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Application of Artificial Intelligence in College Students' Physical Education and Competition

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Abstract

With the advancement of the new educational curriculum reform, school physical education faces new challenges. Improving the efficiency and quality of school training has become a key research focus. Using the Openpose pose estimation algorithm, this paper obtained skeletal position data and analyzed differential pose features based on skeletal geometry. The proposed pose matching algorithm enabled action pose matching and evaluation of action standard degree, providing scores. By identifying deviations in non-standard movements, it guides students in learning basic physical movements and offers methods for assessing these movements in physical education. Data were analyzed with SPSS using an independent sample T-test. Results showed that the deviation between video heart rate under fluorescent lighting and wristband heart rate in a normal environment was around 3%. Post-exercise heartbeat measured by video differed by approximately 4.3% from the actual heartbeat. Significant differences were found in fostering students' learning motivation (T=-4.158), learning experience (T=-2.502), and learning outcomes (T=-8.617).

Keywords

Physical Education; Artificial Intelligence; Posture Feature; Action Evaluation.

1. Introduction

With rapid scientific and technological advancement, education has gained increasing attention. China's policy of "reviving the country through science and education" has significantly impacted educational reform. Despite this, Chinese youth's fitness has declined for over 20 years, marked by poor endurance, cardiorespiratory fitness, high rates of poor vision, and obesity. "Intelligent sports," combining "artificial intelligence + physical education," promotes integration and resource sharing.

With the data technology era advancing, its integration into various fields, including sports, has enhanced management levels. Xinchao G studied how new Internet technologies impact physical education in universities [1]. Ding Y found that a college physical education curriculum management system brings convenience for teachers to centrally manage students [2]. Bing Z, using Internet+, promoted reform in Chinese school sports, analyzing through literature, logical analysis, and interviews to develop educational strategies [3]. Zhang J explored AI-driven changes in school data management [4], while Li Z investigated improving physical education effectiveness [5]. Yet, AI in physical education faces challenges like limited effective data and various influencing factors.

Information technology has advanced various fields, including sports. Studies show that Internet technologies and management systems improve convenience in college physical education. Reform through Internet+ enhances the combination of school sports and mass fitness. Innovative approaches using artificial intelligence improve physical education's effectiveness but face limitations like insufficient effective information.

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Traditional physical education methods have drawbacks. AI fuzzy algorithms track students' activities, and machine vision assists physical education teachers. AI combined with inverted classroom methods and Hidden Markov Models improves performance.

AI-integrated classes show higher learning effects than conventional ones (F=7.602), indicating that "artificial intelligence + teaching" enhances learners' autonomous learning abilities. This paper constructs a model of artificial intelligence + table tennis technology within Internet + modern informatization, deeply integrating AI into physical education.

2. Artificial Intelligence Physical Education

2.1 Target Tracking Algorithm based on Deep Learning

A new tracking device, based on the real camera shooting scene and the dynamic characteristics of a table tennis ball, achieves higher accuracy [6]. Another method estimates rotation speed and direction using the ball's spatial structure and photographic mode [7]. This leads to a fusion of motion recognition from the front to the end of the human pose, as shown in Figure 1.

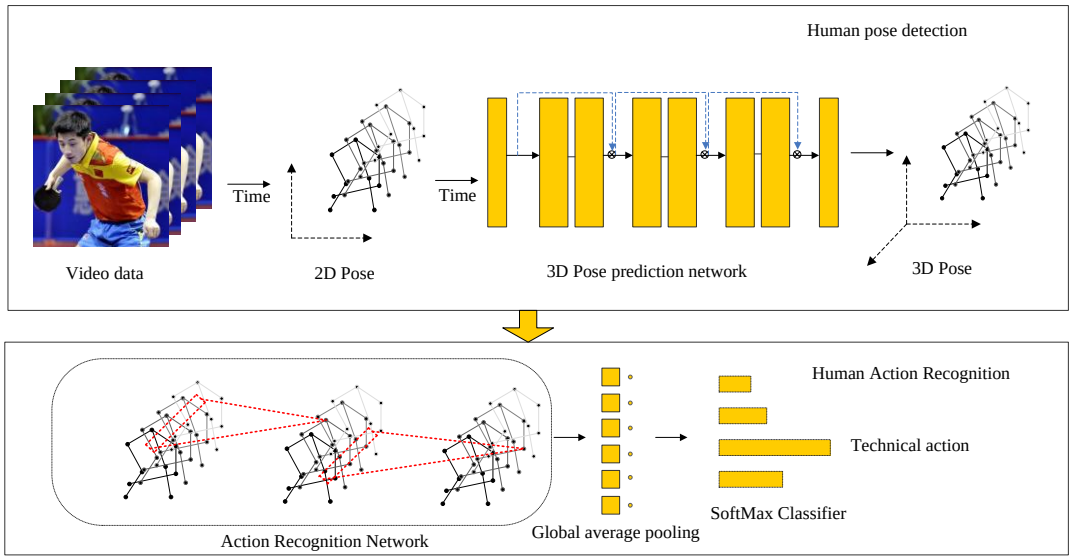

Figure 1. Table tennis technique action recognition method

2.2 Details of the Trajectory Prediction Model

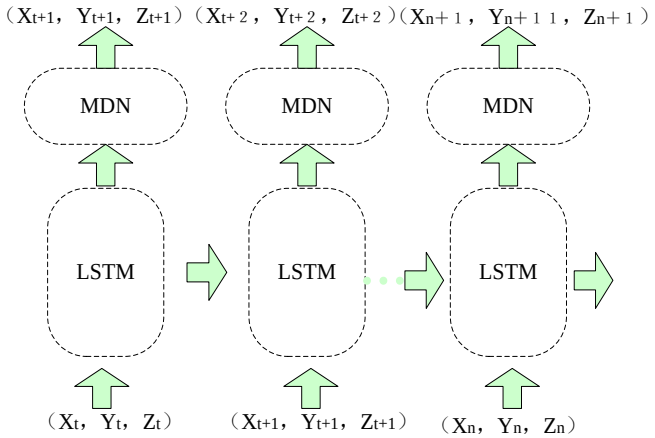

Figure 2. LSTM model structure

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The LSTM (Long Short Term Memory) mode takes a 3D vector, that is, xyz coordinates as input at point t. On this basis, a mixed density network (MDN) is added to the LSTM, and the probability distribution of future modes in the xyz direction is represented by a multidimensional Gaussian distribution. The structure of the trajectory prediction model used in this paper is shown in Figure 2.

From Figure 2, it can be seen that the operating system of MDN is like a fully associative network. It recognizes the halfway condition of LSTM as information and generates various complex Gaussian propagated boundaries [8]. Each Gaussian propagation is handled by 7 boundaries: the means and standard deviations on the i, j, z values, and the connections on the i, j values. For a single Gaussian propagation, when the information state is y, the probability of the resulting velocity x is:

$$\alpha(x \mid y) = \frac{1}{2}\exp(-\frac{1}{2}\begin{bmatrix} x_i - \mu_i \\ x_j - \mu_j \\ x_z - \mu_z \end{bmatrix}^T \begin{bmatrix} \sigma_i^2 & \sigma_i\sigma_j\alpha_{ij} & 0 \\ \sigma_i\sigma_j\alpha_{ij} & \sigma_i^2 & 0 \\ 0 & 0 & \sigma_i^2 \end{bmatrix} \begin{bmatrix} x_i - \mu_i \\ x_j - \mu_j \\ x_z - \mu_z \end{bmatrix} \quad (1)$$

2.3 Skeletal Point Data Acquisition and Standardization Preprocessing

Openpose predicts human skeletal points using a convolutional neural network, outputting their credibility and the affinity field between points, enhancing identification rates [9]. This method splits the network into two iterative architectures: one predicts bone point reliability, the other predicts limbs [10].

3. Experiments of Artificial Intelligence in College Sports Teaching and Competition

In this section, the positioning accuracy under a single view was compared with the orbit prediction model. In view of the complexity of camera installation and large-capacity data transmission under the condition of multi-view, a new method suitable for practical use was presented. Next, the experimental results of orbit prediction were introduced. The test used a computer-generated orbit as a benchmark. Predictions were made using an optimally designed LSTM model, and the model was compared with a Kalman filter. It was found that in the case of a large number of inputs, both of them could track and predict well, while the LSTM algorithm had a higher accuracy rate when the number of input sequences was small.

3.1 Experiment Results of Detection Module

By manually calculating the stored graph, the ping pong ball's position was obtained and aligned with its real position. The tracking algorithm stored predicted target points. Research results shows the predicted and real positions of the ball in the local scene, despite map and background interference.

3.2 Experimental Comparison of Position Estimation under Single Viewpoint

The method extracted the ping-pong ball from the image to obtain the camera extrinsic parameter matrix for a single viewing angle. Errors were compared with triangle localization from two perspectives, improving algorithm accuracy. Six points were experimentally compared, showing estimated coordinate deviations from computer-generated data at a single angle.The experimental results are shown in Table 1.

From Table 1, the average error was 2.9mm, and (X_1, Y_1, X_1) was the coordinate value calculated according to the above-mentioned spatial position estimation algorithm. The error error was defined as the Euclidean distance between the estimated coordinates and the true coordinates. The actual size of the table was 2740 mm*1525 mm, and the resolution of the captured image was 800*600, so if the deviation was less than 2 mm, the difference in the image could not be seen. In this way, computer-generated data using a single viewing angle produced very little error in the real image.

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Table 1. Measurement error of position estimation under single viewpoint in computer-generated data

No.	X_1(mm)	X_1(mm)	X_{gt}(mm)	Y_{gt}(mm)	Z_{gt}(mm)	Error(mm)
1	482.12	458.19	19.25	480	20	2.532
2	1015.35	454.38	22.28	1020	20	3.921
3	725.32	911.69	18.69	750	20	2.523
4	468.96	2285.36	172.36	486	172	3.385
5	1025.32	1826.44	168.92	1030	172	2.658
6	715.36	2285.37	172.28	182	172	2.532

3.3 Training Simulation Test Results

Under normal conditions, 10 seconds of heart rate measurements were taken with normal natural light and compared to video heart rate measurements. Monochromatic fluorescent lights were used to take a 10-second heart rate measurement and compare it to the actual heart rate.

4. Conclusion

Based on further developing games innovation, man-made consciousness innovation is utilized to work on the impact of sports educating, which is a strategy with both monetary and financial importance. This paper utilized Openpose innovation to break down fundamental movement, and utilized it to assess essential movement endlessly pictures, in order to make the web-based fundamental movement showing process more complete. The investigation discovered that based on animating understudies' revenue in sports climate, it can successfully advance understudies' engine capacity; in the showing system, there was no undeniable impact on the way students behave in close proximity. The outcomes showed that there was a huge contrast between the trial bunch and the regular homeroom in developing understudies' cognizance. In order to advance the change of actual training in China, it is important to consistently exhume educational plan assets and understand the modernization of actual schooling. In keen games, the assessment of essential games can successfully conquer the trouble of understudies dominating fundamental games with regards to actual preparation, and advance the education and assessment of essential games.

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