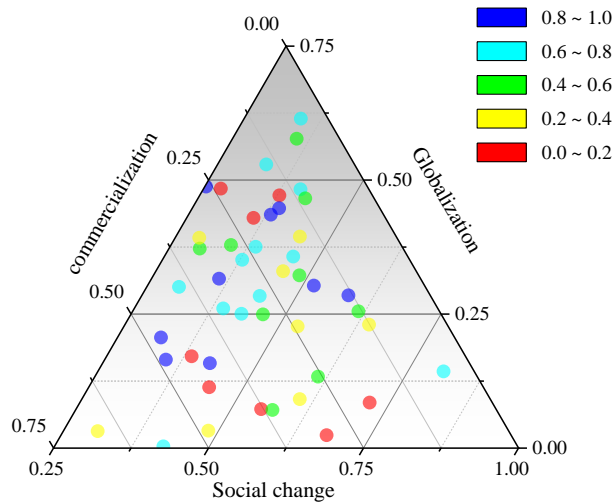


Figure 4: Degree of correlation with different media factors.

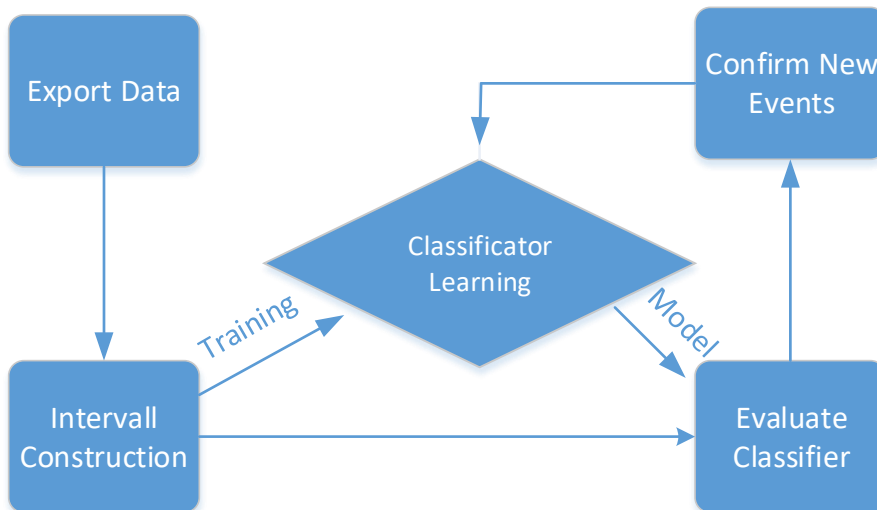


Figure 5: Steps of Media Analysis.

Canadian scholar from the sociological point of view of neo-Durkheimism, this paper puts forward the idea of social development. When major changes take place, media ceremonies and media events may be fierce. Turbulence and conflict, thus stimulating the emergence of a new pattern. On the whole, in the case of major changes, western countries take the lead. The contemporary world sports pattern and the world media sports pattern may also be corresponding. Great changes have taken place. Specifically, in-depth sports media is in COVID-19. After that, the epidemic may be de-globalized, depersonalized and highly digitized. And so on.

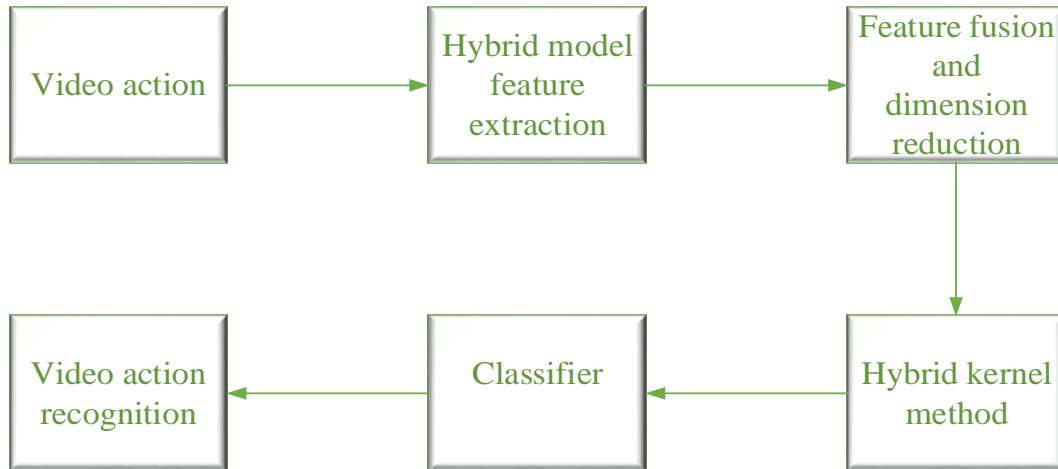


Figure 6: Video action recognition process.

5 SPECIFIC APPLICATIONS OF THE INTERNET IN THE SMART STADIUM INDUSTRY

On August 3, 2019, the first large-scale wisdom article of Ali Sports. The complex officially opened, which is Ali Sports relies on digital media, big data, the Internet of Things, artificial intelligence, and other technologies that are used in all directions in sports venues. Make a breakthrough attempt in the model. Since the establishment of Ali Sports, it is independent and Cultivate and operates the World E-sports Competition (WESG), China University Student Basketball League (CUBA), and China Campus Football League (CUFA) Waiting for famous sports events. During the operation of the event, Ali Sports combined Operation, ticketing interface, market development, audience experience, and logistics support. High-efficiency service needs of users and industries, innovative business models, product Develop the Internet of sports venues industry and take the lead in implementing smart venues. Commercial operating system. Ali Sports will pass Alibaba Cloud Intelligent IoT technology Scattered sports information is integrated into a valuable analysis system, and the system is realized. Intelligent operation of venues and multi-venue linkage management, sports scenes. Digitalization has solved the needs of sports user groups and industry pain points. ① On the big screen of operation command of Ali Sports Center, all venues Data such as flow of people, turnover, number of users, floor efficiency, and number of members can feedback the data information of comprehensive venues more intuitively. ② On the intelligent Internet of Things smart screen of Ali Sports Center, you can check each game. Lighting, electricity consumption, intelligent gates a, and parking lot usage of the pavilion. Such as data display and overall analysis, to ensure that enterprises in the first time. Be able to make adjustments to the venues. Energy consumption and HVAC of the venue's Ventilation system, maintenance, and loss reporting can be implemented through the smart venue operating system. The optimal allocation of resources has greatly optimized the decision-making of stadium managers. The practice has ensured the venue's stability during the competition and under the peak pressure of people flow. 14 Wanfang Data Special Topic Exploration of Volume 45, Issue 7, July 2021 Normal and efficient operation. ③ Use of Ali Sports in Smart Stadium AR technology has designed 32 somatosensory interactive technology games, including big Sports events such as equestrian, baseball, curling, and shooting, which are rarely contacted by many people, are presented to users in the form of "virtual+reality" for sports groups, the development of virtual sports and real sports is shown in Figure 7. Depersonalization is not a new pattern after the COVID-19 epidemic, but with the deepening of new media technology and media integration, it is constantly being raised. The rising "enchanted" landscape. The appearance of depersonalization is

a sports competition. The matter itself was put forward on the grounds of pursuing "fairness" and "justice". But the technology takes It is beyond the original intention of fairness for people to enforce the law or even participate in the competition. Don Shula, a former coach in NFL, suggested that as long as TV viewers It is wrong to be willing to see a penalty, and there is always a camera to support them. Will. This is a metaphor for the pursuit of absolute fairness and justice. Technology can only be an ideal. With the VAR technology in the 2018 Russian Football World Cup All-around application, electronic technology, especially TV broadcast technology, will feed back to sports. The electronic technology of sports events has become commonplace, and it has increasingly become a contemporary sports competition. An indispensable part of the matter. People are used to accepting eagle eyes and door lines. And the "God" trial brought by technology and VAR technology, and even in turn will It is used to judge the performance of referees and linesmen. In past competitions, the "absolute" authority enjoyed by referees has long been replaced by electronic technology, which has almost become an "ultimate" myth of contemporary media sports events. The traditional relationship between referees, athletes, coaches, and sports fans consists of the involvement of electronic technology that has undergone profound changes, personification, and humanism. Socialism is becoming more and more indifferent. At the same time, with the deepening of the media, and sports events the body is also undergoing qualitative changes. Tennis fans clapped rhythmically to wait for the eagle. The result of the eye penalty; The lengthy eagle eye penalty time in volleyball matches may be Let the subsequent serve and attack and defense be affected; Using the base of VAR technology Ben destroyed the linear development of traditional football in time and made the game be Cut pieces for all kinds of emotions and out of control rhythm. Media technology the application of art will make the depersonalization of sports events more and more obvious. Driven by high profits, athletes and coaches are willing to try their best. Law, which makes doping testing and gender testing become countries in the past decades. Important problems that have to be faced in international major sports competitions.

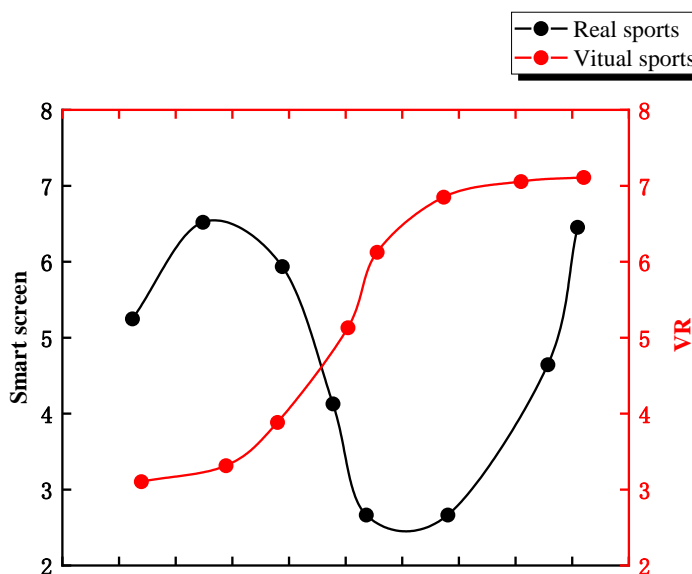


Figure 7: Comparison between virtual sports and real sports.

All Sports is optimized in the application field of smart stadiums. And provide experience for our country to build smart stadiums. Jian created a new model of commercial realization of stadium operation. Ngari Using the huge Internet "gene" accelerator of Sports Alibaba Group Education commercialization development, among which, the smart stadium operation team from precipitation Venue solutions in different vertical scenes, and getting users' thinking guidance. Set

the venue evaluation standard from two angles, and reduce it by digital means. Reduce the operating cost of the sports industry and improve the operating efficiency of venues. a party Face, Ali Sports Center's digital operation mode of smart venues reflected its Advantages of Ali Sports Differentiated Operation. Commercialization of Ali Sports the focus of the exhibition is not on the copyright field of sports events, but on creating itself. The way of IP, bypassing the high copyright cost, takes light assets and re-transport. The business model of Alibaba makes digital technology realize in the whole industry chain of Ali Sports. Full coverage. On the other hand, relying on the huge interconnection of Alibaba Group Network "gene" and ecosystem, and constantly accelerate the digital development of the industry. pander to Alibaba Group's huge Internet resources promote Ali Sports to own the industrial advantages of high barriers and concentrated resources have greatly improved its sports performance. The core competitiveness of the industry. Capital in China's Sports Industry Operation and business model are still in the exploratory stage. Ali sports passed Digital integration of multi-party sports resources, actively developing the stadium industry. The Internet has not only promoted the commercial development of the sports industry but also accelerated the digitalization process of the sports industry has been improved. Figure 8 gives the concept of computer-assisted sports development.

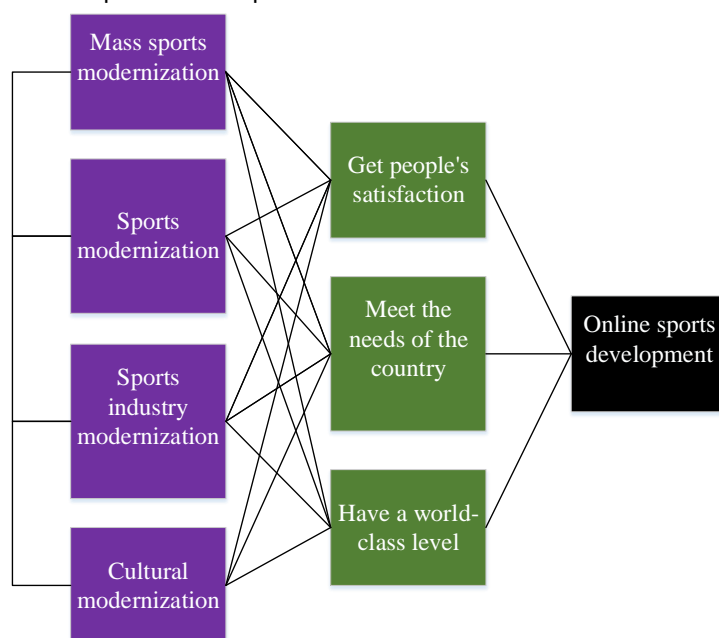


Figure 8: Conceptual model of sports development.

6 CONCLUSION

Entering the era of the digital economy, with the development of science and technology, network, and health. The implementation of China's national strategies in the field sports industry has attracted much attention. Recognizing the position and role of scientific and technological innovation in the development of the sports industry, as the leading force of scientific and technological innovation, digitalization and information technology have developed. Played an important role. Actively develop digital economy and promote sports industry. Digital development has become the only choice to cope with the future development trend. The sudden epidemic situation has caused a great impact on China's sports industry, giving the body The management of educational enterprises brings difficulties, but it will not change the sports industry leader of our country. Looking forward to good fundamentals will accelerate the digital transformation of the sports industry. With the increasing income of urban and rural residents and the sustained sports

consumption in China Synergistic promotion of upgrading, digitalization, and informatization, digitalization of the sports industry. The process will accelerate. Focus on the future, through the development of the digital industry. And suggestions on strategy implementation, consolidating digital infrastructure, and mastering key technologies. Art, cultivate digital economic talents in the field of the sports industry and improve sports production. The service function of industry data sharing platforms can promote the digitalization of sports enterprises. Promoting the digital development of the sports industry with equal paths will help the body continuously. Education of high-quality industrial development, to further meet the broad masses of people for a better The need of sports.

7 ACKNOWLEDGMENT

This work was supported by the Bashu culture research center of Sichuan Normal University, the key research base of Humanities and social sciences of the Ministry of education: Research on the protection of Liangshan Yi intangible cultural heritage and the development strategy of cultural and creative products based on three-dimensional digital technology (No: bszd19-03).

Yan Zhang, <https://orcid.org/0000-0002-9994-1964>

Jiajia Zhao, <https://orcid.org/0000-0003-3019-7986>

REFERENCES

- [1] Xu, K.; Lin, Z.: Exploration of an Intelligent Computer-Aided Physical Education System Based on Web, Computer-Aided Design and Applications, 19(s7), 2022, 90-99. <https://doi.org/10.14733/cadaps.2022.S7.90-99>
- [2] Neumann, D.- L.; Moffitt, R.- L.; Thomas, P.- R.; et al.: A systematic review of the application of interactive virtual reality to sport, Virtual Reality, 22(3), 2018, 183-198. <https://doi.org/10.1007/s10055-017-0320-5>
- [3] Lisenchuk, G.; Zhigadlo, G.; Tyshchenko, V.; et al.: Assess psychomotor, sensory-perceptual functions in team-sport games, Journal of Physical Education and Sport, 19(2), 2019, 1205-1212. <https://doi.org/10.7752/jpes.2019.02175>
- [4] Stein, M.; Janetzko, H.; Lamprecht, A.; et al.: Bring it to the pitch: Combining video and movement data to enhance team sport analysis, IEEE transactions on visualization and computer graphics, 24(1), 2017, 13-22. <https://doi.org/10.1109/TVCG.2017.2745181>
- [5] Kaczanowski, M.: Computer based sport talent identifica Quality in Sport, International Journal of Computer Applications in Technology, 3(4), 2017, 42-56. <https://doi.org/10.1504/ijcat.2019.102108>
- [6] Cust, E.- E.; Sweeting, A.- J.; Ball, K.; et al.: Machine and deep learning for sport-specific movement recognition: A systematic review of model development and performance, Journal of sports sciences, 37(5), 2019, 568-600. <https://doi.org/10.1080/02640414.2018.1521769>
- [7] Schelling, X.; Robertson, S.: A development framework for decision support systems in high-performance sport, International Journal of Computer Science in Sport, 19(1), 2020, 1-23. <https://doi.org/10.2478/ijcss-2020-0001>
- [8] Hutchins, B.; Li, B.; Rowe, D.: Over-the-top sport: live streaming services, changing coverage rights markets and the growth of media sport portals, Media, Culture and Society, 41(7), 2019, 975-994. <https://doi.org/10.1177/0163443719857623>
- [9] Mencarini, E.; Rapp, A.; Tirabeni, L.; et al.: Designing wearable systems for sports: a review of trends and opportunities in human-computer interaction, IEEE Transactions on Human-Machine Systems, 49(4), 2019, 314-325. <https://doi.org/10.1109/THMS.2019.2919702>
- [10] Alhadad, S.- A.; Abood, O.- G.: Application of virtual reality technology in sport skill, International Journal of Academic Management Science Research, 2(12), 2018, 31-40. <https://doi.org/10.1988/IJAMSR..2018.12.31.088>