Construction of Trampoline Simulation Analysis System Based on Digital 3D Arrangement Algorithm

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ABSTRACT: *Trampoline is a highly technical sport that requires athletes to possess high skills and physical fitness. This paper proposes a trampoline simulation analysis system based on a digital three-dimensional arrangement algorithm to improve athletes' training levels and competition performance. This article studies constructing a trampoline simulation analysis system using a digital 3D arrangement algorithm. The system aims to simulate the process of trampoline exercise, accurately analyze and evaluate athletes' movements, and provide effective training guidance and feedback for coaches and athletes. This article first introduces the basic principle of digital 3D arrangement algorithm and its application in trampoline motion analysis and then elaborates on the construction process of the system, including modules such as motion capture, data preprocessing, motion recognition and evaluation. Finally, the feasibility and effectiveness of the system were verified through experiments.*

Keywords: Digital, Trampoline, Choreography Algorithm

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1. Introduction

With sports development in our country, our trampoline has made rapid progress and gratifying achievements. However, with the continuous progress of computer algorithms in the research and development of trampoline simulation systems, the application of the simulation system has further expanded the stage. The research of the choreography algorithm is a direct analysis of the research object at the beginning. There is no complex computing method like other algorithms, and it has good overall searchability [1]. Traditionally, the research on the impact of trampoline training simulation could be more thorough, and the time for training simulation cannot be correctly controlled [2]. In this study, we have done spatial optimization by arranging algorithms and overall planning. In planning, we will make applying the choreography algorithm more extensive. The training simulation model of the trampoline simulation system is added, and the training simulation effect is further improved. In the research of simulation systems, I have been in a relatively backward position due to the shackles of computer technology, but it has a broad market prospect [3]. Trampoline is a rigorous movement of technical requirements, and its success is based on many training simulations. Hence, a good trampoline simulation system is the basis of our excellent achievements [4]. Simulation training on simulation has made a breakthrough in the choreography algorithm. As an important part of information collection and processing, we can make our 3D trampoline simulation system more pertinent [5].

2. The State of the Art

The rise of trampoline simulation systems in foreign countries mainly focused on the period from 1980 to 2000. This is a good way to mobilize the athletes' training simulation effect [6] before most developed countries. It is also a way to encourage athletes to achieve excellent results, so in developed countries, constructing a digital three-dimensional trampoline simulation system matters. The level of foreign development has become increasingly mature, with a fixed development model and system management personnel [7]. Digital 3D trampoline simulation system has achieved great success in all aspects and provides strong support for achieving excellence [8]. China's digital three-dimensional trampoline simulation system has been developed in recent years [9]. The development momentum is good, and after a series of measures to be issued and formulated, it has entered a strong rising period. There are also scholars at home and abroad for digital 3D trampoline simulation. Many systems have done much research [10]. However, many things could still be improved in the space planning and design of the digital 3D trampoline simulation system. This paper mainly studies the digital 3D trampoline simulation system by arranging algorithms and making reasonable data overlap.

3. Methodology

3.1. Trampoline Training Simulation Model Building based on Algorithm

The algorithm theory of the trampoline simulation model first appeared in the 90s of last century; at that time trampoline was in the initial stage of development. To better adapt to the development of athletes' muscle strength, the algorithm theory of the trampoline simulation system model was put forward. The so-called algorithm balance strength training simulation, which requires participants to participate in the whole body and mind to play a good role in exercise, improves the entire muscle distribution. The simulation method of balanced training in this algorithm is different from the traditional general physical training simulation, and it needs to make a more precise division for the whole training simulation. Through the training simulation of the central region, the goal of the core balance training simulation is achieved. The so-called core

S.No	Correlation Performance Factor	Load balancing algorithm	
		Static state	Dynamic
1	Characteristic	Compile allocation	Run allocation
2	system overhead	Less	Large
3	Resource utilization	Difference	Good
4	Load tilt	Non-existent	Existence
5	Predictability	Easily	Hard
6	Adaptability	Weak	Strong
7	Reliability	Low	High
8	Response time	Short	Long
9	complexity	Low	High
10	Stability	Good	Difference
11	Cost	Low	High

Table 1. Two Load Types of the Algorithm

refers to the waist, pelvis, and hip joint formation of a whole. is the human body of the intermediate link, specifically below the shoulder joint above the hip, including the pelvic region, including the muscle group back, abdomen and all the muscles of the pelvis, table 1. Core strength is the ability to stabilize the core part of the human body (that is, the shoulder joint to the knee joint), to control the body's center of gravity and to transmit the upper and lower limb strength as the main purpose. The main function of the core strength training simulation is the spinal and pelvic stability of athletes, maintaining the correct body posture, stable centre of gravity, improved body control and balance ability, and improved movement by the core muscles to the limbs and other muscle groups of the energy output, preventive action in injury, which contributes to the improvement of exercise performance. According to the instructions and specifications of each algorithm, the output of the information data for coordinate value information, the model receives the data for digestion processing and finally completes the construction of the entire collection model. To build a platform reasonably, we first consider the choice of static and dynamic load balancing. We do a detailed comparative study of the differences between static and dynamic loads, as shown in the table above.

In the continuous development of foreign countries, a practical training simulation method combining a simulation model with a trampoline training simulation should be formed. According to the analysis of the graph structure and the addition of the algorithm model, we have developed a data transformation model using the algorithm, as shown in Figure 1 below:

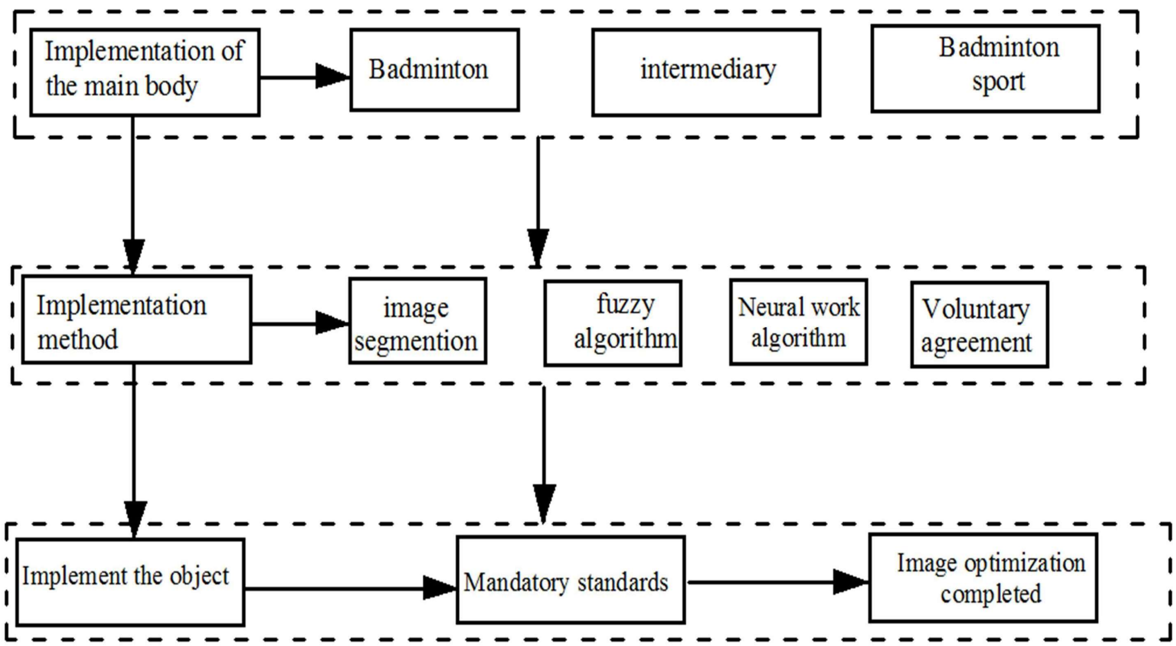

Figure 1. The whole construction model of the simulation system

First of all, the simulation model is based on establishing a high-quality body function movement model based on the above development of muscle strength, and finally, according to the technical characteristics of the trampoline, the development of special action ability. The simulation model is reasonable and effective, which is an effective means to develop muscle group strength balance. To ensure the accuracy of the results, we need to reduce the risk of applying the whole algorithm. So, we construct a corresponding Probabilistic Calculation of XY, assuming $F(X, Y)$, and then input the corresponding training simulation system and get an optimized result Y. The formula model is as follows:

$$(X_i, Y_i), \text{ i} = 1, 2..., \text{n}, X_i \in R^m, Y_i \in Y \quad (1)$$

Using this formula, the minimum value of expected risk can be obtained, and the error can be reduced to the minimum.

$$R(\omega) = \int L(Y, F(X, \omega))\, df(X, Y) \quad (2)$$

Using the formula, I make the corresponding prediction function, in which the set of prediction numbers is expressed OBJ, the corresponding function relation is established for these data, and the corresponding difference sequence is obtained. If we encounter the corresponding classification problem, we can take the method of set function, assume *Y* between the region (-1,1), and the loss function follows the formula:

$$L(Y, F(X,\omega)) = \begin{cases} +1, Y = F(X,\omega) \\ -1, Y \neq F(X,\omega) \end{cases} \tag{3}$$

After determining the prediction risk value and the corresponding loss function, we aim at the output probability between the hypothetical system *S* and the simulation system *ST*. Finally, we calculate the corresponding joint probability by integrating the series of risk values. The joint probability can be calculated from the formula (3.2) to minimize the expected risk. Since the joint probability is unknown, it is impossible to compute the *R* directly. However, using the significant number theorem, the arithmetic mean can be used according to the known training simulation sample set:

$$R_{emp}(\omega) = \frac{1}{n}\sum_{i=1}^{n} L(Y_i, f(X_i\omega)) \tag{4}$$

After the theory of the whole algorithm is determined, we can insert the corresponding algorithm according to the corresponding risk dimension according to the need. The algorithm is an essential basis for solving the problem; we must strictly control the effectiveness of the training simulation and prevent the error sequence of the algorithm leads to incorrect training simulation results. After adding the corresponding algorithm foundation to our training simulation model, the training simulation planning is more reasonable, and the risk caused by the training simulation is also reduced to the lowest.

3.2. Data Overlapping Based on Choreography Algorithm

We have made a preliminary design for the algorithm. To make the classification of the management data more apparent, we add the choreography algorithm based on the two variables. By adding two variables, we can better achieve the classification of data coding, as shown in the following chart, which is the variable table of two variables; we manage data risk control, and two variables play a data adjustment role.

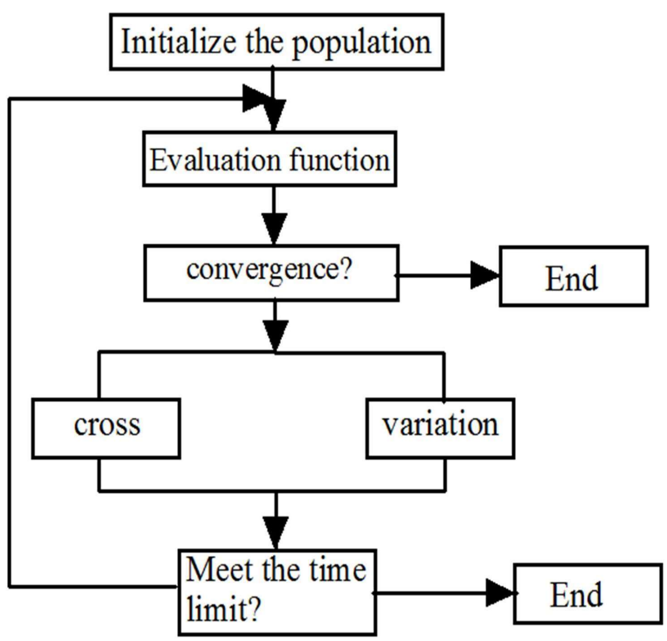

Figure 2. The influence graph of data after adding the algorithm

“What is the difference between the symmetric two variables and the asymmetric two variables? “If the two states have the same value and weight, then the two variables are symmetric: two values or no priority. The similarity based on symmetric two variables is called constant similarity; when some or all of the encoding of the two variables changes, the calculation results will not change. For constant similarity, the most famous factor for evaluating the dissimilarity between two objects ***i*** and ***j*** are the simple matching coefficient, which is defined as follows:

$$d(i,j) = \frac{r+s}{q+r+s+t} \tag{5}$$

If the output of the two states is not equally important, then the two variables are asymmetric, for example, the positive and negative results of the examination. The similarity based on such variables is called a non-constant similarity. For the non-constant similarity, the corresponding evaluation system is adopted. In the calculation, the negative number of matches is not considered important; it ignored the student current expansion of all nodes and the recent expansion node in the slipknot point list; to seek the optimal general value and resource problem two binary trees and to find the shortest path problem that is general in the child node in the tree, cut those could not produce viable (or optimal) node. To control the height of the trampoline training simulation, the height difference adjustment of the simulation system is carried out by using the data:

The principle and formula of the discrete point terrain elevation calculation system adopt the principle of inverse distance weighting method and elevation interpolation calculation to realize the elevation calculation of the discrete points. Firstly, we can use the most straightforward "inverse distance weight" interpolation method.

$$F(x,y) = \sum_{i=1}^{n} w_i f_i; \tag{6}$$

N: surround (x, y) peripheral to define the number of its Z values.

$$w_i = \frac{h_i^{-p}}{\sum_{j=1}^{n} h_j^{-p}}; \tag{7}$$

$$Z = \frac{\sum_{i=1}^{n} \frac{1}{(D_i)^p} Z_i}{\sum_{i=1}^{n} \frac{1}{(D_i)^p}}; \tag{8}$$

p: index is usually set to 2

h: The distance between the interpolation point and known point i .

Finally, the location of the discrete points is determined according to the position of the interpolation.

$$h_i = \sqrt{(x-x_i)^2 + (y-y_i)^2} \text{ or} \tag{9}$$

$$h_i = \sqrt{(x-x_i)^2 + (y-y_i)^2 + (z-z_i)^2};$$

h: The distance between the interpolation point and known point i .

Distance between interpolation points and farthest points of R .

We construct the computational model according to the rigorous derivation process. The basis of the data algorithm is based on the analysis of the whole trampoline simulation system, including the corresponding basic components and the functional support provided by each module. We focus on the data of each module to the database function, which will be paired up as an essential reference point but also provide a basic guarantee for the subsequent algorithm. In addition, using data algorithms also broadens the application range of data algorithms, making it difficult for scholars to study and calculate in the future.

4. Result Analysis and Discussion

After creating a 3-*D* model, giving material and setting light source and viewpoint (camera), the system can browse dynamically at any time, make 3*D* photorealistic rendering or animation, and use rendering effect graphs to reflect the effect of light and shadow and texture to test the feasibility of the algorithm. We set up sub-items according to the simulation module of the trampoline $I = \{I_1, I_2, I_3, I_4, I_5, I_6, I_7, I_8, I_9, I_{10}\}$, and we established the candidate set $C1$ according to the confidence and confidence degree of each item, which can be obtained from Table 2 below.

Items	*A*1	*A*2	*A*3	*A*4	*Z*1	*Z*2	*Z*3	*Z*4	*E*1	*E*2
Support	2%	5%	11%	7%	2%	4%	15%	4%	14%	11%
Confidence%	6.7	25	31.4	46	10	230	30	40	20	36

Table 2. Candidate Set $C1$

According to the requirements of support and confidence, we exclude some irrelevant items. To improve the efficiency of the data search, the minimum support *minsupport* = 5% and the minimum confidence *minconfidence* = 25% are obtained according to the actual situation. In 3*D CAD*, the difficult problem is real-time dynamic 3*D* browsing of large capacity and large volume models, display card application systems with high performance and low cost, mature interface language based on hardware accelerated such as Open *GL*, Direct 3*D*, and through the complexity of 3*D* fast triangulation, solves the large capacity rapid dynamic entity the display problem. At the same time, the smooth processing of the specific 3D mesh surface also greatly reduces the data processing. The system uses the triangle and triangle fan provided by Open *GL* to reduce the records on the repeating nodes and reduce the nodes of the stereotyped objects. At the same time, the smooth processing of the specific 3*D* mesh surface also greatly reduces the data processing and has a noticeable effect in practical applications.

Secondly, in the process of falling athletes, the body is not a straight drop, but with the fall of body posture and movement adjustment. Only by adjusting the angle of each joint can the whole gravitational potential energy be converted into the elastic potential energy of the net surface when the bed player is in contact with the net surface. At the same time, with the foot on the net surface effectively, athletes can get more from the game of the height. Lower limb joint changes in the scheduling algorithm *Qiaoqiao software* can give accurate movement of athletes, including 15 joint and knee joint and ankle, respectively, as shown in the figure.

By observing the joint angle change, the angle intersection of the left and right joints was inconsistent. During the jump, the players can move the joints with skills, knee joints, and joint forces on the joints. We observed that the collective force of the right lower limb is more significant than that of the lower left. The joint force of the right lower limb is gradually increased with the posture adjustment, reaching the maximum value of 300*N* after the contact with the mesh and then gradually decreasing. In the joints of the left lower limb, the force of the joints is about 550*N*, and there is no significant change. The knee joint force is in contact with the network in front of a small straight 1050*N*, and after contact with the net surface, it rapidly increases to 1600*N*.

Finally, we use the node to calculate the coding, and finally, based on the increase of nodes on the impact of the entire algorithm processing model. We also selected the result of the foreground aperture sequence to draw the scatter plot, as shown in the diagram.

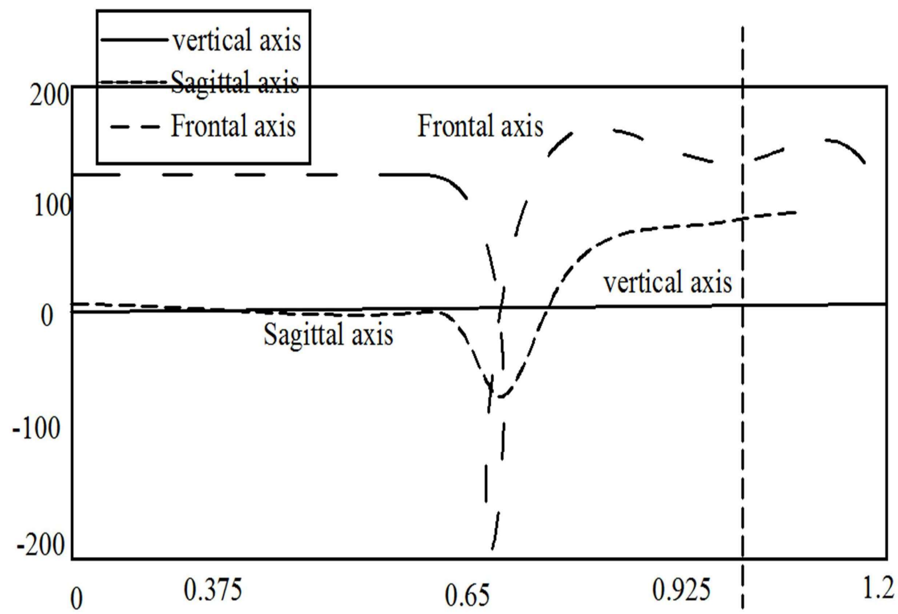

Figure 3. Let athletes' lower limb joint changes

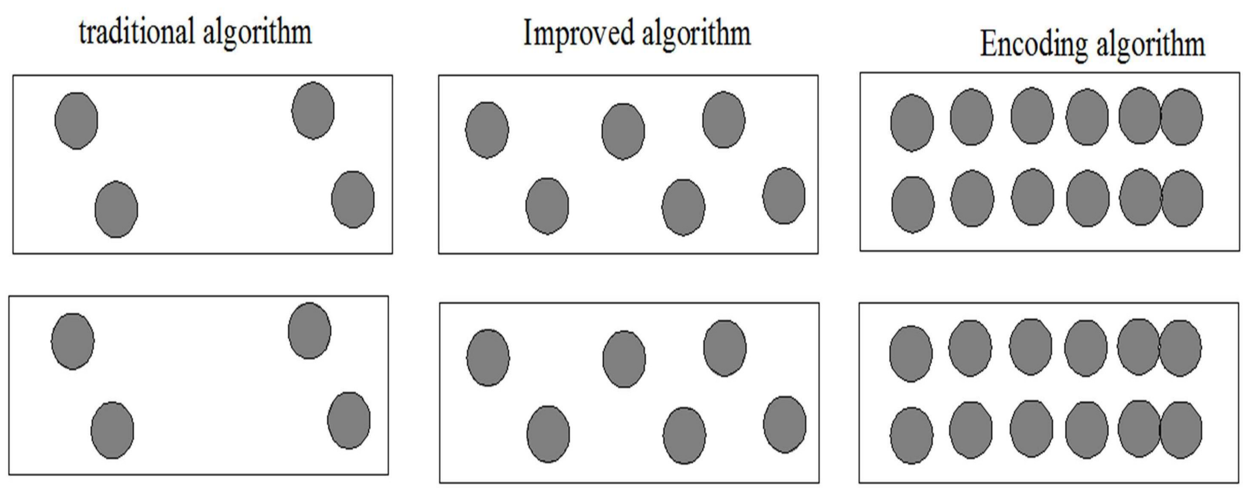

Figure 4. Node change test diagram

Each point in Figure 4 represents the specific segmentation result of the image content. The distribution of the points reflects the effect of the experiment, and the scatter diagram can directly reflect the comprehensive impact of the index. The more concentrated the point is, the more ideal the experiment effect is. It can be seen from Figure 4 that most of the segmentation techniques proposed in this paper focus on the right corner region, and the validity of this technique is verified again. The improvement effect of this algorithm is particularly significant. Further analysis shows that this is due to the multi-character code update strategy and the multi-feature synthetic similarity, designed to adapt to the global illumination changes and richer in the two sequences. A custom dataset containing three clusters is used to evaluate the algorithm. The algorithm runs repeatedly 100 times, and its accuracy reaches 98%. Therefore, the algorithm designed in this paper can be effectively calculated. Since the algorithm runs in the *MPI* cluster environment, it can improve the overall speed of the algorithm by changing the number of Slave processes responsible for executing the algorithm when computing the larger data set. Our results further show that the whole method has a substantial reference value and can be used to predict the different test values. It solves the relevant factors to explore and provides further guidance.

5. Conclusion

With the continuous development of trampolines, the demand for trampoline simulation systems increased. Therefore, this paper put forward the layout algorithm of a digital 3*D* trampoline simulation system. First, build a 3*D* trampoline simulation system. In this system, the data overlapping system to the scheduling algorithm is the core of the simulation system and has more relevance. In a further study, I have added a scheduling algorithm based on the binary variable to make the classification of data management more obvious. In the process of the algorithm testing, we first test the confidence of the whole algorithm and get the minimum support *minsupport* = 5%, minimum confidence *minconfidence* = 25%, and prove a good confidence interval. Then, test the variation of lower limb joint *Qiaoqiao scheduling algorithm software* can give an accurate description of the athletes based on the good performance of the simulation algorithm, run repeatedly 100 times, its accuracy reaches 98%; our results further show that the method has a strong reference value, can use different test values for the prediction process the corresponding. Therefore, the algorithm designed in this paper can be effectively calculated. However, in the study of this article, it is not necessary to make a reasonable plan for the training of athletes, which should be paid more attention to in the future research.

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