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The Application of Artificial Intelligence in Computer-Aided Physical Education and Training

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Abstract. Sports is not only good for physical health; it can also promote the metabolic function of the human body. Every country has carried out different levels of physical education and training. Traditional sports teaching and training often use the mode of transmission and demonstration to teach sports technical movements. However, the demonstration movements are instantaneous, and it is difficult for sports learners to understand the main points, which makes it difficult to stimulate their understanding of the difficult points of sports technical movements. Although computer-aided systems have been promoted in different disciplines, the traditional computer-aided mode only displays the relevant knowledge of sports technical movements to students in the form of images, which can display the technical movements in the form of each frame. Demonstration, which improves students' understanding of physical education teaching and training. However, this also lacks a certain degree of interactivity and rich technical action material. In this study, a computer-aided physical education and training system based on artificial intelligence theory is designed with volleyball physical education and training as the research object. It can use the hybrid CNN-LSTM technology to mine the technical actions of volleyball, such as padding, serving and spiking. The research results found that CNN-LSTM is suitable for mining and matching of technical movements in volleyball sports teaching and training.

Keywords: Physical education and training; Computer aided; Artificial intelligence skills; Assessment and testing.
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1 INTRODUCTION

Physical exercise is a form of exercise that promotes physical health. If people do not participate in physical exercise for a long time, this can easily lead to physical problems [1]. Since ancient times,

people have participated in physical exercise in different forms. Physical exercise is also actively promoted in different countries. Active participation in physical activity not only promotes physical health, it also contributes to people's good mood. Active physical activity also boosts the body's metabolic capacity [2]. In China, different students or different grades have PE classes. Some students also take entrance exams through sports. Active competition in various sporting events in each country also illustrates the importance of sport. It can reflect the comprehensive national strength of a country. For physical education and training, the traditional way of teaching is to teach and demonstrate movements. The teaching method is simply to transmit the physical considerations of sports and the main points of different sports, which will allow students to learn the knowledge points of sports programs. Demonstration is also a quick way to teach sports knowledge [3]. However, the teaching method of sports demonstration movements is an instantaneous process, and it is difficult for students to distinguish the main points of sports events. It is only a process of memorizing sports events. This is an unfavorable way for the teaching and training of sports.

Teaching efforts in other disciplines have found the advantages of computer-aided design methods. When the computer-aided design system participates in the teaching of other subjects, it will display the subject content to students in the form of images or videos, which allows students to understand the knowledge imparted by the subject. The way computer-aided technology is taught also expands the content of learning, which is knowledge that is closely related to the subject. For physical education and training, if the computer-aided system is applied to the demonstration teaching work, it will decompose each action. Students will watch the process of each sports action through pictures or videos. Computer-aided technology can also realize functions such as pausing, slow-playing, and fast-playing of images or videos. The slow-playing state of the computer-aided system will display every action of the physical education content. Each frame of sports is also in high-definition form, which will deepen students' memory and understanding of sports movements. Computer-aided technology can also collect more sports-related technical action images from the Internet, which can enrich the memory and learning content of sports learners. Compared with the traditional physical education teaching and training mode, the computer-assisted physical education teaching and training method is a more intuitive way.

Although the computer-aided system can assist the physical education and training process, whether it is the transmission of physical education or the demonstration of movements, it is limited to the relevant knowledge collected by the teacher. The computer-aided system at the current stage lacks a certain degree of interactivity, which is due to the lack of a little bit of intelligence in the computer-aided system. Artificial intelligence theory has also been practiced in computer-aided systems. Artificial intelligence algorithms can match relevant teaching content from the Internet by mining relevant information in physical education teaching. For example, for volleyball, the artificial intelligence algorithm in computer-aided technology can learn the action characteristics of volleyball, such as padding and spiking. Information is displayed to students or teachers, which is also an intelligent way of physical education and training. This can also be extended to the long jump and other sports like basketball. The application of artificial intelligence theory and computer-aided technology in physical education and training is also a new sports development trend.

2 RELATED STUDIES

Teng and Cai [4] has used a computer-aided system to design an instruction system for the implementation of physical education classrooms, which can overcome the shortcomings of traditional physical education teaching, which lacks relevant instructions. It uses statistical methods and logical analysis to explore a new computer-aided physical education instruction system. The results of the study demonstrate the benefits of such a system for physical education. An [5] has also found that the application of various resources and methods in physical education

has also promoted the progress and development of physical education classrooms, which is also beneficial to students' physical health. It analyzes the use of computer-aided systems for physical education courses, and finds that computer-aided systems can promote the training and education of physical education. Zhang [6] uses computer-aided method to design a volleyball teaching forum program. This system allows uploading volleyball-related graphic information, which can realize the combination of volleyball teaching work in class and after class. The results of the study found that the computer-aided program can fully mobilize the students' initiative. It is also conducive to the rapid development of volleyball teaching work. Sonparote and Mahajan [7] combined the physical structure of the students in the physical education classroom, the single degree of freedom system and the relevant information of physical education to create a computer-aided sports dynamics teaching scheme. This method can enhance students' or teachers' understanding and learning process of sports dynamics. This can improve the relationship between the body and engineering. Cojocaru et al. [8] has also found that the COVID-19 epidemic has caused more difficulties in teaching students in different courses, and physical education courses have also been affected more. It also believes that the introduction of social networks and fitness websites will also promote students' interest in sports. It used a computer-aided system to design a system for video analysis and sports-related imagery, which was also tested in relevant schools in Romania.

This article will solve the problems existing in traditional physical education teaching and training, which are mainly the transmission process and demonstration process of traditional physical education teaching. It will use computer-aided technology to display each sports action in full or slow-play form. It also uses related technologies in the field of artificial intelligence to evaluate different sports characteristics in sports, which can match the sports characteristics of sports with information from other media, which can enrich the content of physical education and training. This study takes volleyball teaching and training as the research object. It studies the reliability of artificial intelligence technology and computer-aided technology in physical education and training through five different aspects. The importance of physical exercise and teaching, and the significance of computer-assisted physical education forms are explained in Part 1. The current state of the computer-assisted physical education approach is described in Section 2. The application process of the self-designed CNN-LSTM technology in the intelligent computer-aided physical education system is investigated in Section 3. Section 4 focuses on the accuracy of artificial intelligence technology in testing the characteristics of sports and teaching, which mainly refers to volleyball. Section 5 describes the reliability of the entire study.

3 SCHEME OF COMPUTER AIDED DESIGN AND INTELLIGENT ALGORITHM IN PHYSICAL EDUCATION AND TRAINING

3.1 Extraction of Complex Relationship Between Physical Education and Training

First, it needs to explain that this study selected volleyball as the research object of the physical education and training process. There are many similarities in the action teaching process of volleyball and other sports [9]. Therefore, this study mainly uses the self-designed CNN-LSTM technology and computer-aided technology to evaluate and demonstrate the relevant characteristics of volleyball teaching. The teaching and training process of volleyball will involve the main action links such as cushioning, serving and spiking. Serving as well as cushioning and spiking are all a coherent process. Therefore, the intelligent way not only needs to map the complex relationship of the movement, it also needs to learn the temporal connection during the volleyball movement. This is because each volleyball action has a time relationship before and after. This section mainly introduces CNN technology to test the complex relationship between volleyball sports teaching and training.

From the above description, it can be found that the action information of volleyball sports teaching and training, such as padding, serving and spiking, all exist in the form of images. It is

difficult for researchers to find commonalities only by observing the form of images [10]. If they only show these sports movements to students and teachers through computer-aided technology, they can only observe more detailed movements and detailed analysis of movements. However, in order to truly understand every process of volleyball sports, it requires more images to support, which requires CNN technology to learn the relationship between the technical characteristics of volleyball sports teaching process, it can use Internet technology Match the relevant volleyball technical characteristics. CNN is an intelligent algorithm with strong data processing ability. It can not only fully mine the connections between data, but also establish complex relationships between complex data. Regardless of the relevant data in any field, CNN can always establish the relationship between the input and output data. It is difficult to show this relationship through specific formulas or other forms. It generally replaces the explicit formula form with the display of the weight value distribution.

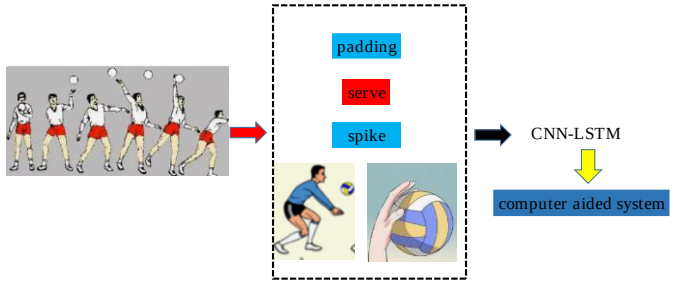

Figure 1: The application process of CNN-LSTM skills in volleyball sports teaching and training.

Figure 1 shows the application process of CNN-LSTM skills in physical education and training with volleyball as an example in detail through the process diagram. For the physical education of volleyball, the data it collects are all volleyball technical images or video information of volleyball. This requires formatting and unifying these images or videos related to physical education. In this study, these data are uniformly processed into the form of mathematical values, and these volleyball kinematic-related values will be input into the CNN in the form of a matrix. In fact, the form of matrix is also an image expression, which is beneficial to the iterative process of CNN technology. When the data is processed uniformly, it needs to be input into the LSTM network to mine the temporal relationship of action technical characteristics. Once the self-designed CNN-LSTM network is trained, it can store the optimal weight distribution in the computer-aided system. In this case it also establishes the relationship between the technical characteristics of volleyball and Internet-related image information. The computer-aided system can learn and test the relevant technical actions according to the technical characteristics of the volleyball displayed. The purpose of computer-aided system in volleyball sports teaching is to calculate technical action characteristics and display relevant sports knowledge.

3.2 Establishment of The Relationship Between Physical Education Teaching and Training Time

This paper mainly studies the feasibility of applying intelligent algorithms in physical education and training through volleyball. The movements involved in volleyball are characterized by coherent and time-related movements. If we do not study the relationship between the technical characteristics of volleyball sports and time, this will lead to the action images of the test set that are independently considered by the computer-aided system. It only maps the relationship between the input technical action features such as padding and serving and images related to

different media such as the Internet. In this case, computer-aided technology and artificial intelligence algorithms may be mapped to a discontinuous volleyball teaching process, which may increase the difficulty for students to understand the technical characteristics of physical education and training. Therefore, the excavation of the technical characteristics of physical education and sports must explore the time relationship.

The long-short-term memory neural network LSTM is used to mine the temporal relationship of volleyball sports teaching and training-related action technical features. The LSTM trick is an improved algorithm for recurrent neural network RNNs. RNN does not have memory, it can only process temporal data. LSTM technology has memory capabilities. The information it memorizes about technical actions is stored in the weights and biases of the LSTM technique. The values and distributions of weights and biases represent the particular relationship of the research object. LSTM technology also has different variants, but LSTM technology has a relatively mature application process, which is more convenient for researchers in physical education and training. However, the LSTM technique requires higher memory and computing power of the computer. In the iterative process, it will read a large amount of data related to physical education, which means that the memory requirements are high.

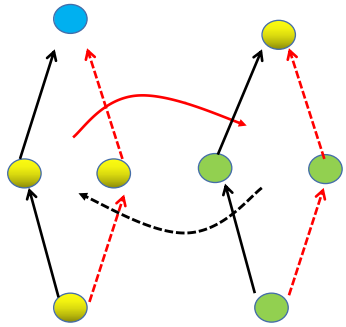

Figure 2: Time relationship mining of technical action information related to teaching and training of volleyball sports.

Figure 2 introduces the workflow of LSTM technology in the mining of technical indicators related to physical education and training. The most important post-section of LSTM is the gate structure. The gate structure can control the inflow and outflow of information features at different times. It determines the historical information that needs to be retained by calculating the distance relationship between data at different times. This information will be combined with new information to form a sequence input to continue the extraction of relevant information. The information about volleyball sports teaching and training technical movements will be input into the LSTM structure in the form of time series. The sorting of these data is based on a time period of cushioning or serving, which can ensure the time characteristics of volleyball technical movements.

3.3 Computer Aided Technology and Processing of Sports Technology Action Information

This research realizes an intelligent volleyball sports teaching and training system by means of computer-aided technology. The computer aided system used in this study is different from the traditional aided system. The traditional computer-aided technology is just a device for displaying or adjusting courseware, which can realize the functions of pause and slow-down of sports technical movements. However, it lacks an intelligent external linking feature. The computer-aided

technology designed in this study can link data with different media. It also stores the weights of the CNN-LSTM distribution at the end of training. It can use the sensor to receive the information of the relevant physical education and training technical movements, and then it can complete the matching work of the relevant teaching and training technical movements according to the weight information.

It can also be seen from Figure 1 that the data collected in this study is complex and cumbersome, and it will include the characteristic data of the technical movements of cushioning, serving and spiking in volleyball sports teaching and training. These data are mixed together, which requires distinguishing the characteristic data of these three technical actions before using intelligent algorithms to test and learn. This study will use the relevant distance method to distinguish and classify the characteristic data of the ball, serve and spiking technical movements. However, there will also be abnormal data in the classified data, which may be the extreme situation of volleyball movements, which requires data supplementation and data abnormality replacement for the characteristic data of the three technical movements. The final step of data processing is to process the characteristic data of physical education and training into a data form that meets the needs of intelligent algorithms.

4 RESULTS AND DISCUSSION SECTION

4.1 Analysis of Movement Error of Volleyball Physical Education and Training Techniques

It will take volleyball as the research object to analyze the effect of artificial intelligence skills and computer-aided methods on physical education and training. This study compares the performance of algorithms with LSTM and with this time. It first takes the global performance index to judge. Figure 3 shows the evaluation effect of volleyball sports-related information tested by a single CNN technique. Generally speaking, the error of 5% for the research object can meet the needs of engineering technology. From the effect shown in Figure 5, it can be seen that the errors of the three technical action indicators of volleyball can meet the needs of teaching and training. For the three technical movements of volleyball, serving and spiking, the error of spiking is relatively high, and this value is as high as 2.934%. However, the error of the spiking technical action did not exceed 3%. The error for volleyball's serve technique is the smallest, it's only 2.325%. This means that the global errors of the three technical actions of volleyball sports are all within 2-3% without considering the temporal LSTM algorithm. This shows that CNN has a certain ability to evaluate volleyball sports teaching and training parameters, but this error can be further reduced.

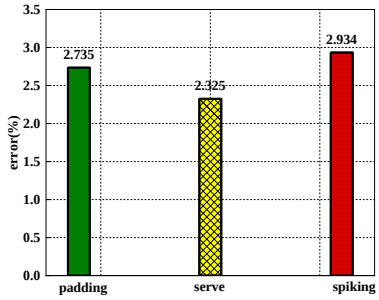

Figure 3: The overall effect of volleyball physical education and training technical movements.

Figure 4 evaluates the performance of individual CNN and hybrid CNN-LSTM techniques in evaluating volleyball sports teaching and training technical movements in the form of multiple sets of error histograms. It can be seen from Figure 4 that the error distributions of the three technical indicators of volleyball technical movements are reduced after the use of LSTM technology, which shows that the relationship between technical movements and time in volleyball sports teaching is relatively large. A part of training that cannot be ignored when it comes to related actions. The error of volleyball's padding technique was reduced from 2.735% to 2.173%. For the three technical movements in volleyball sports teaching and training, this is a relatively large margin of error reduction. This shows that the timing of the padding action is more powerful. The error for the serve action was reduced from 2.325% to 1.872%. The error reduction rate of this part of sports technical actions is also relatively high. The above analysis shows that the CNN-LSTM technology is more suitable for the analysis of technical movements related to volleyball sports teaching and training. It is also helpful for assisting computer-aided systems to find and match more appropriate action images.

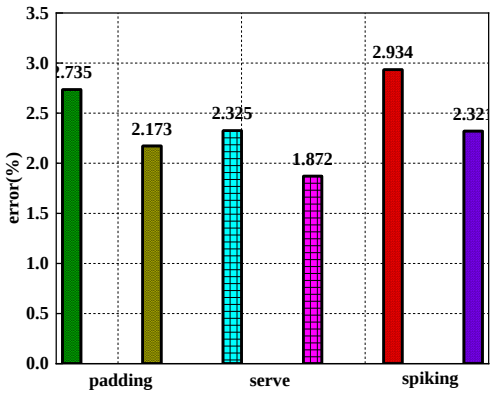

Figure 4: The overall effect of volleyball physical education and training technical movements using a hybrid intelligent algorithm.

4.2 Evaluation Effect of Some Physical Education and Training Action Test Sets

This research will use the hybrid CNN-LSTM technology to analyze the related technical actions in volleyball sports teaching and training. Figure 5 shows the test effect of the ball-cushion action in the form of a test curve. Test effectiveness refers to the ability of an intelligent algorithm in a computer-aided system to evaluate and match relevant technical actions. If the intelligent algorithm in the computer-aided system can more reliably evaluate and match the technical movements of volleyball, it can enrich the image information in physical education teaching and training, which strengthens students and teachers' understanding and understanding of technical movements in physical education teaching. interest. It can be seen from Figure 5 that there are many twists and turns in the technical action of volleyball padding, which shows that the forms of padding action are diverse. There are also many differences in the understanding and learning of different physical education learners for the action of padding. However, the CNN-LSTM technology can perfectly match the fluctuation and value of the volleyball's padding technique. It can not only learn the changing trend of the technical action characteristics of volleyball, but also learn the numerical value of each test set. This test effect can make full use of the computer-aided system to match more knowledge of padding.

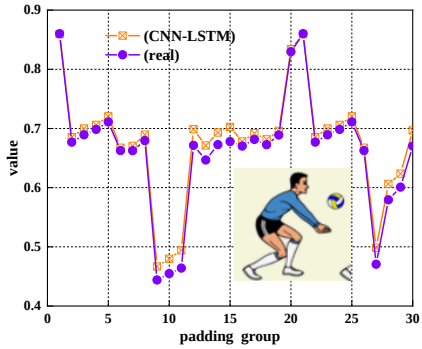

Figure 5: The evaluation curve of the ball-padding technique.

The serving of volleyball physical education and sports is also a key technology, and serving can also be scored directly, which requires students to truly master the technical movements of serving. Serious defense is also required to serve, which involves the technical theory of scoring and defense. Figure 6 shows the effect of the CNN-LSTM technique in evaluating the technical features of volleyball serve in the form of error distribution. From Figure 6, it can be seen that the error of the volleyball serving technique is mainly distributed between 1-2%. The error of some technical movements of the serve is more than 2%, but it is not more than 3%. This shows that the CNN-LSTM hybrid algorithm can fully learn the temporal relationship of the technical action of the serve and the technical links of each frame. This error distribution can also fully explain that the computer-aided system can match the image information related to physical education and sports from different media such as the Internet.

Spike is an important technical action for scoring in volleyball sports, and it is difficult to learn the spiking action, which requires a computer-aided system to match more accurate information about the spiking technical action. Figure 7 shows the performance of the CNN-LSTM technique in testing the spiking technique action in the form of linear correlation. Spike is one of the most difficult technical movements to test in volleyball sports teaching and training. However, it can be seen from Figure 7 that the distribution of spiking technical actions is in line with linear correlation. The correlation value of the spiking technique action has been well distributed in the vicinity of the function. This shows that the actual spiking technical action eigenvalues are quite consistent with the tested technical action eigenvalues. The linear correlation has exceeded the common 0.95. This can prove that the CNN-LSTM intelligent algorithm can be competent to test the spiking technical actions in volleyball sports teaching and training.

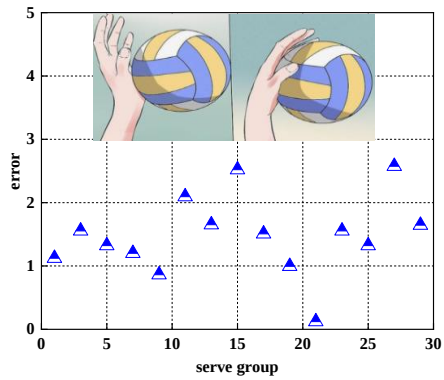

Figure 6: The evaluation curve of the technical action of serving.

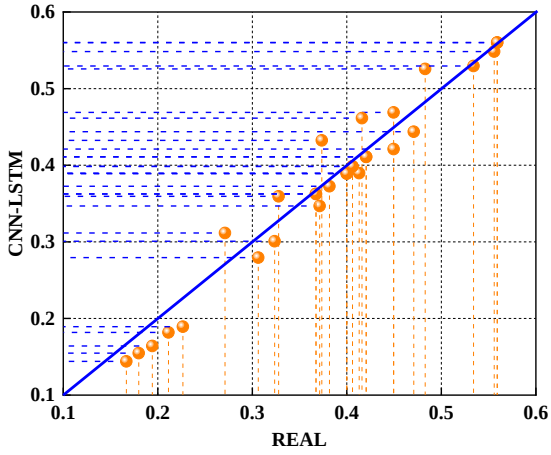

Figure 7: Evaluation curve of spiking technical action.

5 CONCLUSION

Sport is an important activity for national health. Physical education and training are also carried out in many countries. The traditional mode of physical education and training is to use books and demonstration movements. This method has the disadvantage of poor teaching effect, and PE learners may have difficulty understanding the main points. With the application of computer-aided technology in physical education, it also shows the importance of computer systems for physical education and training. This research uses the traditional computer-aided physical education model to realize an intelligent physical education and training technical movement testing and matching system. It uses the hybrid CNN-LSTM technology in the field of artificial intelligence to realize the recognition and matching of the characteristics of the ball, the serve and the spike in the volleyball sports teaching. Students can understand more technical action features according to the image information matched by computer-aided technology. The study found that the hybrid CNN-LSTM technology is more suitable for the evaluation process of physical education and training than the single CNN theory. The error of the ball-cushion technique obtained by the hybrid CNN-LSTM technique is only 2.173%, and the evaluation error of the spiking action is 2.321%. The lowest test error comes from the technical action of the serve, which is only 1.872%.

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