

## Research Article

# Swimming Training Evaluation Method Based on Convolutional Neural Network

Lei Zhang<sup>1</sup> and Wei Liu <sup>2</sup>

<sup>1</sup>Physical Education Department, Xuzhou Institute of Technology, Jiangsu, Xuzhou 221008, China

<sup>2</sup>School of Medical Information & Engineering of Xuzhou Medical College, Jiangsu, Xuzhou 221004, China

Correspondence should be addressed to Wei Liu; lw\_xzmc@xzhmu.edu.cn

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By investigating the status quo of the swimming training market in a certain area, we can obtain information on the current development of the swimming training market in a certain area and study the laws of the development of the market so as to provide a theoretical basis for the development of the market. This paper designs an evaluation algorithm suitable for swimming training based on the improved AlexNet network. The algorithm model uses a  $3 \times 3$  size convolution kernel to extract features, and the pooling layer uses a nonoverlapping pooling strategy. In order to accelerate the network convergence, the model introduces batch normalization technology. The algorithm uses data augmentation technology to expand the data set, including rotation and random erasure, to a certain extent alleviating the problem of overfitting. The results of the study showed that there were no significant differences in fat, minerals, protein, body mass index, basal metabolic rate, and total energy expenditure in the body composition ratios of children in the convolutional neural network assessment group and the control group, while muscle and total body water were not significantly different. However, there are significant differences in fat-free body weight and muscle strength of various segments of the body, among which there are very significant differences in muscle strength of lower limbs in each segment of the body. There were no significant differences in minerals, body mass index, basal metabolic rate, total energy expenditure, and lower limb muscle strength in the body composition ratios of men and women in the convolutional neural network assessment group. There are significant differences in body weight, upper limb muscle strength, and trunk muscle strength. There were no significant differences in the proportions of body composition between men and women in the control group, except for fat and protein.

## 1. Introduction

Swimming has a history of hundreds of years. Although it has experienced many ups and downs, it has always been loved by people for its own fun and practicality. With the continuous improvement of people's living standards, various forms of swimming upsurge such as swimming fitness, swimming competitions, and outdoor swimming which have been set off all over the country [1]. The construction of a scientific system of physical training is a shortcoming of swimming physical training, and it is in the stage of development and research. Good physical stamina is the guarantee for athletes to win in swimming competitions. Without good physical stamina, technical and tactical levels

cannot be effectively displayed and played [2]. Therefore, physical training needs to be solved as the primary problem in daily training. In recent years, the age of outstanding athletes has shown a trend of getting younger and younger, but swimming physical training is very weak [3]. Searching the literature also found that there are very few studies on swimming physical training. However, speeding up the improvement of the swimming athletes physical training system has become an urgent need for us.

Deep neural networks have developed rapidly and have attracted much attention. Among many machine learning algorithms, convolutional neural networks have obvious characteristics and strengths that are different from other algorithms, such as the ability to deal with complex

scenarios, the ability to subsidize local characteristics, and the way of simulating human neurons [4–6]. Through the summary and comparison of current research directions and results, it can also be found that deep learning neural networks have made many breakthroughs in digital image processing, natural language processing, and other fields and have solved many application problems in complex scenarios [7, 8]. After proper swimming training, through experimental tests, it can be determined that different training methods have different degrees of impact on the human body during swimming training. Some positive changes are conducive to people's healthy development and also conducive to better exploration [9].

This article optimizes the AlexNet model, adds batch normalization technology to AlexNet, adjusts the convolution and size, and adjusts the network structure. We introduced the model structure in detail, built the model based on the TensorFlow framework, and performed experiments. There are significant differences in muscle content between the convolutional neural network assessment group and the control group. Since the resistance of water is greater than that of air, the human body needs a certain amount of strength to overcome the resistance of water during the swimming process, and muscles are the source of strength, and the power generated by more muscles will be greater. In general exercise, the shoulder straps, chest, back, and leg muscle groups are involved in the work during the training process. The muscles periodically contract and relax to thicken the muscle fibers and increase the cross section of the muscles, thereby promoting muscle development. The convolutional neural network assessment group and the control group have significant differences in fat-free body weight. Muscle is an important part of fat-free body weight. Because systematic training leads to an increase in muscle content and there is a significant difference in muscle content between the convolutional neural network evaluation group and the control group, there is a significant difference in fat body weight.

## 2. Related Work

In deep learning, machine vision and natural language processing tasks often use pretrained models as the initial parameters of new models, thereby reducing the cost of training because neural networks require a lot of time and computing resources to train and obtain information from data [10]. Some work is devoted to designing different sampling strategies. Relevant scholars pay attention to the structural characteristics of the first-order similarity and the second-order similarity in the network and propose the LINE model using a new sampling strategy [11]. The first-order similarity means that if two nodes are directly connected, it can be considered that the semantics of the two nodes should be similar, so their representations should also be similar. For example, two people directly related in a social network often have the same characteristics in terms of interest; two words directly related in a word network usually have the same semantics or parts of speech. Pages

that are linked to each other on the Internet often express the same subject matter. Second-order similarity means that if two nodes have shared neighbor nodes, the representations of these two nodes should also be similar. For example, in a word co-occurrence network, words that always appear with the same word should have similar meaning. Therefore, in order to retain these two characteristics in the network, the LINE model uses breadth-first search as a sampling strategy for generating context node sequences. This strategy considers that only nodes that are at most two hops away from a given node are considered as neighboring nodes [12]. This preserves the characteristics of the first-order similarity and the second-order similarity in the map. However, this method cannot obtain the node relationship above the second order, which limits the grasp of the global structure characteristics [13].

At present, scholars mainly conduct related research from the organic combination of training methods and training theories [14]. In the theory of physical fitness training for athletes, researchers mentioned that swimming fitness training is inseparable from scientific and reasonable training methods, combined with the corresponding morphological structure of the human body, using effective methods to improve the human body shape, exert human body functions, and store the material strength inside the human body [15]. The storage and transfer of this power can better adapt to the external environment. Relevant scholars analyzed the physical training of swimmers on land and found that for swimmers to achieve high-level competitive results, physical training on land is essential, and physical training on land can supplement and assist water training [16]. The combination of training and the use of their respective strengths in different special trainings can achieve the rationalization of physical training, promote swimmers to improve their sports quality and level, and help swimmers to better exert their physical functions and competitive advantages in competitive competitions [17]. Relevant scholars have analyzed the relationship between physical training on land and swimmers' performance and found that scientific and reasonable physical training can bring positive effects to swimmers, and planned and purposeful physical training can scientifically and rationally combine the physical training on land with swimmers [18]. The combination of water training can help swimmers improve their corresponding sports performance, and land physical training, as an important training method, can promote the improvement of swimming performance.

Relevant scholars analyzed the annual swimming training plan for children and pointed out that swimming training needs to consider various factors such as physical function and posture [9, 19–22]. As children are in the growth and development stage, all aspects of their bodies are not yet perfect, will be further developed and changed, and have strong plasticity. Therefore, arranging a swimming training plan for children at this stage needs to be closely related to the children's physical foundation. Scientific training at this stage is of great importance [23–25]. In the future, their sports performance will have a vital impact;

therefore, in the scientific arrangement of training, the connection between different factors is closely related to the overall effect.

### 3. The Methods of Swimming Training Evaluation

*3.1. Design of the Questionnaire.* According to the research content of this article and the needs of the survey, three questionnaires are designed, including “Consumer Questionnaire,” “Teacher Questionnaire,” and “Swimming Training Organization Leader Questionnaire.”

In questionnaire 1 “Consumer Questionnaire,” regarding the research on service quality, this article selects the use of a more extensive SERVQUAL model as the theoretical basis for evaluation, consults the opinions of relevant experts and scholars, combines the arguments of related papers, and makes revisions after deliberation. Existing scales appear and form the form of questionnaires. The questionnaire on service quality is still analyzed from the five dimensions of tangibility, reliability, responsiveness, safety, and empathy. A total of 26 questions are designed with specific aspects. The five criteria of swimming training “training expectation-perceived service gap” are shown in Figure 1.

*3.2. Validity Test of the Questionnaire.* In the service quality survey part of the questionnaire, the SERVQUAL used is universal in the service field and is still the main scale used in service quality evaluation. For the design of other parts of the questionnaire, we first consulted some experts. After repeated revisions, 12 experts were asked to evaluate the validity of the questionnaire using the simplified Delphi method, as shown in Table 1. The results show that the content and structure of the questionnaire have high validity and can meet the requirements of the survey.

*3.3. Reliability Test of the Questionnaire.* Regarding the 7-point survey scale of the service quality part, this paper uses the internal consistency coefficient as a value to test the reliability and uses the SPSS17.0 software to test the five dimensions of the index through Cronbach’s alpha coefficient. The test results are shown in Table 2.

A coefficient greater than 0.7 indicates that the questionnaire has a high reliability, and a value between 0.35 and 0.7 indicates that the questionnaire is reliable and can be distributed. The coefficient of the two variables of the questionnaire in this study is greater than 0.7, and the reliability is very high. The coefficient of the three dimensions is greater than 0.6, and the questionnaire is generally more reliable. By dividing the obtained consumer questionnaires into two groups according to odd and even numbers, the correlation between the two sets of data in each questionnaire is 0.962, respectively. The two sets of data are highly correlated, indicating that the survey data are consistent.

## 4. Swimming Training Evaluation Algorithm Based on Convolutional Neural Network

### 4.1. AlexNet Network

*4.1.1. Correction of Linear Unit.* “Activation function” is an indispensable important component in neural networks, and it is also called “nonlinear mapping function.” Most of the powerful representation capabilities of deep neural network models come from the nonlinear characteristics of the activation function. The Sigmoid function is the first universally recognized activation function in the development of artificial neural networks.

The Sigmoid function is also called the Logistic function, and the function expression is as follows:

$$\text{Sigmoid}(x) = \frac{1}{1 + e^{-2x}}. \quad (1)$$

The output value of the function ranges from 0 to 1. “0” can be regarded as the “inhibition state” of the neuron, and the “excited state” can correspond to “1.” However, in the saturated region, the function gradient is approximately 0, the value of backpropagation is extremely weak, and the risk of the gradient “disappearing” is high. When there are more network layers, this phenomenon becomes more obvious, which is a major obstacle to deepening the network depth. In addition, the sigmoid function involves exponential calculation, and the derivation involves division, which requires a large amount of calculation.

In order to avoid gradient saturation, we apply rectified linear unit (ReLU) to the neural network. The most common deep neural network activation function still has a place for the ReLU function. At present, many new activation functions are also optimized versions based on the ReLU function. The mathematical expression of the ReLU function is a piecewise function:

$$\text{ReLU}(x) = \max(0, x) = \begin{cases} 0, & x \leq 0, \\ x, & x > 0. \end{cases} \quad (2)$$

Compared with the Sigmoid activation function, when  $x$  is less than or equal to zero, the gradient value of the ReLU function is 0, and when  $x$  is greater than zero, the gradient value is 1. The ReLU function effectively avoids the occurrence of gradient saturation. Compared with the Sigmoid function with exponential calculation, the calculation of the ReLU function is simpler and the calculation complexity is lower. Compared with Sigmoid, the ReLU function can make the learning speed of the network model using the stochastic gradient descent algorithm about 6 times faster.

The network model uses the ReLU activation function which can greatly reduce the amount of calculation in the network learning process. Using the ReLU activation function can make the output of some neurons equal to 0 so that the network has sparseness, can reduce the mutual dependence of parameters, and alleviate the overfitting problem to a certain extent.

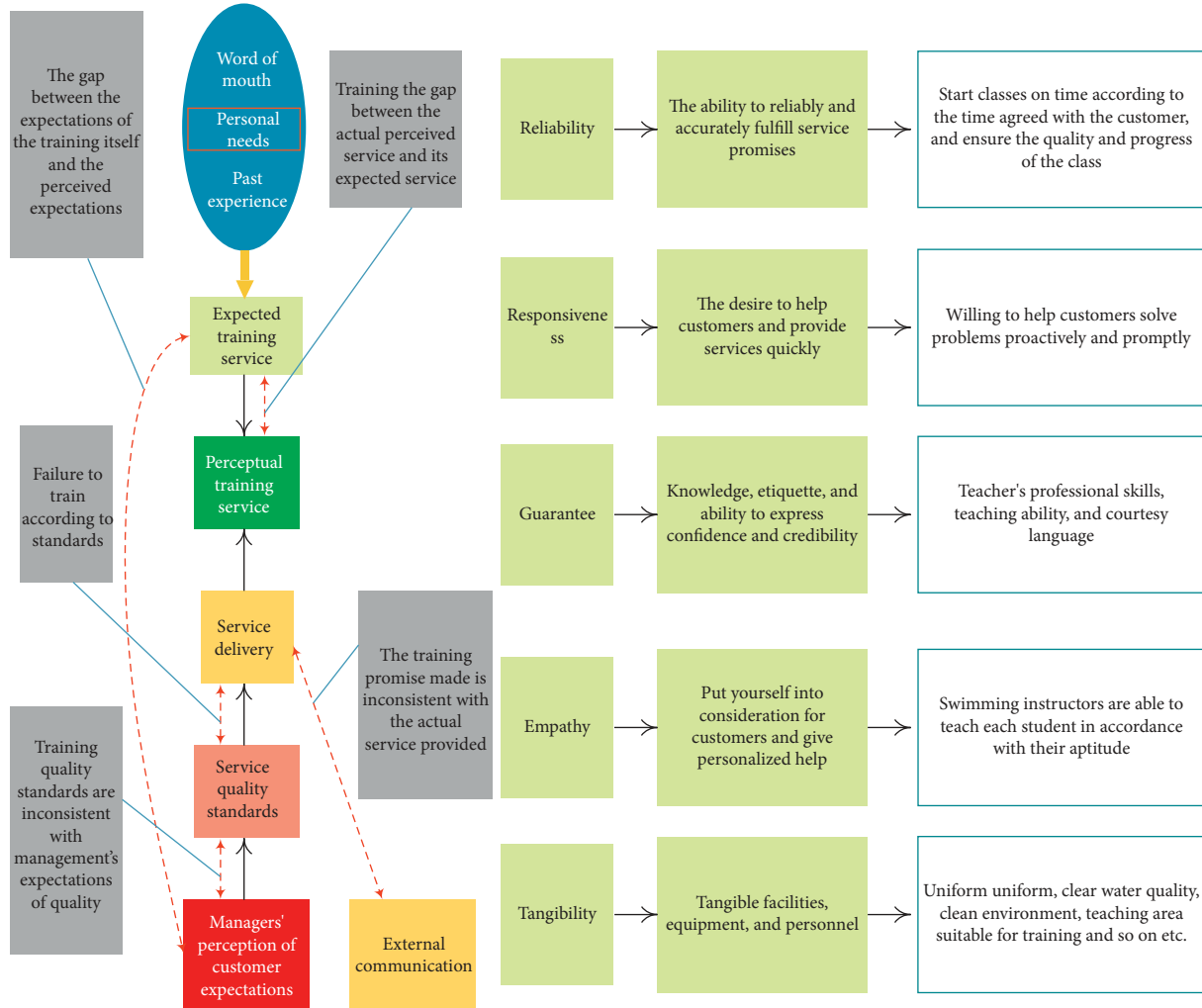


FIGURE 1: Schematic diagram of the five standard relationships of “training expectations-perceived service gap” in swimming training.

TABLE 1: Statistic table of experts' test of validity of questionnaire content.

	Consumer questionnaire percentage (%)	Percentage of teacher questionnaire (%)	Percentage of questionnaires from training institutions (%)
Very effective	55	50	48
More effective	32	37	39
Generally effective	8	7	8
Not very effective	3	4	4
Completely ineffective	2	2	1

4.1.2. *Standardization of Partial Response.* Local response normalization (LRN) is a local inhibition mechanism that draws on the side inhibition thought of the nervous system. It can make more active neurons become more active and, at the same time, inhibit other neurons that respond weakly. Assuming that  $a_{ij}$  represents the output response of the convolution kernel of the  $d$ -th channel at position  $(i, j)$ , the normalized result of the local response  $b_{ij}$  can be expressed as follows:

TABLE 2: Reliability test of the questionnaire 7-point service quality survey scale.

Dimension	Number of items	Crobach's alpha value
Effectiveness	7	0.83
Reliability	6	0.78
Responsiveness	4	0.66
Safety	3	0.75
Empathy	6	0.63

$$b_{i,j}^{d-1} = a_{i,j-1}^d \cdot \left[ \alpha \cdot \sum_{t=\max(0,d-0.5n)}^{\min(N,d+0.5n)} (a_{i,j-1}^t)^2 + k \right]^{-1}. \quad (3)$$

Among them,  $n$  represents the number of local convolution kernels that act on LRN and  $N$  represents the number of convolution kernels in this layer.  $k$ ,  $n$ ,  $\alpha$ ,  $\beta$ , and so on are hyperparameters that need to be selected through the validation set.

## 4.2. Design of Convolutional Neural Network Evaluation

### Algorithm

**4.2.1. Batch Standardization.** The training of deep neural networks is very difficult because in the training process, small changes in the parameters of the previous layer will also cause changes in the input distribution of the next layer. Batch normalization is a deep neural network training technique. It can improve the training speed of the network. At the same time, it also alleviates the problem of “gradient dispersion” in the deep neural network to a certain extent, making the learning process of the deep network model easier and more stable. Currently, there are almost no convolutional neural networks that do not use batch normalization techniques. The average value of batch data is calculated as follows:

$$u_B \longrightarrow \frac{1}{m-1} \cdot \sum_{i=0}^{m-1} x_i. \quad (4)$$

The variance of batch data is calculated as follows:

$$\sigma_B \longrightarrow \sqrt{\frac{1}{m-1} \cdot \sum_{i=0}^{m-1} (u_B - x_i)^2}. \quad (5)$$

Batch normalization is to perform batch normalization operations on the network output through minibatch during model training so that the response obeys a normal distribution with a mean of zero and a variance of one. The batch standardization operation is divided into four steps. The first two steps are to find the mean and variance of the batch of data, and the third step is to normalize the batch of data based on the calculated mean and variance. The “scale transformation” and “offset” operations in the fourth step are used to make the network have the ability to restore the original input, thereby ensuring the capacity of the entire network.

**4.2.2. Improved Network Architecture.** The network model structure is shown in Figure 2. The network structure has five convolutional layers like the AlexNet model. The improvement of network model efficiency is closely related to the depth and width of the network and is closely linked to the complexity of the network. Therefore, the model designed in this paper is based on AlexNet as much as

possible to increase the width of the model and slightly adjusted to obtain higher accuracy. The structure includes five convolutional layer modules and two fully connected layers.

Figure 3 shows the combination of convolutional layers and other operating layers in the network model. In the AlexNet network structure, the size of the first layer of convolution kernel is  $11 \times 11$ , the size of the second layer of convolution kernel is  $5 \times 5$ , and the size of the third, fourth, and fifth layers of convolution kernel is  $3 \times 3$ . Related scholars pointed out that a large convolution kernel can be stacked by using multiple small convolution kernels [26, 27]. Therefore, in order to simplify the design process, the convolution kernel size in the convolution layer used in this article is all  $3 \times 3$ . The size of the feature map is adjusted by the nonoverlapping maximum pooling layer with a size of  $2 \times 2$  and a step size of 2. Using nonoverlapping pooling strategy helps to reduce the correlation between pixels. The input image first passes through the convolution layer, performs convolution operation with the convolution kernel, and then inputs to the batch normalization layer. After the batch normalization layer, it passes through the ReLU layer and finally uses a  $2 \times 2$  maximum pooling core to compress the size of the feature map, thereby reducing the amount of network parameters and calculations. The feature map after the maximum pooling layer continues to be input to the next layer of the network.

In this network model, the number of convolution kernels in each layer of the network draws on the parameters of the VGG model. The first convolution block has 64 convolution kernels, the second convolution block has 128 convolution kernels, the third convolution block has 256, the fourth has 512, and the fifth has 512. The output layer is a fully connected softmax layer. It is a single-layer neural network evaluator that calculates the probability of the input sample assigned to each class by constructing a function and adjusts the parameters to maximize the probability of the correct label.

**4.2.3. Model Parameters.** The parameter of this model is 101.1 M, and the floating-point arithmetic unit is 762.4 M. The input picture pixels of this model are  $224 \times 224$ . After the first convolution block and  $64 \ 3 \times 3$  convolution kernels, the convolution calculation is performed. After the maximum pooling layer in the convolution block, the size of the feature map is halved to  $112 \times 112$ . In the same way, the feature map becomes  $56 \times 56$  after the second convolution block,  $28 \times 28$  after the third convolution block, and  $14 \times 14$  after the fourth convolution block. After that the feature map is input to the fully connected layer as the final feature vector, and the evaluation task is completed through the softmax function. Compared with the AlexNet network, this model uses a stack of convolutional layers with a size of  $3 \times 3$  and a step size of 1. The local response normalization layer is abandoned, and the batch normalization layer is introduced. The size of the pooling core is no longer  $3 \times 3$ . It is  $2 \times 2$ . In addition, the

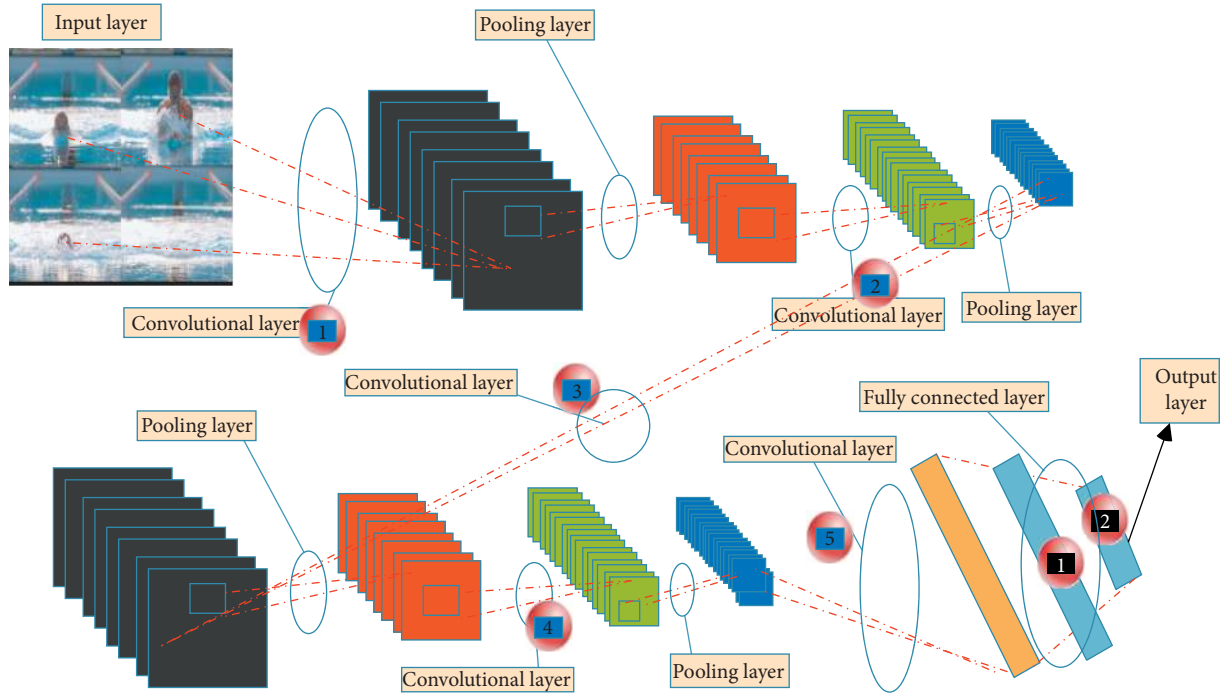


FIGURE 2: Swimming target evaluation model structure.

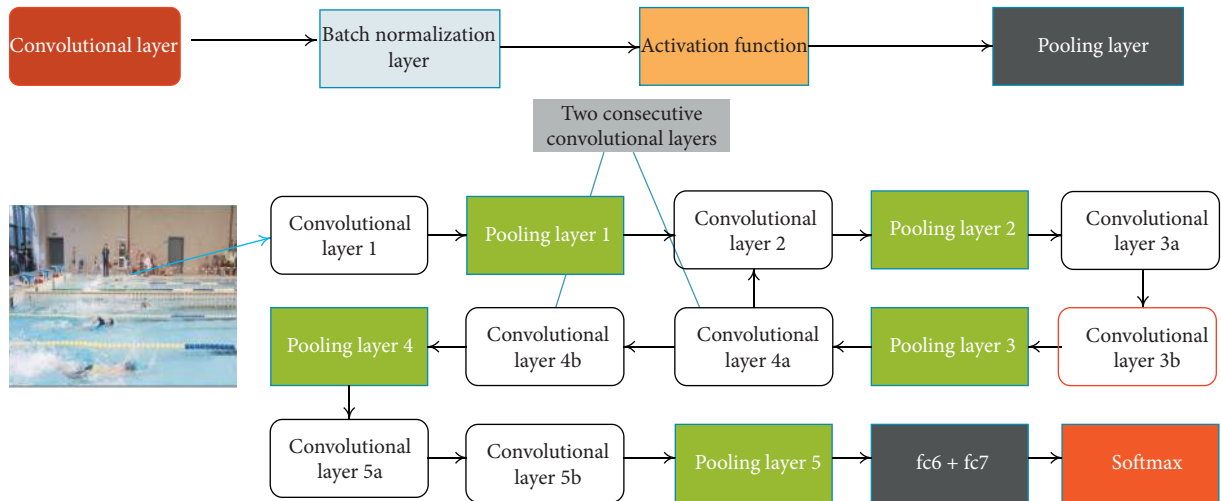


FIGURE 3: Combination of operation layers.

number of convolution kernels in the convolutional layer is also different from AlexNet.

## 5. Experimental Results and Analysis

**5.1. Analysis of the Basic Situation of the Convolutional Neural Network Evaluation Group and the Control Group.** Age refers to the length of time a person survives from birth to calculation, usually expressed in years. Height is the vertical distance from the top of the head to the ground. Height is the length of the longitudinal part of the human body, which originates from the longitudinal growth of the human body and is greatly influenced by genetic factors. The body weight refers to the body weight obtained by being naked or wearing

work clothes of known weight, and it is one of the important indicators to reflect and measure a person's health status.

After comparative analysis of Figure 4, we can find that there are no significant differences in the age, weight, and height indicators between the convolutional neural network (CNN) evaluation group and the control group.

**5.2. Analysis of Muscle Strength of Each Segment of the Body.** Muscle strength analysis mainly includes three parts: upper limb strength, lower limb strength, and trunk strength. Upper limb strength refers to the muscular strength of the upper limb, which is divided into the left upper limb and the right upper limb. Lower limb strength refers to the muscular

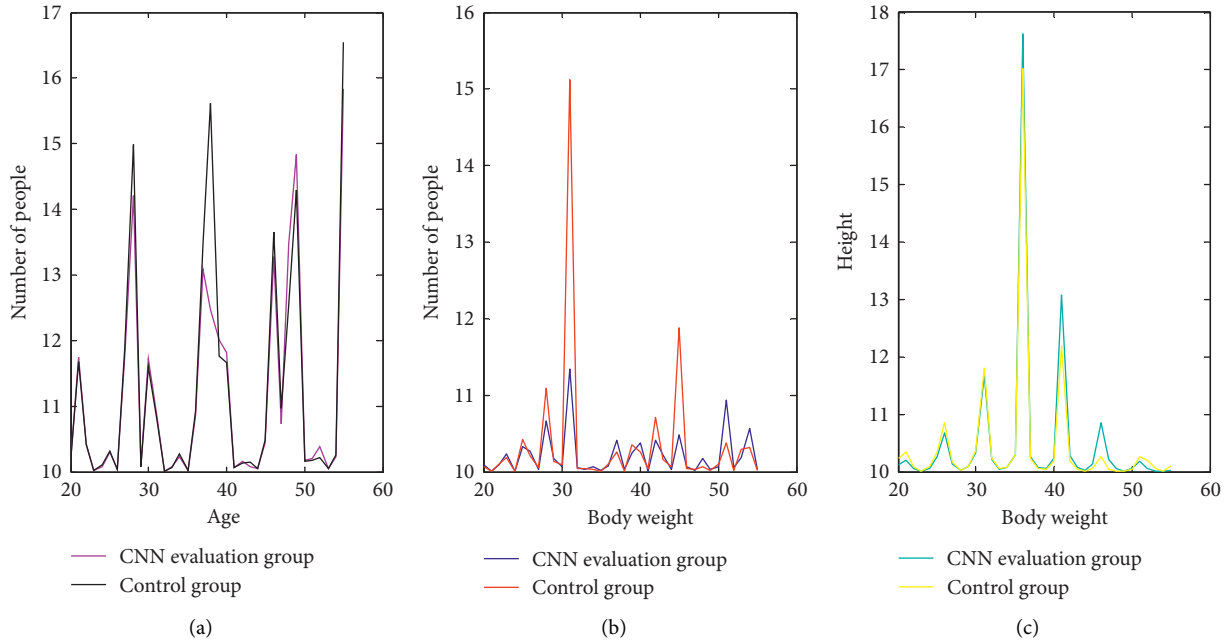


FIGURE 4: Basic situation of convolutional neural network evaluation group and control group.

strength of the lower limbs, which is divided into the left lower limb and the right lower limb. From the test results in Figure 5, we can see that the muscle strength of the convolutional neural network evaluation group is greater than that of the control group. Through comparative analysis, we can find that the assessment of swimming training can not only thicken and increase the muscle fibers of the human body and make the body more symmetrical and coordinated but also shape a good body shape. This is because swimming is a whole-body exercise, and exercise is continuous, which can fully mobilize a large number of muscle groups to participate in the exercise, thereby increasing the elasticity and cross section of the muscles, so that the muscle strength of each segment is continuously increased. Therefore, there are significant differences in muscle strength between the convolutional neural network assessment group and the control group. In addition, because the training volume and intensity of the lower limbs are greater than those of the upper limbs and trunk during the training process, there are very significant differences in the muscle strength of the lower limbs between the convolutional neural network assessment group and the control group. In addition, the distribution of muscle strength on the left and right sides of the upper and lower limbs in the convolutional neural network evaluation group was relatively even, while the distribution of muscle strength on the left and right sides of the lower limbs in the control group was not very uniform.

**5.3. Analysis of Various Indicators of Men's and Women's Body Composition in the Convolutional Neural Network Assessment Group.** From the test results in Figure 6, we can see that the fat content of men in the convolutional neural network evaluation group is 2.21 and the fat content of women is 5.67. After comparative analysis, we can find that there is a very

significant difference in content. The fat content of women is significantly higher than that of men, and there is a very significant difference, while the muscle content of men is higher than that of women, and there are significant differences, which is basically in line with the growth and development of the human body.

Through comparative analysis, we can find that the average protein content and total body water content of men in the convolutional neural network evaluation group are greater than the average value of women's protein content and total body water content, and there are significant differences. It is composed of protein and total body water. Because the muscle content of men is significantly different from that of women, the protein content and total body water content of men and women in the convolutional neural network assessment group are significantly different. In addition, since children are in the stage of growth and development and the growth environment is basically the same, there is not much difference in mineral content between men and women.

The average value of women's body mass index is greater than the average value of men's body mass index, but there is no significant difference between the two in mathematical statistics. However, there is a significant difference between men's and women's fat-free body weights. This is related to participating in swimming training. Exercise can reduce fat content and increase muscle content to a certain extent. Due to gender differences between men and women, men's fat content is more important. Compared with women, the fat content is relatively low, while the muscle content is relatively high.

From the test results in Figure 7, we can see that the upper left muscle mass of men is 1.73 and the upper left muscle mass of women is 1.44. After comparative analysis,

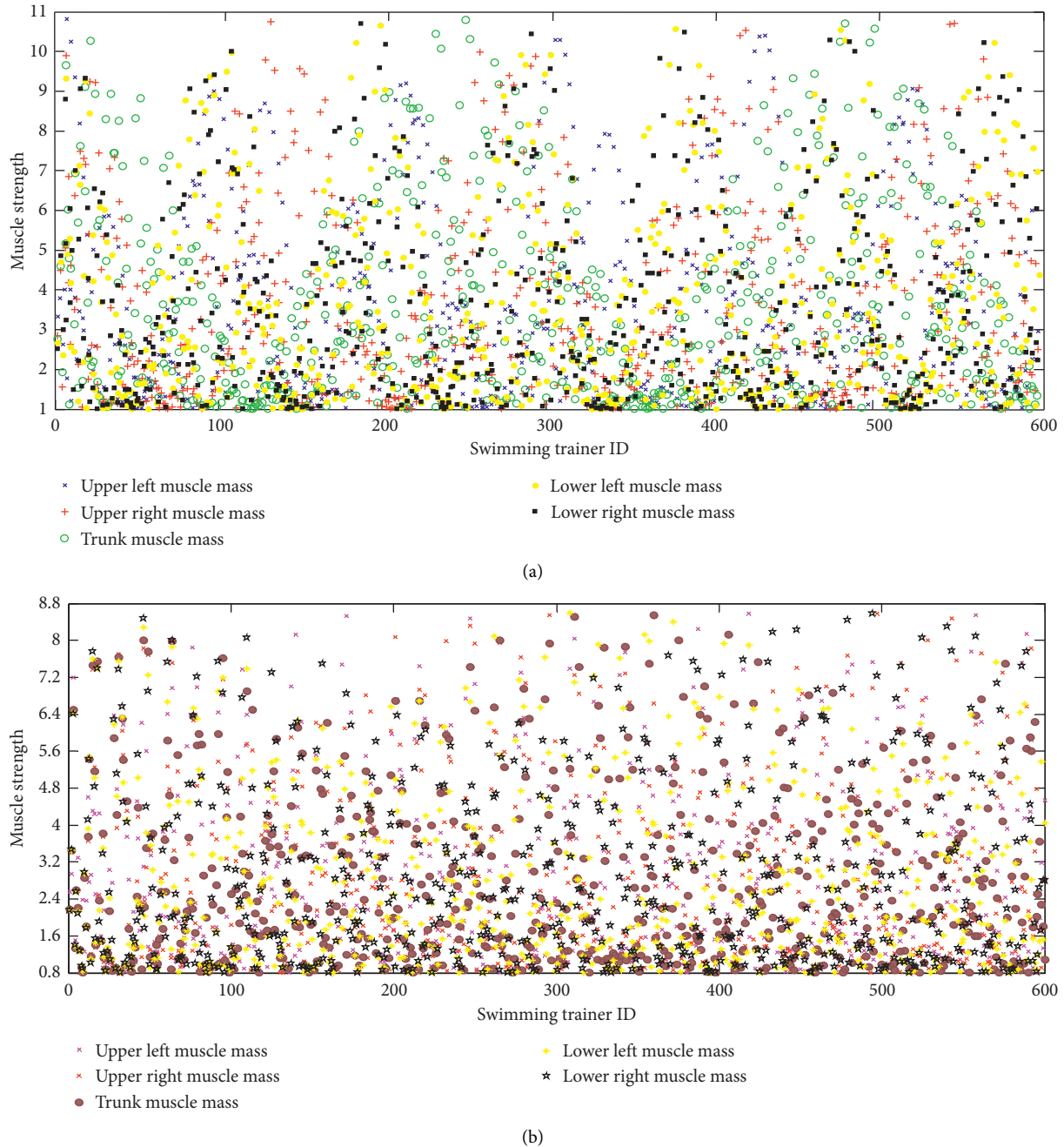


FIGURE 5: Muscle strength of each segment of the body in the (a) convolutional neural network evaluation group and (b) control group.

we can find that  $p < 0.05$ , so there is a significant difference in the upper left muscle mass between men and women in the convolutional neural network assessment group. The upper right muscle mass of men is 1.82, and the upper right muscle mass of women is 1.41. There is a significant difference in the upper right muscle mass of men and women in the convolutional neural network assessment group. The trunk muscle mass of men is 13.61, and that of women is 11.24. There is a significant difference between the trunk muscle mass of men and women in the convolutional neural network assessment group. The lower left muscle mass of men was 4.80, and the lower left muscle mass of women was

4.31. There was no significant difference in the lower left muscle of men and women in the convolutional neural network assessment group. The lower right muscle mass of men was 4.91, the lower right muscle mass of women was 4.12, and there was no significant difference in the lower right muscle mass of men and women in the convolutional neural network assessment group.

Through comparative analysis, we can find that participating in swimming training will promote the increase in children's muscle strength in each segment of the body. However, except for the lower limb muscle mass between women and men, there is no significant difference, and the



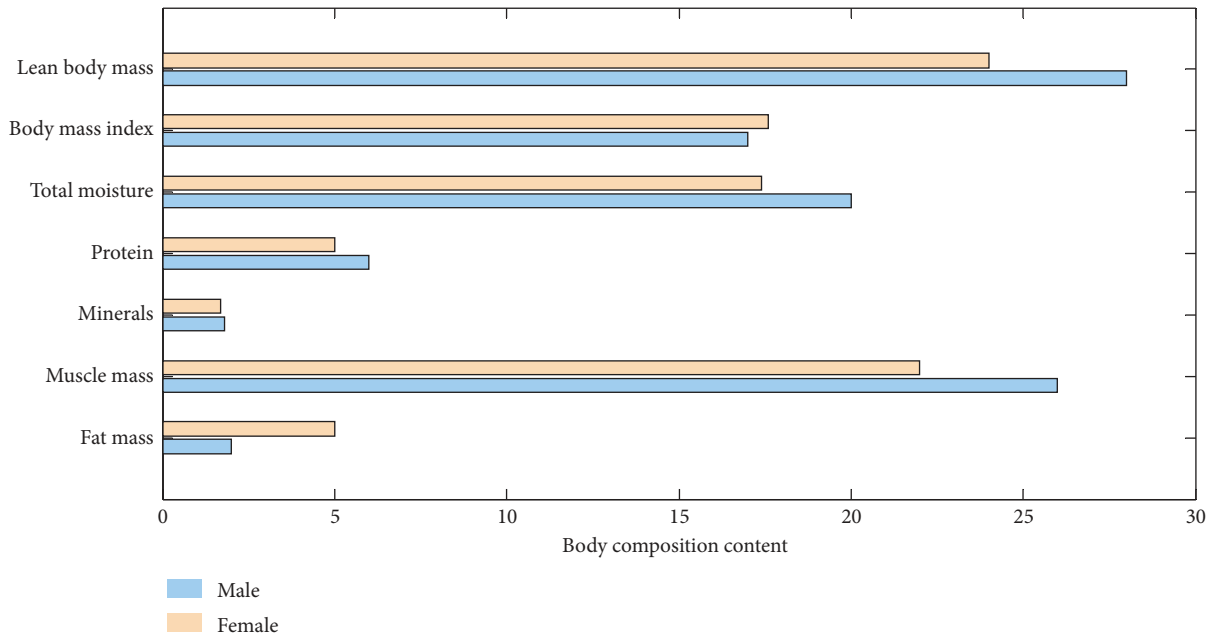


FIGURE 6: Men’s and women’s body composition indicators in the convolutional neural network assessment group.

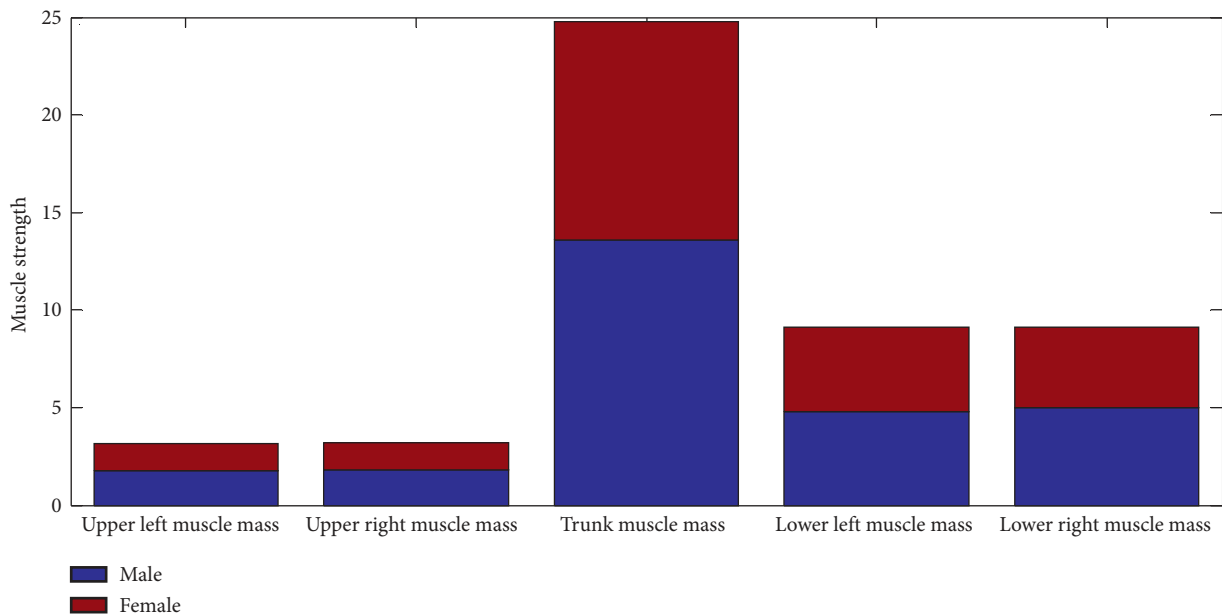


FIGURE 7: Convolutional neural network assessment group male and female body muscle strength.

upper limb muscle mass and trunk muscle mass of women are significantly lower than those of men. This is because in the swimming training process, the training volume of the lower limbs is more than that of the upper limbs and torso, which promotes the increase in the muscles of the lower limbs of women so that there is no significant difference in the muscles of the lower limbs of men and women. Due to the small amount of training and the influence of gender differences, there are statistically significant differences in the amount of upper limb muscles and trunk muscles between men and women.

5.4. Analysis of Various Indicators of Body Composition of Men and Women in the Control Group. From the test results in Figure 8, we can see that the fat content of men is 1.96 and the fat content of women is 3.35. After comparative analysis, we can find that because  $p < 0.05$ , there is a significant difference in fat content between men and women in the control group. The muscle content of men is 26.44, and that of women is 23.56. After comparative analysis, we can find that there is no significant difference in muscle content between men and women in the control group. Although the mean value of muscle content of men in the control group

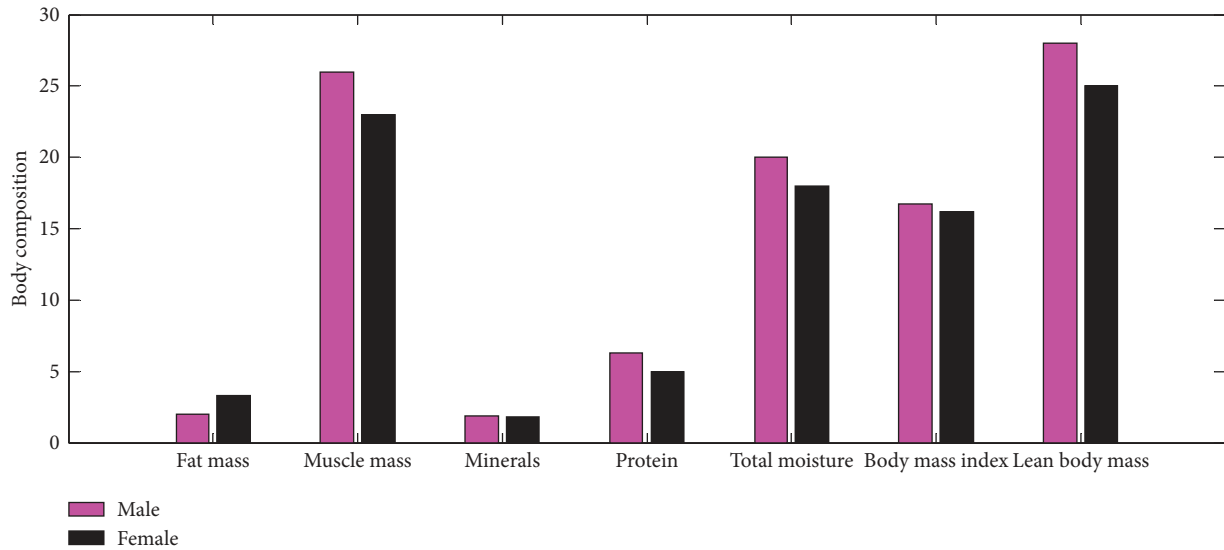


FIGURE 8: Body composition indicators of men and women in the control group.

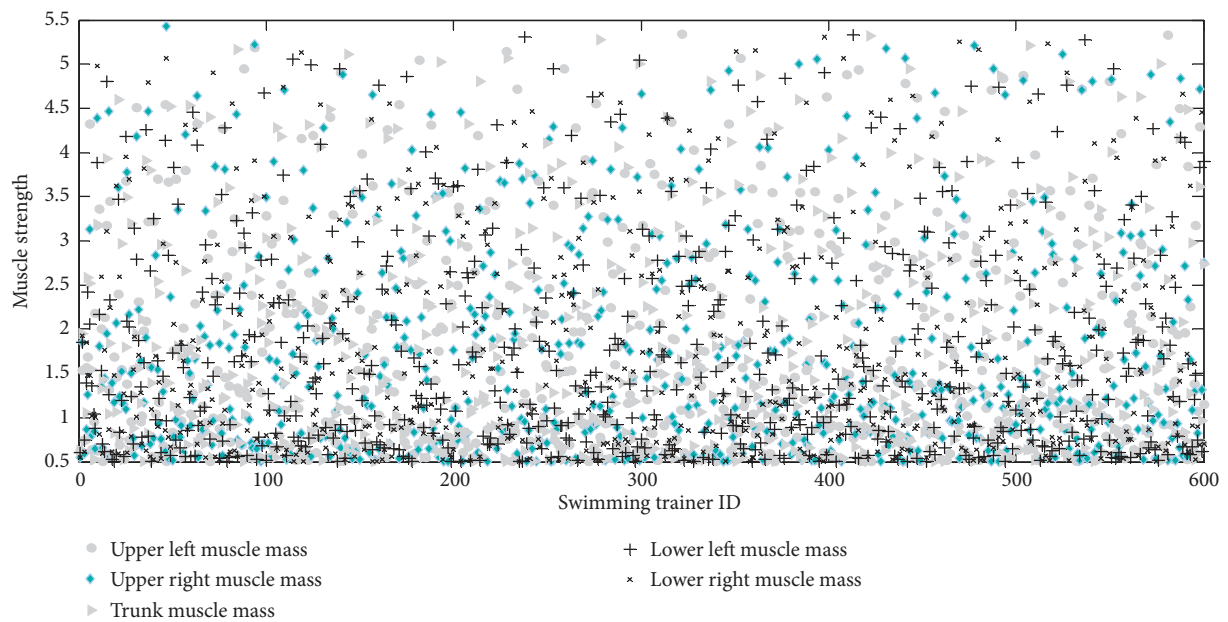


FIGURE 9: Muscle strength of each segment of the control group men and women.

was significantly higher than that of women, there was no significant difference in mathematical statistics. This is because due to the gender difference between men and women, men's hyperactivity coefficient is greater than that of women. The fat content of women is higher than that of men, while the muscle content is lower than that of men. However, children are in the stage of growth and development. Apart from participating in school sports activities, there is no amount and intensity of exercise stimulation. Therefore, there is no statistically significant difference in muscle content.

From the test results in Figure 8, we can see that the total body water content of men is 20.15 and the total body water content of women is 18.46. After comparative analysis, we can find that the total body water content of men and women in the control group is not significantly different. Although the average value of men's mineral content and total body water content is greater than the average value of women's mineral content and total body water content, there is no significant difference in mathematical statistics. There is a significant difference in the protein content of women. This is because the muscle content of men is significantly greater

than that of women. Although there is no significant difference, muscle is the general term for protein and total body water. There is no significant difference in total body water between men and women, but there are significant differences in protein.

From the test results in Figure 9, we can see that the muscle strength of each segment of the body of the control group is 1.76 and 1.55 for the upper left muscle, 1.74 and 1.57 for the upper right muscle, 13.58 and 11.69 for the trunk muscle, and 13.58 and 11.69 for the lower left muscle. After comparative analysis, we can find that there is no significant difference in muscle strength between men and women in the control group. Through comparative analysis, we can find that although the average value of the muscle strength of each segment of the male body is greater than the average value of the average muscle strength of each segment of the female body, there is no significant difference in mathematical statistics. In school physical education and after-school sports activities, the amount and intensity of exercise are relatively small and the degree of stimulation of the muscle strength of each segment of the body is relatively low.

## 6. Conclusion

This article improves the AlexNet model, adjusts the size of the convolution kernel to  $3 \times 3$ , and adjusts the number of convolution kernels in each layer. The pooling layer adopts a nonoverlapping pooling strategy, and the pooling core size is  $2 \times 2$ . Batch normalization technology is introduced to accelerate network training, and data enhancement technology is used to alleviate the problem of overfitting. In this article, we first mark and unify the image format and then pass it to the convolutional network model. The network model training learning rate is set to 0.0001, and the random inactivation probability is set to 0.5. There is a significant difference in total body water between the convolutional neural network assessment group and the control group. Because swimming is a sport carried out in water, the loss of human body moisture during exercise is relatively slow, and when the human body is in a water environment, the moisture on the skin surface can be guaranteed, unlike sports on land, which will be emitted into the air. During exercise, the body's metabolism will speed up, and more water will be replenished than in a quiet state. The convolutional neural network assessment group and the control group have significant differences in muscle mass. Muscles are composed of protein and total body water. Since there is no significant difference in protein between the two, there is a significant difference in total body water between the convolutional neural network assessment group and the control group. There are significant differences in upper limb muscle strength and trunk muscle strength between the convolutional neural network assessment group and the control group, while there are very significant differences in lower limb muscle strength. Because the training volume and intensity of the lower limbs are greater than those of the upper limbs and trunk during the training process, there are very significant differences in the muscle strength of the

lower limbs between the convolutional neural network assessment group and the control group.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The authors declare that they have no conflicts of interest or personal relationships that could have appeared to influence the work reported in this paper.

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