

Video Sequence Analysis for On-Table Tennis Player Ranking and Analysis

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ABSTRACT

With the rapidly development of the scientific research in the field of sports, big data analytics and information science are used to carry out technical and tactical statistical analyses of competition or training videos. Table tennis is a skill-oriented sport. The technique and tactics in table tennis are the core factors to win the game. With the endlessly emerging innovative playing techniques and tactics, the players have their own competition styles. According to the competition events among athletes, the athletes' competition relationship network is constructed, and the players' rankings are established. The ranking can be used to help table tennis players improve daily training and understand their ability. In this paper, the table tennis players' rankings are established from their competition videos and their prestige scores in the table tennis players' competition relationship network.

KEYWORDS

Competition Relationship Network, Players' Ranking, Video Sequence Analysis

1. INTRODUCTION

With the rapid development of information technology, artificial intelligence (AI) (Dwivedi et al. 2019; Vaishya et al. 2020), Internet of Things (IoT) and cloud computing (Jahantigh et al. 2019; Haji et al. 2020) have been widely used in social development. Relevant scientific research in the field of sports is also developing rapidly (Козина et al. 2017; Matic et al. 2020). The big data analysis has been widely used to carry out technical and tactical statistical analysis for competition videos. As a skill oriented net competition project, the proper skills and tactics are the core of table tennis for the victory. With the development of table tennis sports, various innovative techniques and tactics emerge one after another. Athletes in various countries have their own competition style. Scientific statistical analysis of various techniques and tactics can help athletes win the competition (Bańkosz & Winiarski 2020; Ma 2020).

The study of table tennis techniques and tactics is the main theme of table tennis sports (Wang et al. 2019; Huang et al. 2021). Among them, scientific research scholars mainly use two statistical methods: manual table statistics and computer statistics for technical and tactical analysis. The initial method of technical and tactical statistical analysis is manual table statistics, which is a way for researchers to design index system according to research needs and use tables for statistical analysis with reference to statistical contents. Manual statistics has the advantages, including convenient material acquisition, less investment, large audience and convenient application. However, it also

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has its disadvantages. The statistical speed is slow and the process is cumbersome. The amount of statistical information is huge and needs the cooperation of many people. There are human factors in the statistical results, which is easy to lead to differences in statistical data. The post-processing of statistical data costs lots of time and is difficult to reuse.

Computer statistics (Ceri 2018; Andersson & Kroisandt 2018) is an intelligent processing method for video analysis based on the statistical purpose and statistical demand through machine learning and video analysis. Computer-aided system (Wang & Jiang 2021; Zhang & Liu 2021) has become a development trend of technical and tactical analysis in athletic sports, such as table tennis sports. A well-designed technical and tactical analysis and statistics system can improve statistical efficiency and video utilization, greatly save time, reduce the cost, avoid subjective assumptions, overcome most defects of manual statistics, and provide relevant data for coaches and athletes.

The intelligent technical and tactical statistical analysis of video data combined with machine learning has been widely applied in athletic sports training and competition (Herold et al. 2019; Wenninger et al. 2020). Table tennis statistical index refers to the statistical content designed according to the research purpose to cover the utilization of techniques and tactics of table tennis players in the competition. The difference of statistical needs, statistical means and statistical objects will lead to the difference of statistical objectives. The collection and statistics of table tennis technical and tactical data need experienced researchers or researchers with a deep understanding of table tennis technology and skills. By combining with table tennis technical and tactical analysis theory, the coacher can design statistical indicators to help athletes grasp the correct technical and tactical characteristics.

There are many factors to win table tennis competition. Among them, the control of landing point is an indispensable point of scoring. Between the rounds of each ball, the landing point of the previous ball will have a relevant impact on the threat of the other party's return ball. A good hitting landing point is very important in the table tennis competition.

Statistical index is the embodiment of the concretization of statistical content and the core issue of technical and tactical analysis. It reflects the concept and specific value characteristics of the overall phenomenon. With the help of the analysis of index system, it can effectively reflect the essential characteristics and laws of technical and tactical in the competition to construct statistical index system for table tennis techniques and tactics. The statistical index system should follow the scientific principle, comprehensiveness principle, and measurement principle.

The scientific principle refers to that the design of technical and tactical video statistical indicators should aim at the special characteristics of table tennis, take scientific thought as the guidance, be able to establish a real, accurate, objective and scientific index system, take the statistical purpose and demand as the standard, take the corresponding discrimination standard as the evaluation scale, and take the expert consultation and questionnaire results as the basis with clear content and mutual independence to build a scientific and feasible index system.

The comprehensiveness principle refers to that the statistical index system should fully cover all statistical indicators to make it be comprehensive. According to the different statistical objects and statistical needs, the statistical indicators adopted by researchers are also different. Through consulting the literature, it can be seen that more researchers focus on the statistics of technology and tactics, and adopt the three-stage index or four-stage index evaluation method. The landing point in table tennis competition is not only the key point of scoring, but also a measurable index. Simply analyzing the use of technologies and tactics cannot fully explain the situation of the game.

The measurement principle requires the selected index must be objective and qualitative to avoid the uncertainty of statistical results. The statistical index data is an intuitive embodiment of the situation of athletes in the sports. The index content is the key factor to build a table tennis technical and tactical video statistical system. The meaning of the index needs to be clear. The data should be easy to collect.

The primary indexes are applied to the actual measurement of the sports team, and the index contents are revised according to the modification opinions. Through the questionnaire survey to test

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