Research Article

Evaluation of Physical Education Teaching Quality Based on the Random Multivariate Matrix Convolution Neural Network Model

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With the non-stop merchandising and improvement of bodily training instructing reform, the institution of a couple of getting to
know the assessment and evaluation mannequin of bodily training different educating impact can stimulate the enthusiasm and
activity in sports activities and learning, which is useful to domesticate students’ cognizance of lifelong bodily exercise. In the
educating process, through the integration technique of varied instructing methods, this paper explores the issues present in the
method of bodily training reform, places ahead a diverse bodily training instructing impact assessment mannequin that meets the
wants of customized intelligence education and construction, and makes use of the technique of empirical evaluation to affirm the
comparison model. In order to reflect the effect of physical training effectively and accurately, a convolution neural neigh-
bourhood model based totally completely on the random multivariate matrix is proposed to reflect on consideration on the
excellent of bodily education. The overall performance of the prediction accuracy assessment mannequin is evaluated via the
simulation test and in contrast with the standard approach model. The experimental information is that the average assessment
accuracy of the single convolution neural community mannequin is 82.15%, whilst the common comparison accuracy of the
convolution neural community mannequin based totally on the random multivariate matrix is 97.58%, and the prediction
accuracy is increased by means of 15.43%. The common prediction error of the single convolution neural community mannequin
is 0.97, and the common error is 0.91, the common error is decreased by using 0.05. It shows that the random multivariate matrix
convolution neural neighbourhood model can efficaciously realize the evaluation of instructing quality.

1. Introduction

In physical education, teachers play a leading role. The
teaching methods, contents, means, and results are deter-
mined by teachers. Students’ learning motivation, learning
methods, and learning effect will be affected by teachers’
teaching. However, with the deepening and advancement of
the new curriculum guidance outline in physical education
teaching, physical education teachers not only play a leading
role, but also a guiding role in the teaching process, so as to
give full play to students’ creativity, strengthen the guidance
of students’ learning methods and practice methods, and
improve the students’ ability of self-study and self-practice
[1]. Therefore, the teaching quality of physical education
teachers directly affects the teaching quality and determines
the students’ physical quality and self-training ability in the
future. The evaluation of physical education teachers’
teaching quality has become a main aspect of evaluating
teaching quality and the students’ learning ability. The
evaluation of teaching quality plays an important role in
improving teaching quality [2]. Teachers are guided to
deeply study educational and teaching theories, constantly
update educational concepts, and improve the teachers’ own
professional ability and the teaching level [3]. It is addi-
tionally conducive to the tremendous supervision of edu-
cating fine by using the instructing administration
department, extra scientific, institutionalized, and stan-
dardized administration of instructing work, and subse-
quently promote the typical enchantment of educating
quality.

Artificial genius technological know-how represented
with the aid of neural community is a new challenge in the
subject of facts science and technology. It is a record pro-
cessing gadget based totally on imitating the shape and
feature of the human brain [4]. With its very own features of simulating human thinking, nonlinear transformation, and self-learning, the neural community utterly overcomes the defects of the above standard techniques and will become a fine way of instructing first-class evaluation. However, this technique has some problems, such as gradual convergence speed, convenience to fall into neighbourhood minimal, and massive prediction error of the complicated system [5]. With its fundamental traits of nonlinear mapping, studying classification, and real-time optimization, the neural community suggests amazing benefits in sample attention and classification, awareness filtering, automated manipulate, and prediction. The emergence of the neural community gives a new way for educating high-quality evaluation. Through non-stop mastering and training, the neural community can discover its regularity from a giant quantity of complex information of unknown patterns [6]. In particular, it can deal with any kind of data, totally method any complicated nonlinear relationship, mannequin the nonlinear process, successfully remedy the nonlinear complete contrast trouble, and decrease the effect of human elements on decision-making results, which is unmatched through many normal methods. Therefore, the introduction of neural community principle into the instructing first-class assessment device no longer solely solves the issues of qualitative and quantitative indications in the complete contrast index system and overcomes the issues of setting up complicated mathematical fashions and mathematical analytical expressions in the regular contrast process; however, it additionally avoids the direct effect of human elements on the assessment results, making the comparison extra correct and effective [7]. The educating first-class contrast mannequin mounted by using the usage of neural community theory is a superb technique for instructing pleasant evaluation.

In this paper, the convolution neural community principle is used to set up the comparison mannequin of bodily schooling instructing quality. Firstly, a scientific and lifelike contrast index machine is formulated, and then the dimension of the comparison index is decreased by the usage of the multivariate random matrix. Then, the neural community assessment mannequin of bodily schooling instructing fantastic is determined. The experimental records exhibit that the prediction accuracy is multiplied by 15.43% and the common error is decreased by 0.05. It is proved that the neural community is totally viable for educating high-quality assessment and meets the accuracy requirements.

The chapters and contents of the paper are organized as follows: Section 1 is the introduction, which introduces the history and magnitude of this research. Section 2 introduces the primary principle of the convolutional neural network. In Section 3, the convolution neural community mannequin based totally on the random multivariate matrix is constructed, and the topology of the mannequin and the will-power of the wide variety of nodes in every layer are mentioned in detail. At the equal time, the education float chart and education consequences of the community mannequin are given. Section 4 compares the convolution neural community mannequin based totally on the random multivariate matrix with the typical mannequin to illustrate the blessings of this model. Section 5 summarizes the work accomplished in this paper and factors out the in-addition lookup content.

2. Related Work

Neural community principle is a record science that learns from the human brain. Convolutional neural community is one of many sorts of neural networks. It is a multilayer feedforward network. Convolutional neural community can entirely approximate any complicated nonlinear relationship, and it can mannequin the nonlinear procedure except appreciation of the motives of data. Convolutional neural community is a fee mannequin of the evaluated object received through coaching in accordance with the present knowledge, which can correctly clear up the hassle of nonlinear complete comparison and limit the effect of human elements on decision-making results. The applicable lookup on the contrast of education by means of the usage of the neural community is summarized as follows.

Many researchers have adopted the neural community approach in the assessment of educating satisfactory comparison model. The software of the neural community in the area of prediction can be traced lower back to the laptop environment [8]. By writing applications to simulate the neural network, analyze the information pattern and predict nonlinear data. Some pupils practice the convolution neural community algorithm to instruct first-rate evaluation, use the convolution neural community approach to set up the mannequin of the university educating satisfactory comparison system, quantify the notion of the educating assessment index into decided information as its input, and instruct impact as its output [9]. Using MATLAB to elevate out empirical research, the software of this technique in instructing first-class contrast can overcome the subjectivity of specialist evaluation, the end result is fairly correct, and the applicability of this approach is good [10]. Liang utilized the multiplied convolution neural community algorithm to the lookup of a school room instructing the first-rate assessment model, and the contrast impact has been improved. However, the gradient descent algorithm used in the convolutional neural community has sluggish mastering velocity and excessive dependence on preliminary weight and threshold, so it is convenient to fall into neighbourhood optimization [11].

Some pupils use the genetic algorithm optimized neural community to learn about the comparison of water quality, soil quality, air exceptional, and different fields; however, it is not often utilized to the area of educating high-quality evaluation [12]. This paper optimizes the convolution neural community blended with the genetic algorithm to optimize the contrast mannequin of training and educating the best in a university, which absolutely overcomes the above defects. It is an extra high-quality technique of instructing exceptional evaluation, and the decision of the neural community mastering algorithm has an awesome effect on the contrast consequences of educating quality [13]. Because the commonplace algorithm itself has some defects, the training pace
of the algorithm is very slow, which makes teaching hard to master. In the manner of neighborhood training, it is undemanding to fall into close by minima, and it is difficult to spoil out from close by minima, and there is neighborhood paralysis [14]. Therefore, if the trendy algorithm is used for community training, it is handy to motive the convergence pace to be pretty sluggish or even nonconvergent.

To sum up, the blessings of the above technique are that a number of assessment elements are utterly viewed, and professional journey and information are reflected. The deficiency is that there is randomness and subjectivity in the contrast process, which fails to take into account the non-linear relationship between every contrast index and the educating effect, so that the assessment outcomes have notable subjectivity, ensuing in the failure to surely mirror the scenario of instructing quality [15]. Due to the effective nonlinear processing capability of the convolutional neural network, it is more reasonable to use the neural community to consider the educating quality. However, there are nevertheless some defects in the procedure of the use of the neural community to consider instructing quality. For example, the concern of comparison is generally single, and the particular symptoms of assessment are highly general, ensuing in the distortion of the remaining end result of evaluation. At the equal time, special neural community algorithms are utilized in the decision of assessment methods.

3. Convolution Neural Network Model Based on the Random Multivariate Matrix

3.1. Convolutional Neural Network. Convolutional neural community is mostly composed of enter layer, hidden layer, and output layer. The hidden layer is composed of repeated and an alternating multi-level convolution layer and a pooling layer. The shape of the convolution neural community is proven in Figure 1. Input the preliminary facts except function extraction to the enter layer, and method the enter statistics through convolution kernel convolution in the convolution layer to gain the corresponding convolution function map [16]. Obtain the corresponding pooling attribute map with the aid of capacity of pooling the attribute map obtained by way of processing the convolution layer via the pooling layer. Repeat the operation in the hidden layer, following the convolution layer and the pooling layer. By putting the convolution and pooling of the network, we can efficaciously extract the aspects of incorrect motion data, enhance the tolerance of distortion invariant characteristic pictures in the system of incorrect motion detection in bodily schooling educating and training, and enhance the photo resolution, so as to attain a massive quantity of characteristic data and ultimately output the closing detection effects through the full-connection layer.

Take the x, y, and z information of the acceleration sensors that have finished the preprocessing as the enter data. In order to make sure that the dimension of the enter and output is consistent, the statistics wishes should be stuffed in. During the convolution operation, the transformation of the identical convolution kernel does no longer have an effect on its weight, and the weight is shared in the x-axis data. Through this feature, the parameters of the convolutional neural community can be efficaciously decreased and the coaching pace of the community can be accelerated. All convolution kernels in the convolution neural community have the feature of computerized characteristic extraction. The convolution processing is accelerated by using the convolution check, and various important points of bodily schooling educating and coaching pictures can be extracted via every convolution kernel.

Through the pooling layer, the dimension of records and corresponding education parameters can be decreased to the biggest extent and the pace of community education can be accelerated. In order to forestall over becoming due to the small measurement of the facts set used in the convolution neural community process, the regularization approach is frequently brought into the full-connection layer [17]. The randomness of this strategy will make the neighbourhood structure corresponding to the records set transmitted each and every time inconsistent, and then again, all neighbourhood weights are shared, which can drastically beautify the steadiness of the error action detection model of bodily education teaching and training, making neurons adapt to each and every one-of-a-kind is a lot much less complex. The convolution layer of the convolution neural community applies the weight sharing method, reduces the parameters and situation of its structure, prevents the neural community from becoming in the early stage, and makes it have a higher generalization ability [18]. Through pooling, the steadiness of the neural community is guaranteed, a range of traits of the community preserve the translation, scaling, and distortion unchanged in the match of transformation. Convolutional neural community has robust expression impact and expansibility, and can be properly utilized to all types of troubles with excessive difficulty.

3.2. Construction of the Cognitive Model of Family Education Decision-Making. The enchantment of the detection accuracy of bodily coaching relies upon on the depth of the neural network. There is a high-quality correlation between the elements and the illustration ability, the convolution neural community will calculate the facets of all incorrect motion data [19, 20]. The deeper the remaining output, the more improved the characteristic extraction ability [21]. In the technique of deepening the neighbourhood depth, the phenomenon of gradient disappearance is handy to occur, ensuing in the decline of neighbourhood performance. In order to remedy this problem, we can extract the delicate facets of bodily training instructing and the education pattern facts quicker and better, add the normalization layer and the residual block in batch between the convolution layer and the pooling layer, pace up the community coaching speed, alter the records transmission strategy, and promote the similarly optimization of community performance [22]. Batch normalization algorithm is utilized in the batch normalization layer, which integrates the processing
operation of the community layer to enter into the incorrect motion detection of bodily training educating and training and approaches the incorrect motion samples of bodily training educating and education via micro batch normalization [23].

When optimizing the neighborhood parameters, the back-propagation algorithm is used to acquire the Jacobian matrix corresponding to the batch normalization of the enter vector and the everyday teaching sample value. WV_he batch normalization processing of the enter vector of all layers has a giant quantity of computation and takes a lengthy time to gain the covariance matrix. In this regard, the following two simplified enchantment strategies are proposed:

(1) The impartial batch normalization processing is used to substitute the joint normalization processing of every dimension data, and the formulation is as follows:

\[ X^{(k)} = \frac{x_i^{(k)} - E(x^{(k)})}{\sigma - \mu^2} + \frac{\text{var}(x^{(k)})}{\lambda} \]  

Among them, the \( \lambda^{(k)} \) is equal to variable \( X^{(k)} \), they are all variance, which more often may not refer to the \( k \)th dimension of the enter pattern after scale transformation; \( \beta^{(k)} \) is equal to \( E(x^{(k)}) \), they are the expectations of the input, usually referring to the \( k \)th dimension of the enter pattern after translation transformation [26]. Using this parameter to instruct the community collectively with the parameters in the mannequin can efficiently minimize the output error of the convolutional neural network.

(2) The random gradient coaching of the convolution neural community is carried out via micro batch samples, and the suggest and variance of every degree on every pattern are estimated. The reverse propagation of gradient can be realized via the use of the above operations [27].

3.3. Evaluation Model and Test. On the basis of the above-mentioned educational reform models, combined with statistical evaluation methods, a multiteaching model of sports activities is established [28]. Using the regular distribution model, the independent estimation mannequin of a couple of mastering comparison of sports activities, different educating impact is established. The ordinary distribution feature is described as follows:

\[ F(x) = \frac{x - \mu}{\sqrt{2\pi\delta}} + \frac{x^2 - \mu^2}{2\delta^2} \int_{-\infty}^{x} \exp\left(\frac{x}{\delta}\right) dx. \]  

In formula (1), \( \mu \) the self-assurance parameters of a couple of the mastering assessment mannequin for the different instructing effect of bodily education, \( \delta \) is the scale parameter; okay is the getting to know parameter of more than one studying comparison of the bodily schooling assorted educating effect. According to the statistical attribute quantity, the preferred everyday evaluation is carried out, and the self-belief distribution chance distribution feature of
bodily schooling different educating impact comparison is received as follows:

\[ F(x) = \int_0^x (x - \mu)^2 \sqrt{2\pi \delta} + \int_x^\infty \exp \left[ \frac{\ln(x/k) - \mu}{\sqrt{2\delta}} \right] dx \]  

(4)

According to the bad bias of the comparison of varied educating impact of bodily education, the chance distribution characteristic of the reliability distribution of varied educating impact of bodily schooling is acquired by means of the use of the approach of binary parameter evaluation as follows:

\[ F_t(x) = \int_0^x \frac{\delta(x/k)^{k-1} \exp[\ln(x/k) - \mu]}{x^2 - \mu^2} dx + \int_x^\infty \exp \left( \frac{x^2}{k} \right) dx. \]  

(5)

Combined with statistical decision-making and fuzzy decision-making methods, the generalized severe fee distribution feature for the comparison of varied bodily training educating impact is bought as follows:

\[ H = \frac{F_T(x, y) / \partial \partial F_T(x_{1-1}, y) / \partial \partial F_T(x_{1-2}, y) / \partial \partial \cdots \partial F_T(x_1, y) / \partial \partial \theta}{\alpha_{ij}(x^2) + \beta(k\delta) + \gamma(\delta)} + \frac{P_{ij}(PP) - R_{ij}(RM)}{P_{ij}(PP) - R_{ij}(RM)}. \]  

(6)

In formula (6), \( P_{ij}(PP) \) and \( P_{ij}(RM) \) are the information and imply price below the take a look at method; \( R_{ij}(RMSE) \) and \( R_{ij}(RMSE) \) are RMSE facts and imply values for the comparison of different instructing impact of bodily education. The characterization price of whether or not the check is exceeded \( \chi^2 \). The self-assurance stage of the contrast of varied educating impact of bodily training is set to 0; in any other case, it is taken as 1. The illustration fee of the contrast of the various educating impact of bodily schooling is obtained via the \( k \)-s test. It is set to zero when passing the \( k \)-s test; in any other case, it is taken as 1. The consultant price of the self-belief degree of the diverse instructing impact of bodily training whether or not it passes the test. When it passes the test, it is set to 0; in any other case, it is taken as 1. To sum up, the contrast mannequin of the diverse instructing impact of bodily training is constructed, and puts forward the observation and evaluation results of different educational effects are proven in Figure 2.

4. Experiment and Analysis

4.1. Sample Data Training. In order to consider the fantastic of bodily schooling teaching, we commonly consider its instructing content, educating method, educating mind-set, and educating effect. There are seven \( x_1 \) contrast indicators, which characterize the route progress, instructing depth and breadth, and the practical diploma of studying burden; \( x_2 \) represents the diploma of integration with exercise and whether or not it can replicate present day scientific and technological achievements; \( x_3 \) represents the diploma of clarity, hierarchy, and center of attention of lectures; \( x_4 \) represents vivid explanation, idea and guidance, attractive, traditional examples, and integrating principle with practice; \( x_5 \) stands for guiding mastering strategies and cultivating the analytical ability; \( x_6 \) represents the seriousness of full lesson preparation and expert explanation; \( x_7 \) stands for educating and instructing people, continuously enhancing teaching, and the assessment purpose is set as the instructing effect. Its major contents encompass students’ examination results, study room discipline, perception and mastery, potential to analyze and clear up problems, etc. Import the statistics into SPSS software program and analyze it. The outcomes are proven in Figure 3.

It can be considered from Figure 3 that the correlation between \( x_5 \), \( x_3 \), \( x_4 \), and \( x_6 \) and instructing impact is the most significant, with the order of 0.775, 0.644, 0.629, and 0.212, indicating that \( x_7 \) can actively and continually enhance teaching, educating, and instructing people, and the more obvious the instructing effect. \( x_3 \), the clearer the lecture is, the clearer the degree is, and the extra distinguished the key factors are, the higher the instructing impact is. \( x_1 \), the more sensible the path schedule, educating depth, and breadth, and students' getting to know burden, the higher the educating effect. \( x_6 \), the fuller the lesson preparation, the extra skillful the explanation, the more serious the query answering and correcting homework, and the higher the educating effect. At the identical time, it can be viewed from Figure 3 that the correlation coefficient between \( x_3 \) and \( x_5 \) is 0.738, and the correlation coefficient between \( x_5 \) and \( x_4 \) is 0.661. The correlation between these prediction elements is particularly large, which will lead to the overlap of enter data and minimize the prediction accuracy of the neural community model. Therefore, it is vital to make foremost thing evaluation on the prediction elements to enhance the prediction accuracy.
4.2. Analysis of Evaluation Accuracy. The simulation test of educating pleasant contrast is realized via mannequin analysis, and the trade of suggesting the rectangular error and prediction accuracy share of the mannequin based totally on the random multivariate matrix convolution neural community are obtained, as shown in Figure 4.

Figure 4 indicates that the random multivariate matrix convolution neural network community mannequin is in era 60, that is, the range of convergence steps is 60, indicating that the random multivariate matrix convolution neural community mannequin can speed up the convergence velocity of the network. It can be viewed from Figure 4 that the prediction accuracy shares of 29 organizations of 30 businesses of take a look at samples is greater than 96%, and the prediction accuracy of 22 corporations is greater than 98%. It can be viewed that the convolution neural community mannequin primarily based on the random multivariate matrix has a desirable approximation effect.

The sum of squares of errors and health feature curves based totally on the random multivariate matrix convolution neural community mannequin are shown in Figure 5. The sum of squares of mistakes is quicker and earlier than era 5, and the convergence velocity of generations 10 to 30 is especially slow. After the wide variety of iterations is 34, the sum of squares of mistakes of the community reaches a secure level, indicating that the international optimization can be realized extra rapidly based totally on the random multivariate matrix convolution neural community model. Figure 5 suggests that the education health feature based totally on the random multivariate matrix convolution neural community mannequin converges quicker and earlier than era 10. After forty-five iterations, it essentially reaches a steady
state, which indicates that the adaptability of the mannequin is high. In a word, the interior mechanism of the random multivariate matrix convolution neural neighbourhood model determines its schooling and prediction performance. Considering the prediction accuracy and adaptability, the instructing great evaluation model based totally on the random multivariate matrix convolution neural community mannequin is notable and robust.

In order to affirm the overall performance of this model, the random multivariate matrix convolution neural community mannequin is used to simulate the pattern data. The absolute error assessment format is proven in Figure 6. It can be considered that the absolute error expected through the instructing first-class comparison mannequin based totally on the convolutional neural community mannequin degrees from zero to 1.48, and the absolute error envisioned by means of 10% of the samples is large, the absolute error range of prediction based totally on the random multivariate matrix convolution neural community mannequin is 0 to 0.05, and the absolute error of the expected cost of 90% pattern assessment effects can be managed inside 0.1. The prediction effects of person samples of the single convolution neural community mannequin deviate greatly, and the prediction outcomes primarily based on the random multivariate matrix convolution neural community mannequin are exceptionally stable.

The contrast effects of common comparison accuracy exhibit that the common comparison accuracy of the single convolution neural community mannequin is 82.15%, whilst the common comparison accuracy of the convolution neural community mannequin primarily based on the random multivariate matrix is 97.58%, which is expanded via 15.43%.

**Figure 4**: Experimental results of mean square error variation and prediction accuracy. (a) Mean square error. (b) Percentage of prediction accuracy.

**Figure 5**: Experimental results of sum of squares of error and fitness function curve. (a) Sum of squares of errors. (b) Curve of fitness function.
It can be considered that it is possible to use the convolution neural community mannequin based totally on the random multivariate matrix in instructing nice evaluation.

4.3. Comparative Analysis of Prediction Accuracy. In order to confirm the effectiveness of the mixed prediction mannequin proposed in this paper, the accuracy of community simulation and community prediction are in contrast with the usual community mannequin in the experiment. In this paper, the first sixteen coaching units and eight take a look at units in the 24 samples records in the normalized facts are used. The community enter nodes are the 5 fundamental element values chosen after most important aspect analysis, and the community output node is the educating impact to be predicted. Figure 7 shows the comparison of simulation accuracy of different models.

Figure 6: Average evaluation accuracy and error of prediction results. (a) Comparison of absolute error of prediction results. (b) Chart of prediction results.

Figure 7: Comparison of simulation accuracy of different models.

Figure 7 indicates the assessment of simulation in two kinds of networks. The maximal error of a single convolutional neural community mannequin is 1.265, the minimal error is 0.00135, and the common error is 0.705. The maximal error of this mannequin is 1.2457, the minimal error is 0.0158, and the common error is 0.71044. The common accuracy of a single convolutional neural community mannequin barely decrease than that of this model. Figure 8 suggests the evaluation of prediction in the two kinds of networks, the maximal prediction error of the single convolutional neural community mannequin is 3.2338, the minimal error is 0.0971, and the common error is 0.97052. The maximal prediction error of this mannequin is 1.4329, the minimal error is 0.5547, and the common error is 0.91135. It can be concluded that the prediction accuracy of a single convolutional neural community except any facts
preprocessing earlier than setting up the community mannequin is low. However, the prediction accuracy of the convolutional neural community mannequin primarily based on the random multivariate matrix proposed in this paper is excessive due to the fact it eliminates the dispersion of pattern facts and the interference between enter variables with massive correlation.

5. Conclusion

In this paper, the current shortcomings of bodily training instructing pleasant contrast are analyzed. On this basis, the educating fine is simulated and evaluated based totally on the random multivariate matrix convolution neural community model, the check and evaluation approach is delivered to analyze the getting to know assessment of bodily training educating effect, the multivariate gaining knowledge of assessment mannequin characteristic of bodily schooling various educating impact is constructed, and the multivariate getting to know comparison mannequin of bodily schooling various instructing impact is optimized, the self-assurance stage and reliability of diverse bodily schooling instructing impact is improved, and different getting to know is evaluated. The contrast of simulation penalties and the contrast with the prediction accuracy of neighbourhood model show off that this approach has the benefits of appropriate basic overall performance and immoderate evaluation efficiency. Based on the random multivariate matrix convolution neural community model, the instructing nice assessment mannequin overcomes the shortcomings of robust subjectivity and linear assessment of typical comparison methods. It has vital realistic guiding fee for the proper educating satisfactory assessment and affords a foundation for greater superb enchantment of instructing first-class in the future.

Data Availability

The data are available upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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