

## *Retraction*

# **Retracted: PE Classroom Teaching Innovation Based on Deep Learning from the Perspective of New Curriculum Standard**

### **Wireless Communications and Mobile Computing**

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

### **References**

- [1] Y. Tang and Q. Zhu, "PE Classroom Teaching Innovation Based on Deep Learning from the Perspective of New Curriculum Standard," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 4114406, 9 pages, 2022.

## Research Article

# PE Classroom Teaching Innovation Based on Deep Learning from the Perspective of New Curriculum Standard

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In recent years, due to the influence of various factors, most of the physical quality of primary and secondary school students in China are in a state of subhealth. According to relevant studies, nearly 70 percent of Chinese students lack daily physical exercise. Physical quality is the primary factor and prerequisite of study and work, so how to improve the physical quality of primary and middle school students has become the top priority of physical education. Based on the requirements and guidance of China's physical education in the new curriculum standard, this paper innovates China's physical education classroom teaching to a certain extent based on deep learning algorithm. The final results show that the students who choose PE class based on deep learning algorithm account for about 85% of the total number of students, which exceeds the students who choose traditional PE class by 70%. Therefore, we believe that the estimation and recognition of students' movement posture in PE class can not only greatly improve students' enthusiasm for physical exercise but also avoid sports injuries caused by inaccurate operation in the process of exercise. Human posture estimation is to detect the position of each part of the human body from the image and calculate its direction and scale information. The advent of the era of big data is based on the relationship between multiple frames of images, while human posture recognition is based on the processing of single-frame static images. Correctly recognizing the pose information of multiple frames of continuous images still makes it possible to realize correct behavior analysis and understanding.

## 1. Introduction

In the education system of primary and middle school students, physical education class has always been a subject of weak attention. Especially for students facing primary school, high school entrance examination, and college entrance examination, PE class is almost always occupied for teaching cultural courses in the year before graduation (Zhiyong, 2022) [1]. In recent years, with the imbalance of educational resources, parents worry that their children will lose the starting line in academic performance, and they increase their academic study. This further leads to the absence of PE in the daily curriculum system (Congmin, 2022) [2]. Combined with the current social background, the development of Internet technology not only has a certain impact on traditional industries but also has a huge

impact on some students. First and foremost, children's fragmented time is occupied by a variety of entertainment software. More and more children do not choose to do some outdoor sports in their spare time and also lose interest in running, mountain climbing, playing basketball, table tennis, badminton, and other outdoor activities (Miao, 2021) [3]. As a result, primary and secondary school students in China are increasingly lack of exercise, and a large number of developing adolescents are in a subhealth state, which is very unfavorable for their development. Considering that the development stage of teenagers is mainly high school, the new curriculum standard of our country seldom pays attention to these problems and puts forward relevant measures. As early as 2017, The Physical Education and Health Curriculum Standard for Ordinary Senior High Schools in China (2017 Edition) proposed "Health First" as the guiding

ideology of senior high school physical education curriculum. Meanwhile, innovation was carried out for physical education classes to cultivate students' interest and love for sports (Ding, 2021) [4]. The following scholars, Yu Fuli and Dang Linxiu, respectively, compared China's curriculum standards with those of six other countries, including the United States, the United Kingdom, Australia, New Zealand, South Korea, and Canada, from the aspects of curriculum nature, curriculum development framework, curriculum basic concepts, and curriculum ideas. Some suggestions are put forward, such as attaching importance to the mastery of basic sports skills, paying attention to students' feedback on classroom teaching, and cultivating students' complete sports spirit. Therefore, teaching innovation in PE classroom is imminent (He, 2020) [5].

Considering that senior high school is the key stage for teenagers' development and sports skill learning, centering on the guidance of sports and health curriculum standards "Health First" and "sports spirit cultivation," we finally decided to focus on the innovative cultivation of "sports health" and "sports interest" in China's physical education classroom teaching system. Based on the one-to-many teaching method in China, a PE teacher often leads dozens of students in a class to do warm-up and other sports exercises, which cannot take into account the operation of the whole class. Some students may practice nonstandard or wrong movements. In the long run, the wrong action will cause certain damage to the body [6]. At the same time, there is no complete outline of physical education in China, and only some warm-up exercises or self-study is carried out in physical education. As a result, more and more students no longer have expectations for physical education. Therefore, how to implement the new curriculum is one of the main themes to meet the above two aspects. With the development of computer science, deep learning algorithms are gradually applied to all walks of life. With its good learning function and transparent visualization function, it has been favored by all walks of life (Zhihui, 2021) [7]. Deep learning algorithm is a machine learning method to solve complex problems through massive data. Usually, with the support of massive data, the potential of deep learning method is fully released and brought into play. When the amount of data is relatively small, ordinary machine learning methods can meet the application requirements of data modeling and prediction. In this paper, we can accurately fit students' movements through deep learning algorithm, to judge the accuracy of students' movements, avoid physical injury caused by nonstandard movements, and improve students' interest at the same time.

## 2. Related Work

Since the standard degree of movement posture plays a decisive role in the process of sports, the standard of movement posture has always been attached importance to by sports-related personnel. However, because the traditional correction of standard posture is only through pictures or oral guidance, although people pay more and more attention to sports in recent years and begin to pay attention to certain

harm caused by nonstandard sports, there is still no written system for quantitative research on standards. Teenagers are in a critical period of development, and the substandard sports in PE class may affect their development. Therefore, we need to adopt effective methods to assist in correcting the sports standards in PE class (Laibing and Lee, 2020) [8].

By comparing the trajectory of the human body's ongoing motion with the standard picture or video, we can evaluate the standard degree of the human body's ongoing motion, which is also the theoretical basis of human motion posture estimation based on deep learning. In the early stage, human motion posture estimation and recognition still need to rely on external equipment, such as balance instrument and position sensor. These instruments are used to record the movement tracks of human limbs, such as legs, head, hands, and other key parts, so as to calculate the movement tracks of the whole human body (Yuan and Huiping, 2021) [9]. With the development of deep learning, the research field of human motion posture has gradually appeared different development directions. Based on the high recognition and processing capability of deep learning for image heads, human motion pose estimation and recognition can start to get rid of external auxiliary devices and perceive human movements only through cameras (Zhipeng, 2021) [10]. There is no denying that it is a milestone leap from the auxiliary stage of external devices to the stage of motion posture recognition only by camera, but the accuracy of the current human motion posture evaluation system on the market needs to be further discussed. Based on the investigation of some existing body recognition devices on the market, such as kinect devices, we found that most of the current body catchers are evolved from VR games (Yi and Jie, 2020) [11]. Its initial purpose is to enable players to have a better experience in VR games. Therefore, these devices cannot be widely promoted among ordinary sports fans and have the disadvantages of high price. At the same time, they also have the problems of unqualified evaluation standards for sports with higher requirements for accurate identification (Yu and Zhihong, 2022) [12]. On the other hand, there are studies on the transformation of human motion posture assessment system suitable for sports based on kinect equipment in the academic circle, and some achievements have been made, but because the studies in the academic circle are in the experimental stage, there is still a certain distance from the real use stage. Therefore, based on this background, we hope to develop a set of human motion posture estimation and recognition system based on the new curriculum standard that can be widely promoted and well applied to physical education in primary and secondary schools through deep learning algorithm (Wenli et al., 2021) [13].

With the advent of the era of big data, deep learning has been successfully applied in the field of computer vision. Therefore, considering how to use deep learning to solve the problem of human posture estimation is another focus that scholars in the field of human posture estimation should explore after the graph structure model. The early methods of estimating human posture using deep learning are to directly regress the coordinates of joint points in the input

image through deep learning network. The estimation of human motion posture based on deep learning algorithm mainly goes through three stages. The main distinguishing feature of different stages lies in the positioning of key points of human body parts in the process of human posture estimation. For example, the early theory of human motion pose estimation believed that different parts of the human body as key points had different results for human motion pose recognition models. Therefore, researchers designed a large number of different joint pose models during this period. For example, Yuan Yupeng et al. proposed to use heuristic local search technology to locate key points of human joint pose model, so as to construct image model (Mengxiao and Huahe, 2020) [14]. This method ensures the correct location of the node to the maximum extent, but this model needs a lot of calculation and has certain feasibility for the local optimal solution, but there is no optimal solution in the global model. Based on this problem, Wang Jinshou et al. proposed the partition of human model, which uses different geometry to replace human body to identify key points. Human motion pose estimation and detection are carried out through confidence of different aggregates (Yuanbao, 2020) [15].

### 3. Method

At present, there are still three problems to be solved in the concrete implementation of the method of comparing actual actions with videos or pictures. The first is the recognition of movement accuracy. Because sports have higher requirements for precision in specific movement exercise, it may not play a role in exercise when the exercise intensity is low, while it may cause certain damage to the body when the exercise intensity is too high. The algorithm recognition only depends on vision, so the recognition of two actions with similar time and space is extremely dependent on the accuracy of recognition [16, 17]. Second, different sports training scenes may contain different training actions, but in different systems, the same action may have different meanings. The human posture estimation method based on deep learning mainly uses convolutional neural network (CNN) to extract human posture features from images. Compared with traditional methods of manually designing features, CNN can not only obtain features with richer semantic information but also obtain multiscale and multi-type human joint feature vectors and all contexts of each feature under different receptive fields, to get rid of the dependence on the structural design of component models. Then, coordinate regression is carried out on these eigenvectors to reflect the current attitude, to apply the attitude information to specific practice. Therefore, how to accurately judge the accuracy of the action requires the algorithm to train up and down the scene to output the conclusion. The third is the objective condition limitation of real training action recognition. When we capture the real action visually and input it into the algorithm library, the real light conditions and visual angle patency will change the way of action perception and algorithm recognition. Therefore, the text is mainly based on the above three questions, taking primary

and middle school students' badminton posture as an example to carry out teaching innovation in physical education class. The main research ideas of this paper are shown in Figure 1.

As can be seen from Figure 1, the research idea of this paper is mainly to record the specific badminton actions of students in class by external cameras and import them into the system. The system will place the standard action records we stored in advance, and then, the system will compare different sports scenes and standard actions according to the algorithm we set in advance. The final output results include the standard degree of students' actions, nonstandard action description, and standard action demonstration. Different from the traditional method of explicitly designing feature extractors and local detectors, it is easier to construct CNN for deep learning. At the same time, CNN models that deal with sequence problems, such as recurrent neural network RNN, can be designed to obtain the change law of human posture by analyzing continuous multiframe images, so as to establish a more accurate topology between various joint points in human posture. The most important one is the confirmation of the comparison algorithm, which requires high accuracy of the action and repeated comparison. However, deep learning is just suitable for complex computing and autonomous learning scenarios. Therefore, based on this background, this paper improves the traditional deep learning algorithm to make it suitable for the use of physical education classroom teaching from the perspective of the new curriculum standard.

This paper is mainly based on YOLO Nano, a traditional target detection algorithm based on deep learning. The algorithm is a strategy algorithm achieved through human-machine collaborative design. The algorithm is mainly composed of basic convolution unit, PEP (Project Expansion Project module), EP (Expansion Project module), and FAC (Fully Connected Attention) module. Through the series and parallel relationship between different modules, the input picture or video information can be finally position standard and output. Its advantage is that it can monitor multiple targets at the same time, and the monitoring sizes can be selected from  $52 * 52$ ,  $26 * 26$ , and  $13 * 13$  three sizes. Therefore, the number of training channels alone is 3549, and the specific expression is shown in

$$\text{Nums}_{\text{channel}} = 13 * 13 + 26 * 26 + 52 * 52. \quad (1)$$

At the same time, there are usually three prior boxes of different sizes in the hidden layer of the depth algorithm based on the YOLO Nano model, so the number of training boxes in the whole training process of the deep learning algorithm is 10647. The specific expression is shown in

$$\text{Nums}_{\text{box}} = \text{Nums}_{\text{channel}} * \text{Nums}_{\text{anchor}} = 10647. \quad (2)$$

The output result of the algorithm is 1 expected confidence and 80 actual class confidence, so according to the calculation logic that one training box can generate 4

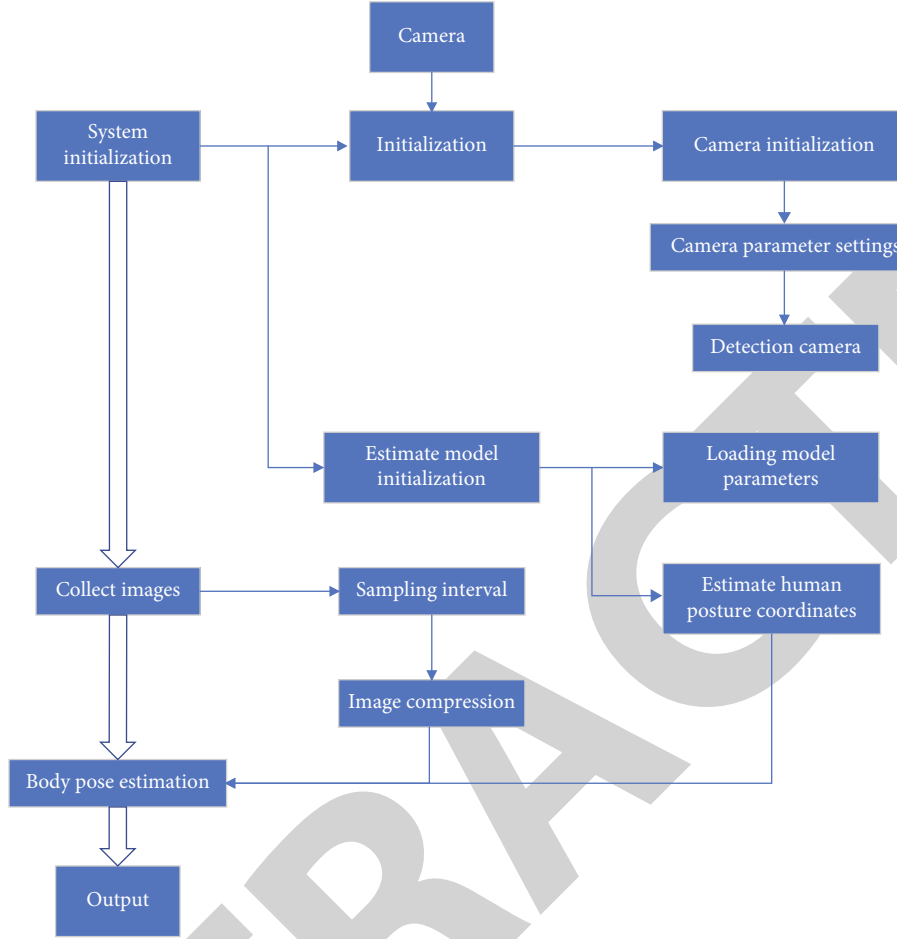


FIGURE 1: Human motion pose estimation and recognition based on deep learning algorithm.

offsets, the number of parameters of YOLO Nano algorithm is 904995, and the specific expression is shown in

$$\text{Nums}_{\text{parm}} = \text{Nums}_{\text{channel}} * \text{Nums}_{\text{anchor}} * [4 + 1 + 80] = 904995. \quad (3)$$

The above is the normal model recognition process of the algorithm. After the training process of the above multiple training boxes, the accuracy of the output position comparison information can be guaranteed to the maximum extent. However, when the algorithm is directly applied in the movement recognition process of PE class, we find that the innovation of PE class teaching based on the perspective of the new curriculum standard in this paper mainly hopes to correct the standard degree of students' movements, and the main body of position comparison is the human body. However, as YOLO Nano is an original multitarget monitoring model, it makes a comprehensive comparison of input information. Therefore, although a large number of training boxes ensure the accuracy of location information comparison, because they detect a large number of irrelevant objects at the same time, it also causes a serious low efficiency of computer calculation. Therefore, we hope to transform the model

without affecting the recognition accuracy of human position information, exclude the monitoring resources occupied by other objects in the monitoring process, and only retain the Person class in the category name. The specific process is shown in

$$\text{IOU} = \frac{\text{area}(\text{Intersection})}{\text{area}(\text{Union})}. \quad (4)$$

At this point, we can conclude that the number of parameters only used to monitor human body is 63882, and the specific expression is shown in

$$\text{Nums}_{\text{parm(per)}} = \text{Nums}_{\text{channel}} * \text{Nums}_{\text{anchor}} * [4 + 1 + 1] = 63882. \quad (5)$$

After adjustment, changes in calculation efficiency and monitoring accuracy and other parameters are shown in Figure 2.

From Figure 2, we can see the change of computational efficiency after regional control on YOLO Nano algorithm level. Overall, the computational efficiency gradually increases with the increase of iterations. We preliminarily speculated that when the number of iterations is too low,

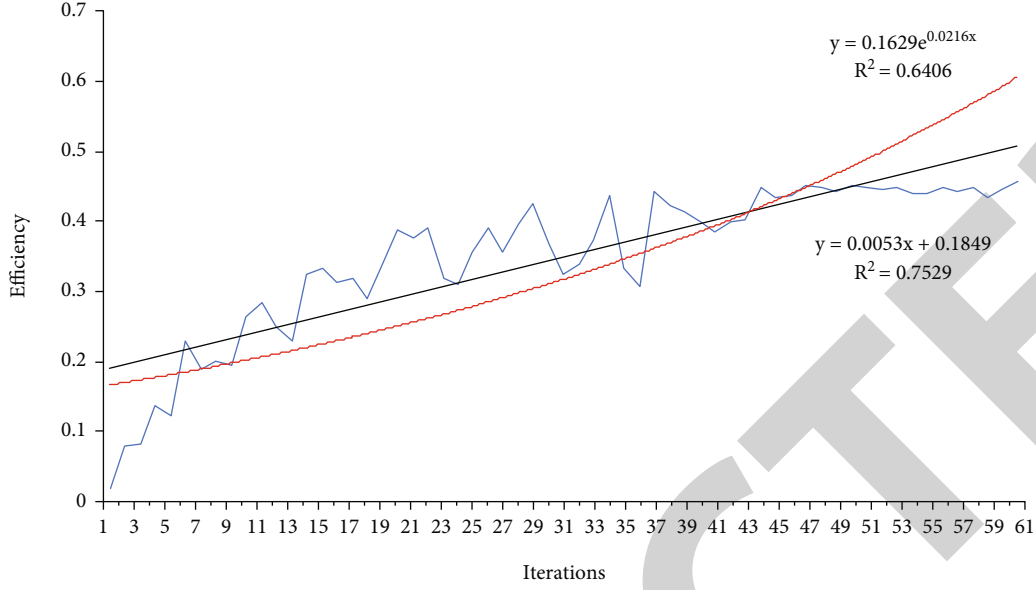


FIGURE 2: The calculation efficiency of different iterations before and after optimization is improved.

the computation space before optimization is enough to connect human body region with other regions for calculation. Therefore, the computer operation mode and process are the same before and after optimization, so the computational efficiency is less than 10%. But when training high number of iterations, from more than 10 times before optimization model cannot support the computer at the same time for human action position than in position compared with other object, and the optimized model with only for compare the human body motion, calculation of space is still abound, so on the position of the human body than remain high computational efficiency. Different from the traditional method of explicitly designing feature extractors and local detectors, it is easier to construct CNN for deep learning. At the same time, CNN models that deal with sequence problems, such as recurrent neural network RNN, can be designed to obtain the change law of human posture by analyzing continuous multiframe images, so as to establish a more accurate topology between various joint points in human posture. In contrast, monocular cameras are more common in daily life. Although the color images collected by monocular cameras are easily affected by environmental factors such as illumination, neural networks can be used to extract convolution features that are more accurate and robust than artificial features to predict more complex posture. Therefore, human posture estimation methods based on deep learning have been deeply studied. Therefore, the computational efficiency after optimization is significantly higher than that before optimization.

After the framework of the model algorithm is determined, we need to further optimize the accuracy of the model based on deep learning algorithm. Although the original algorithm model has a high level of accuracy, the accuracy level of only about 50% does not meet the requirements of PE classroom teaching from the perspective of the new curriculum standard. And our initial goal is to automatically

identify students' nonstandard movements and avoid the damage caused by students' movements in blind practice due to the lack of teachers' energy. Here, we first collect human movement data for prediction. According to the four training offset parameters initially determined by the algorithm, the position coordinate value is predicted, and the specific expressions are shown in

$$\hat{b}_x = \sigma(\hat{t}_x) + C_x, \quad (6)$$

$$\hat{b}_y = \sigma(\hat{t}_y) + C_y, \quad (7)$$

$$\hat{b}_w = p_w e^{\hat{t}_y}, \quad (8)$$

$$\hat{b}_h = p_h e^{\hat{t}_h}. \quad (9)$$

Here,  $T_x$  and  $T_y$ , respectively, represent the coordinate value of the upper-left offset parameter in the reference grid region;  $T_w$  and  $T_h$  represent the width and height of the grid region, respectively.  $B_x$  and  $B_y$  are the center coordinates of the grid reference area;  $B_w$  and  $B_h$  represent the aspect ratio of the reference area.  $P_w$  and  $P_h$  represent the length and width of the prior frame. Considering the nonconvergent nature of this set, sigmoid function is selected for the activation function of the hidden layer, and the specific expression is shown in

$$\sigma(x) = \frac{1}{1 + e^x}. \quad (10)$$

In order to verify the difference between the predicted value and the real value, we define a new function value—human detection loss function. This paper constructed the body monitoring model mainly through optimization algorithm for the outer edge of the range of human body recognition, optimization of the human body action degree of

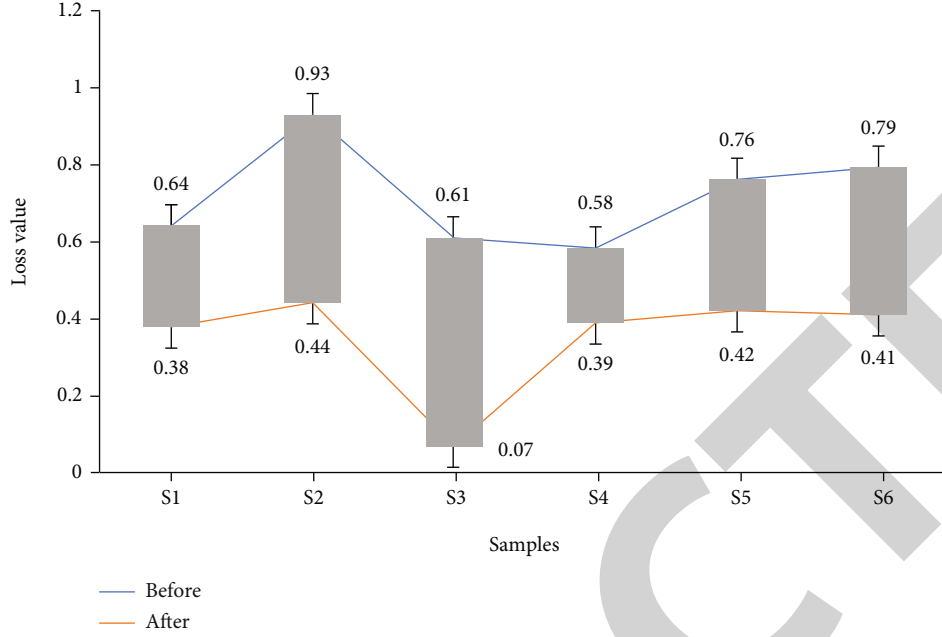


FIGURE 3: Variation of total function loss of different types before and after optimization.

confidence and the motion type category of confidence level optimization, and the three kinds of optimization, respectively, corresponding to three different kinds of loss function, namely,  $(y_i - (mx_i + b))$  loss function, the cross entropy function, and the confidence level loss function. The corresponding expressions are shown in

$$e_{coord} = \lambda_{coord} \sum_{i=0}^{S^2} \sum_{j=0}^B \lambda_{ij}^{per} \left[ (t_{xi} - \hat{t}_{xi})^2 + (t_{yi} - \hat{t}_{yi})^2 + (t_{wi} - \hat{t}_{wi})^2 + (t_{hi} - \hat{t}_{hi})^2 \right], \quad (11)$$

$$e_{conf} = \sum_{i=0}^{S^2} \sum_{j=0}^B \lambda_{ij}^{per} [C_i \log \hat{C}_i + (I - C) \log \hat{C}_i] + \lambda_{noper} \sum_{i=0}^{S^2} \sum_{j=0}^B \lambda_{ij}^{per} [C_i \log \hat{C}_i + (I - C) \log \hat{C}_i], \quad (12)$$

$$e_{class} = \sum_{i=0}^{S^2} \lambda_i^{per} [p_i \log \hat{p}_i + (I - p_i) \log \hat{p}_i]. \quad (13)$$

By adding the three human detection loss functions, we can obtain the final total value of the total loss function, which is expressed in

$$E = e_{coord} + e_{conf} + e_{class}. \quad (14)$$

The change of function loss value of the model before and after optimization is shown in Figure 3.

From Figure 3, we can obviously see that the loss value of the optimized function is smaller. The essence of the function loss value is the transverse coefficient of the difference

between the predicted value and the actual value. Therefore, the smaller the function value is, the more sufficient evidence that our predicted value is closer to the real value. The loss value of the optimized function is smaller, which also indicates that the predicted value is closer to the real value after the optimization of the model. In contrast, monocular cameras are more common in daily life. Although the color images collected by monocular cameras are easily affected by environmental factors such as illumination, neural networks can be used to extract convolution features that are more accurate and robust than artificial features to predict more complex posture. Therefore, human posture estimation methods based on deep learning have been deeply studied. Therefore, it can be preliminarily proved that our motion recognition accuracy is improved. In addition, the difference between the predicted value and the real value of different sample data sets is also different. At present, we believe that this is a normal phenomenon, and it is preliminarily believed to be caused by the influence of some irrelevant variables that cannot be excluded, as well as the influence of different training iterations mentioned above.

However, the above is only our preliminary judgment, and we need further data support to draw specific conclusions on accuracy. Therefore, we carried out weighted average on the loss points of different functions and finally obtained a performance index of the balance model, whose specific expression is shown in

$$AP_{det} = \frac{\sum_i^n R_i \max(P_i)}{n}. \quad (15)$$

In order to obtain more accurate conclusions, we carried out experimental verification on multiple indicators including the equilibrium model defined performance indicators under the condition of different number of prior frames,

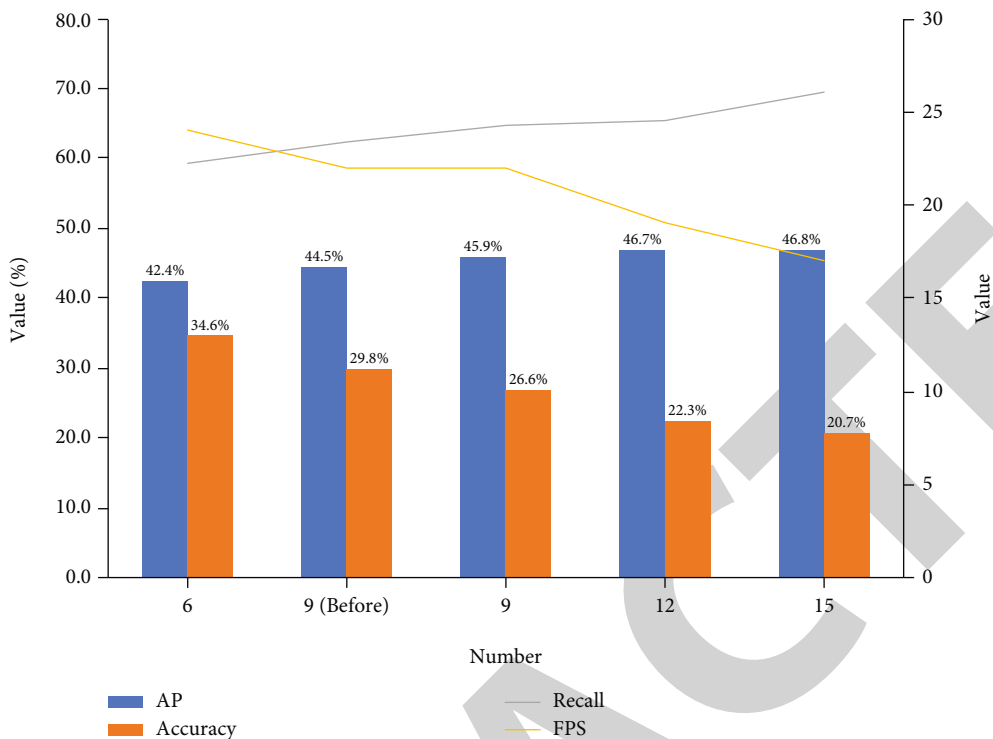


FIGURE 4: Performance of human detection models with different prior frames.



FIGURE 5: Innovative display of PE classroom teaching under the new curriculum standard.

and the results are shown in Figure 4. The results show that the proposed algorithm model has better performance and stability in balance index, accuracy, recall rate, and FPS value. The accuracy was 13% higher than the previous algorithm.

#### 4. Result Analysis and Discussion

Having identified one of the core parts of the system’s algorithm, the next part is the core part of the actual usage. We hope that in practical use, the device can first record and scan students’ movements, then compare the results with standard data, and finally, mark the movement direction and nonstandard positions in the output results, to realize innovative research on PE classroom teaching based on deep

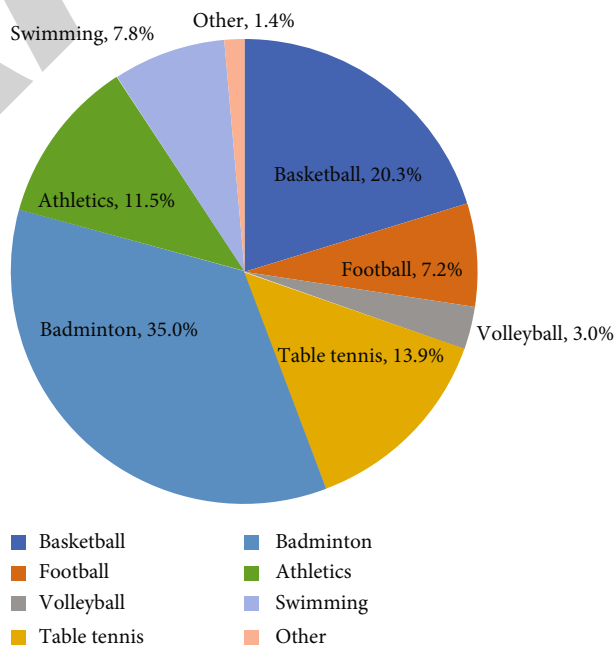


FIGURE 6: Survey results of middle school students’ favorite sports.

learning from the perspective of the new curriculum standard. The specific scenario is shown in Figure 5.

As can be seen from Figure 5, when students practice badminton, the system will automatically record their movement track and compare it with standard movements and highlight the key points. At the same time, when the action is wrong or nonstandard, the system will also mark and



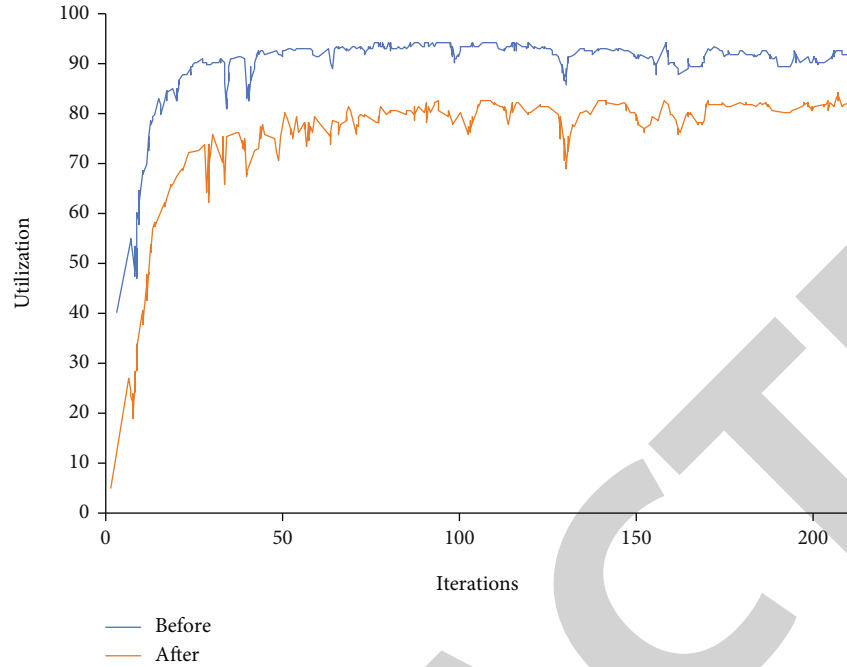


FIGURE 7: Cost utilization changes before and after algorithm optimization.

show the correct action. Through this system, we hope to be able to better adapt to the one-to-many teaching scene of PE classroom teachers through this method in the current educational background and avoid the training problems caused by the lack of teachers' energy. At the same time, it can improve students' interest and enthusiasm for sports class and participate in outdoor activities as much as possible, rather than being immersed in the Internet, which is also what our new curriculum standard expects for sports class teaching. So, we for students for follow-up feedback of the system have carried on the detailed investigation and research, the students generally feedback in this paper, and the proposed learning algorithm based on depth innovation of sports course improvement methods for physical training is helpful; at present, the algorithm only through badminton movement test, test before and after the students for the popularity of badminton has gone up 19%, number one. Under the circumstance of traditional badminton sports classroom teaching and innovative badminton teaching, nearly 85% students choose the innovative method proposed in this paper. The results are shown in Figure 6.

At last, considering the previous academic researches on visual motion capture in physical education class, although some achievements have been made, the reason why it has not been widely applied is mainly due to the cost limitation. Therefore, in order to further promote the innovative application of PE classroom teaching based on deep learning proposed in this paper from the perspective of new curriculum standard, we need to control the cost. As with traditional visual motion recognition applications, the cost of this paper mainly lies in the objective external hardware, such as capture camera and display, as well as some hardware and software support, such as computing system, computational memory, and chip. In order to ensure the quality of the cam-

era, there is a critical value of the cost of external hardware, so if we want to further reduce the cost, we can only reduce the cost of hardware and software through a variety of amplification. To solve this problem, this paper proposes to reduce the amount of the algorithm based on the traditional YOLO Nano, so as to reduce the computing load of the computer. When the computing load of the computer is reduced, the requirements of the computer on the processor, chip, and so on can be reduced, thus reducing the cost. Experiments show that the cost of the optimized visual motion capture algorithm in this paper is reduced by about 7% compared with previous algorithms. The results are shown in Figure 7. According to Figure 7, it can be found that the visual motion capture system proposed by predecessors can reduce at least 90% of the original cost, while the overall cost is reduced by 7% after model optimization based on deep learning algorithm in this paper, which can reach at least 80% of the original cost. Therefore, the algorithm proposed in this paper has more potential for the promotion of PE classroom teaching innovation from the perspective of new curriculum standard.

## 5. Conclusion

To sum up, based on the background of the general decline in physical fitness of teenagers and the current situation of physical education classes for primary and secondary school students, this paper takes innovative measures to improve the lack of fun and standard physical education classes. In summary, human posture estimation algorithms can be mainly divided into two categories: human posture estimation based on traditional methods and human posture estimation calculation methods based on deep learning. Human posture estimation based on traditional methods is

generally realized through the nonlinear mapping of the image to be processed to the location of parts or joints. In order to prevent the physical injury of the developing teenagers caused by the nonstandard sports movements in PE class, we combined with the deep learning algorithm, sorted out the data set of sports videos or photos, and compared them with the specific movements of real students to ensure the standard of the movements of students in PE class. Compared with the existing algorithms, this algorithm has higher precision in action recognition. At the same time, compared with the traditional academic field algorithm, the cost of the algorithm is nearly 7% lower than the existing equipment, which is expected to achieve large-scale promotion, breaking the boundary between traditional academic achievements and practice. At the same time, the data show that after using the algorithm, the standard degree of movement in the PE class of students has been improved by 13%, and the enthusiasm of PE learning has been improved by 19%. Both matching models with theoretical advantages and deep learning networks that improve the accuracy of human posture estimation are promoting the rapid development of the field of human posture estimation.

### Data Availability

The figures used to support the findings of this study are included in the article.

### Conflicts of Interest

The authors declare that they have no conflicts of interest.

### Acknowledgments

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### References

- [1] Z. Zhiyong, "Practice and exploration of deep learning in primary school physical education," *Tianjin Education*, vol. 13, pp. 47-48, 2022.
- [2] J. Congmin, "The goal and method of hierarchical teaching of primary physical education based on the perspective of deep learning," *Track and field*, vol. 3, pp. 69-71, 2022.
- [3] Y. Miao, "Research on teaching design and practice of flipped classroom of college sports basketball option course based on deep learning," *Yunnan normal university*, vol. 9, pp. 116-119, 2021.
- [4] X. Y. Ding, "Sport video classification method based on depth study," *Journal of electronic design engineering*, vol. 3, pp. 162-166, 2021.
- [5] H. Yanying, "Research on multi-level teaching strategy of primary physical education classroom based on the perspective of deep learning," *Education*, vol. 44, pp. 43-44, 2020.
- [6] W. Luying and Z. Weiqiang, "Sports deep learning conceptual framework construction," *Journal of chengdu sports college*, vol. 2, pp. 117-122, 2022.
- [7] W. Zhihui, "Research on the development of students' core literacy in physical education and health subject under the theory of deep learning," *Youth Sports*, vol. 3, pp. 95-96, 2021.
- [8] L. Laibing and B. Lee, "Artificial intelligence technology in the field of international sports clustering and evolution," *Journal of shandong sports institute*, vol. 3, pp. 21-32, 2020.
- [9] L. Yuan and Z. Huiping, "Research on online and offline mixed physical education teaching mode in "internet +" era," *Martial arts research*, vol. 11, pp. 143-146, 2021.
- [10] L. Zhipeng, "Deep convolutional neural network for error movement detection in physical education teaching training," *Journal of Sanming University*, vol. 3, pp. 8-14, 2021.
- [11] Y. Yi and R. Jie, "70 years of physical education curriculum reform in primary and secondary schools in China – also on the influence of artificial intelligence on physical education," *Sports science*, vol. 6, pp. 32-37, 2020.
- [12] F. Yu and X. Zhihong, "Human behavior recognition algorithm based on the depth of the residual network study," *Computer measurement and control*, vol. 3, pp. 251-258, 2022.
- [13] S. Wenli, L. Zhipeng, J. Xiangzhi, and Z. Ji, "Research on the curriculum setting of physical education major in colleges and universities adapting to the "new curriculum standard"," *Youth Sports*, vol. 12, pp. 90-92, 2021.
- [14] X. Mengxiao and Y. Huahe, "Curriculum under the background of the middle school sports development present situation and trend of," *Journal of Education*, vol. 23, pp. 6-8, 2020.
- [15] G. Yuanbao, "Analysis of personalized physical education teaching based on the concept of "new curriculum standard"," *The contemporary sports science and technology*, vol. 11, pp. 133-135, 2020.
- [16] Z. K. Hou, H. L. Cheng, S. W. Sun, J. Chen, D. Q. Qi, and Z. B. Liu, "Crack propagation and hydraulic fracturing in different lithologies," *Applied Geophysics*, vol. 16, no. 2, pp. 243-251, 2019.
- [17] J. Han, H. Cheng, Y. Shi, L. Wang, Y. Song, and W. Zhnag, "Connectivity analysis and application of fracture cave carbonate reservoir in Tazhong," *Science Technology and Engineering*, vol. 16, no. 5, pp. 147-152, 2016.