Research on Data Mining of Sports Wearable Intelligent Devices Based on Big Data Analysis

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Traditional motion data mining models have some problems, such as poor dynamic data capture effect, low information classification effect rate, poor quantitative representation effect, and so on. Based on this, this paper studies the mining method of dynamic motion data based on neural network, constructs a data mining model based on discrete dynamic modeling technology, and realizes the collection of data information from the aspects of motion characteristics and types combined with multilayer sensors. Neural network algorithm is used for comprehensive analysis to realize multivariate analysis and objective evaluation of all data of dynamic motion process and accurate analysis and evaluation according to different data characteristics of different types of motion data. The results show that the data mining model based on discrete dynamic modeling technology and wearable sensor technology has the advantages of high feasibility, high intelligence, and wide application range.

1. Introduction

According to relevant materials, although the multilevel data collection system can generally be realized through stack analysis technology, in order to realize the function of real-time matching between the data collection system and the outside world, intelligent wearable devices are still indispensable, so the sensor technology related to intelligent devices is still irreplaceable [1]. According to relevant surveys, at present, more than 50% of data mining models mostly use static modeling methods in the process of design optimization [2]. However, in data mining technology, static mining process actually accounts for only 10%–20%, and most of the rest need to use dynamic capture technology [3]. These problems lead to a great reduction in the speed and accuracy of data mining. Therefore, using pure static data capture technology to establish data mining model is always not conducive to the development of data mining technology [4]. Due to the increasingly large data set and the increasing number of internal dynamic nodes faced by data mining, the controllability and predictability of each node are not high, and it is difficult to judge and determine the wrong data mining node. Therefore, it is necessary to conduct dynamic simulation analysis on the dynamic nodes of the database [5]. Based on this, this paper proposes a motion data mining model based on discrete dynamic modeling technology of large data complex systems.

Aiming at the problems of low data capture efficiency, low data storage efficiency, and low data classification efficiency of current data mining models, this paper studies the data mining model scheme using discrete dynamic modeling technology and sensor technology, which is mainly divided into four parts. Chapter 1 introduces the research background and the overall framework of this study; Chapter 2 introduces the research status of data mining models. In Chapter 3, a motion data mining model based on discrete dynamic modeling technology and sensor technology is constructed. The multilayer perceptual neural network factor method is used to construct the evaluation index system of data capture effect and data classification effect analysis mode of data mining. In Chapter 4, the quantitative indexes of data capture effect and classification effect of the
data mining model constructed in this paper are experimentally analyzed and verified, and a conclusion is drawn. Compared with the data mining model with static motion data capture as the main research object established by the traditional static model establishment method, the innovation of this paper is to apply the discrete dynamic modeling technology to the motion data mining model. On this basis, it can make full use of a large number of dynamic motion data and extract appropriate motion data feature information. Achieve the integrity approach at the simulation level, quantitatively describe the coincidence degree of quantitative representation eigenvalues, multidimensional vocal music analysis mode similarity, and expected evaluation indicators of different performance processes with multitransformed neural network factors, and complete the ranking of the impact of the model on data capture effect and data classification effect with quantitative indicators. It can efficiently analyze the factors affecting the efficiency and accuracy of data mining.

2. Related Work

Although domestic data mining models have been developed for several years, there are still some deficiencies in the establishment, operation, and upgrading of sports data mining models in China compared with some more developed countries [6]. Likillershuang et al. proposed an automatic capture data mining model based on fuzzy neural network algorithm. By summarizing and analyzing the logic bottom layer and principle of various data capture technologies, they can capture different data types in different ways. Hierarchical capture can also be realized in the capture process [7]. Bakon et al. found that the establishment of most scientific research data mining models still follows the traditional establishment ideas, ignoring that the same type of motion data will show two different forms in dynamic and static. Therefore, the traditional research-based static data mining model can not achieve the optimal state of data capture efficiency and accuracy [8]. Zhou et al. have proved through experiments that the classified data capture method can play a good role in differential learning, effectively improve the mining efficiency of big data, and use a number of indicators to evaluate the data capture ability of the model [9]. According to the traditional establishment mode and practical experience of data collection system in the general sense, Oestreich et al. found that the current data mining model has the problems of great difficulty in capturing and positioning in the process of implementing dynamic data capture. Therefore, they developed a new intelligent data capture technology based on deep learning [10]. Kundri et al. finally established a new data mining system by logically analyzing, adjusting, and summarizing different data mining models. The mining system can realize delayed capture and real-time feedback of motion data. Experiments show that the data mining model established by this method can realize static segmentation of dynamic motion. It solves the problem that it is difficult to obtain dynamic data [11]. Scholars from Daraz et al. put forward a new data mining model establishment method based on multirelationship recommendation algorithm according to the multifactor relationship theory in philology, analyzed the correlation of different modules in the traditional data mining model, and established a double factor analysis model [12]. Yan et al. comprehensively evaluated the data mining model database of a university from the aspects of the selection of storage database structure, content classification, and database storage capacity and realized the simulation of the working process of the model database by capturing different types of data [13]. The research results of Barral-Arca et al. show that the “data outside” interaction model established based on discrete dynamic modeling technology is better than the traditional interaction model in terms of motion data information acquisition ability [14]. In order to improve the acquisition efficiency of motion data and the maximum utilization of storage space, Biswas et al. finally classified different data types into various data models through various research and analysis of different motion data, so as to avoid storing duplicate data and increase the data collection efficiency [15]. Reysandrade et al. have verified this through repeated practice. The final results show that the establishment method based on discrete modeling technology can improve the data capture efficiency of data mining model and the effectiveness of correcting data. It is suitable for external continuous R&D planning of motion data and finding the optimal data structure scheme [16]. Henderson et al. proposed a new multifactor based mass motion data model and database establishment method and used the multidimensional spatial frame sequence to redistribute the data packets of each layer of the original motion database, so as to realize the optimal determination of multiple mining methods in the process of motion data capture [17]. The experiment of GUI et al. has been verified by practice for many times. The results show that the establishment scheme of discrete data mining model has good data collection effect and is also suitable for online feedback of various types of data systems [18].

To sum up, it can be seen that most of the current data mining models do not involve the application of big data discrete dynamic modeling technology combined with intelligent wearing equipment in sports data mining [19]. On the other hand, although China has done more theoretical analysis and research on the establishment method of data mining model, there is room for progress in the actual achievement transformation, and there is no actual establishment of various types of motion data models [20].

3. Establishment Method of Sports Data Mining Model of Sports Wearable Intelligent Device Based on Big Data Analysis

3.1. Application of Discrete Dynamic Intelligent Device Based on Big Data Analysis
traditional biology in the process of neural network [22]. Discrete dynamic modeling technology is based on neural network algorithm [23], combined with the correlation degree between information and fast capture of dynamic data in motion [24]. As a practical, efficient, and robust dynamic data mining system, discrete dynamic modeling technology has developed very rapidly in recent years and has been applied in many fields [25].

Based on this, in the motion data mining model based on discrete dynamic modeling technology and sensor technology, this paper first designs the dynamic modeling technology, that is, through the change difference and real-time feedback of dynamic motion data, combined with neural network factors, to realize the rapid capture of dynamic data. Then, a series of motion data represented by intelligent sensor technology in various sports are accurately divided, so as to realize the high classification of different quality data in various sports, produce the goal of strong synergy and correlation, push it to the process to be optimized in the next stage, and realize quantitative data capture effect evaluation.

3.2. Construction of Motion Data Mining Model Based on Discrete Dynamic Modeling Technology and Sensor Technology. In the data analysis process of constructing the motion data mining model based on discrete dynamic modeling technology, different types of motion patterns are classified by multilayer perceptron. At the same time, the cooperative similarity of motion forms is also studied in this paper. And then the different motion data are divided twice in the analysis process. Select different types of motion data for secondary division and update to ensure the stratification and update of effect analysis and management of different types of motion data. The data processing process is shown in Figure 1.

The steps are as follows:

In the first step, the data mining node coding strategy is selected to transform the parameter set (feasible solution set) into a multilayer sensor structure in multilayer sensors. In order to realize this process, this study combines a new motion data structure conversion method based on multifactor coupling model, randomly scrambles the common data contents and data structures by using the deformed coupling sequence, and then decouples them, so as to realize the optimal determination of the conversion process schemes of different types of motion data structures, and carries out simulation verification. It is verified that the optimal scheme has good data capture and conversion ability. In this process, the simulation results of the relationship between the number of iterative analysis and the coupling level sensors are shown in Figure 2.

3.2.1. Analysis and the Coupling Level Sensor. As can be seen from Figure 2, in the process of processing different data groups and average values under the discrete dynamic modeling technology, with the increase of the number of iterative analyses, the change laws of sensors at different coupling levels are also obvious and similar (controlled within a certain range). Among them, the coupling sequence data groups that are not optimized and deformed increase with the increase of the number of iterations. The operation efficiency of the coupled hierarchical sensor is low (the maximum value is only 0.6), while the operation efficiency of the hierarchical sensor corresponding to the sequence data group optimized and deformed is high (the maximum value is 0.9), which is the result of the discrete dynamic modeling technology following the rule of classifying the data before operation in the process of processing the data.

The expressions of perception function $Q(x)$, dimension function $W(x)$, and level function $E(x)$ used in this process are

$$Q(x) = \frac{x(x + 1)}{(x + 3)(x + 9)}$$
$$W(x) = \frac{(x - 3)\sqrt{x^2 + 1}}{x + 3}$$
$$E(x) = \frac{4x^3 + 2x + 1/x^{-1} + 2)((x + 3)(x^2 + 1)/x^{-1} + 3)}{x + 1 + x^{-1}}$$

(1)

$x$ is the original input data. In the process of data collection for different sports in this stage, the simulation analysis results of the relationship between different numbers of sensors and the number of data mining nodes are shown in Figure 3.

It can be seen from Figure 3 that under the discrete dynamic modeling technology and different sports modes, with the increase of the number of wearable sensors, although the number of data mining nodes changes differently in the analysis of different database groups, the change rules are also different, among which the change of basketball data and football data is the most obvious. The change of football is the least obvious, because the sports data form specific vector matrix groups according to different data division principles and methods, and these matrices are composed of different vector groups. These vector groups have different vector eigenvalues according to the similarity of the system's analysis ability for different types of motion data, so as to realize the storage and processing of the same motion type analysis process, according to the division and classification of data and the existing level of data into spatial vectors and digital information. In this process, the processed data needs secondary analysis and then the expressions of the corresponding secondary perception.

Function $Q'(x)$, truth matching function $R(x)$, and effect analysis function $T(x)$ are

$$Q'(x) = \frac{x + 1}{6x^2 + 2x + 1}\frac{x(x + 1)}{(x + 9)^2}$$
$$R(x) = \frac{9x^2 + 2x + x^{-1}}{8x^2 + 6x + 7}$$
$$T(x) = \frac{4x^2 + 3x + 1}{(x + 5)(3x + 2 + 3x^{-1})}$$

(2)
Figure 1: Data analysis process of sports data mining model based on discrete dynamic modeling technology.

Figure 2: Simulation results of the relationship between the number of iterative analyses.

Figure 3: Simulation analysis of the relationship between different numbers of sensors and the number of data mining nodes under big data analysis strategies.
x is the original input data. In this stage, the simulation analysis results of the relationship between analysis strategies and analysis quality factors of different sports data in different dimensions are shown in Figure 4.

It can be seen from Figure 4 that under the discrete dynamic modeling technology, with the increase of dimensions in the analysis strategy, there are obvious differences in the change law of analysis quality factors in the process of analyzing different data information (4 groups of data types: 2 groups of sports training data and 2 groups of daily training data). This is because the dynamic modeling technology used by different studies in processing these similar pieces of information is based on the classification and summary of different data captured in different types of motion, so as to realize the secondary division of different types of motion data of the same type.

The second step is to define the data mining node function to calculate the fitness value of the function. We take a motion data sequence \( s = (c_1, c_2, \ldots, c_m, c_{m+1}) \) that conforms to the algorithm rules as an individual. The reciprocal of the sum of distances between adjacent objects in this sequence can be used as the data mining node of the corresponding individual \( s \) to calculate the degree, so the data mining node function is

\[
    f(s) = \sum_{i=1}^{n} \frac{6s_i + 1}{\sqrt{s_i^2 + 1}}
\]

The basic implementation process of this step is to encode the data element of the dynamic motion data individual \( s = (c_1, c_2, \ldots, c_m, c_{m+1}) \). The variation results of layer 1, layer 2, layer 3, and layer 4 were as follows:

\[
    s_1 = \sum_{i=1}^{n} (B, A, C, B, C, A)^n,
\]

\[
    s_2 = \sum_{i=1}^{n+1} (A, C, B, C, B, A)^{n+1},
\]

\[
    s_3 = \sum_{m+1}^{2m+n} (C, B, A, A, B, C)^{m+n+1},
\]

\[
    s_4 = \sum_{3m+n}^{4m+n} (A, A, B, C, C, B)^{m+n}. \tag{4}
\]

\((A, B, C)\) is the different variation rule. \( m \) and \( n \) are dimension information.

We then perform the conventional recursive or neighborhood operation in the dynamic modeling technology algorithm, such as exchanging the last three bits; then the mutation results under the mutation factors of layer 1, layer 2, layer 3, and layer 4 are, respectively,

\[
    s'_1 = \sum_{i=1}^{n} (B, A, C, B, C, A)^n,
\]

\[
    s'_2 = \sum_{i=1}^{n+1} (A, C, B, C, B, A)^{n+1},
\]

\[
    s'_3 = \sum_{m+1}^{2m+n} (C, B, A, A, B, C)^{m+n+1},
\]

\[
    s'_4 = \sum_{3m+n}^{4m+n} (A, A, B, C, C, B)^{m+n}. \tag{5}
\]

The simulation analysis results of the relationship between variation factors at different levels and effect evaluation index factors in this stage are shown in Figure 5.

It can be seen from Figure 5 that under the dynamic modeling technology, with the increase of the level of variation factors, in the process of analyzing different data information, the effect evaluation capture index factors show the law of fluctuating rise and change in varying degrees, and the rise speed of three-dimensional dynamic data group is the fastest. Among the three groups of data, when the variation factor reaches 100, the capture index factor of effect evaluation is basically in a stable state, which is caused by the collection operation of multiple capture data in the same spatial position stage.

After compensating the hierarchical variation factor, the simulation analysis results of the relationship between the hierarchical variation factor and the analysis rate evaluation factor at this time are shown in Figure 6.

It can be seen from Figure 6 that under the dynamic modeling technology, with the increase of the level in the variation factor, in the process of data analysis of three groups of different data information, the analysis rate evaluation factors show different change laws, in which the three-dimensional data groups are basically in a steady state. Among the three groups of data, when the variation factor
reaches 160, the analysis rate evaluation factor is basically in a stable state in a certain range. This is because, during the quantitative analysis of motion data, some irrelevant or meaningless data information needs to be deleted or removed purposefully and recorded in the form of vectors to form a special data information record. The data information is converted into vector information and stored in and out. For example, when the classification of similar data information is required, the comparison can be carried out according to these vectors with the function of recording special data information. When the coincidence degree meets the preset requirements, the data processing, judgment classification of the target data can be realized.

4. Result Analysis and Discussion

4.1. Simulation Experiment and Data Analysis. A motion data mining model based on complex system discrete dynamic modeling technology and sensor technology can realize more accurate evaluation and analysis of the differences and characteristics of different types of motion data. Therefore, before the experiment, in order to reduce the interference of random factors, it is necessary to make the consistency hypothesis of non-core factors. The formation algorithm is used to control the formation and cooperation of network nodes, so as to achieve the purpose of full energy saving. This paper studies the dynamic motion data mining method based on neural network, constructs the data mining...
model based on discrete dynamic modeling technology, and combines multilayer sensors to collect data information from motion features and types.

In the experimental design link, this evaluation model can carry out feature monitoring when obtaining the feature information of different types of motion data and then extract the feature information from the monitored data. Further, through the research on the motion types and collected data of various sports, and finally through the data analysis of dynamic detection and experimental process, compared with the eigenvalues of standardized analysis mode, the capture effect evaluation in core indicators is realized. The data processing and analysis flow during the experiment is shown in Figure 7.

In the evaluation link, the dynamic and static characteristic information of the stored motion data will be stored, so as to further comprehensively evaluate the capture quality of different motion data patterns collected in the later stage, so as to intelligently analyze the data mining model established by this technology.

According to the multiple impact indicators, the optimization and high-quality formulation of the analysis mode scheme of each motion unit can be realized, the data recording of each data type can be quickly improved, and then the intelligent recording of different motions can be realized. The motion data mining model analyzes the four indicators (motion type, action feature, data evaluation, and mining effect) of the first group of objects and the second group of objects. The experimental analysis results of deep recursive processing of big data analysis at different levels are shown in Figure 8.

It can be seen from Figure 8 that under the discrete dynamic modeling technology, under three different maximum values of single recorded data (100/200/300), the evaluation efficiency of experimental data also changes significantly with the increase of the number of big data analysis levels, because in the process of big data analysis, the accumulated data group dimension will become larger with the increase of levels. Therefore, it will increase the maximum dimension of single data analysis in the process of data mining and increase the rate of single data processing, so the
overall evaluation efficiency will be reduced, and the overall data analysis completion degree is gradually increasing (the analysis completion degree is the cumulative value after quantifying the analysis proportion corresponding to each level).

4.2. Experimental Results and Analysis. Comparing results of evaluation objective indexes of data mining model combining discrete dynamic modeling technology and intelligent wearable sensor technology after quantification of discrete dynamic modeling technology, the comparison of efficiency index quantization factors of result data analysis in the experimental process is shown in Figure 9.

As can be seen from Figure 9, the effective feature extraction effects of different methods on motion data are different, and they all show an upward trend in varying degrees, but the upward range is different. Compared with the current mainstream static data modeling and analysis method with iterative optimization algorithm as the core and the “analysis while storing” data modeling and analysis method with “stack in stack out” optimization algorithm as the core, the discrete dynamic modeling and analysis method based on multilayer perceptual network strategy has the smallest error and the highest accuracy, and the error can be controlled within the effective range in less than 8 times of analysis, so the discrete dynamic modeling technology has better data capture stability.

According to the experimental results of this study and the analysis results of Figures 8 and 9, the improvement of data capture effect and classification effect of a random action (the extraction process is between 20% and 80% from the spatial location center, and the random number is used for irregular extraction) is taken as the control experimental object. The level of data capture effect and classification effect at the beginning of one action is medium (ranking outside 75.3% of the comprehensive level), and the level of comprehensive analysis of the other action is upper and lower (ranking within 20%–80% of the comprehensive level in this group). Through the application of multiple motion data mining models based on discrete dynamic modeling technology and intelligent sensing technology, it is found that the data capture effect and data classification effect of the experimental group and the control group have been greatly improved, and the ranking of comprehensive analysis effect in the group has increased from 75.3% to 30.1%. In addition, the ranking of the comprehensive analysis effect in the classification effect has increased from less than 15.4% to less than 12.8%. This shows that the data mining model based on discrete dynamic modeling technology and sensor technology can quantitatively evaluate and multidimensionally analyze the data capture and data classification of motion and has practical significance for the innovation and application of current motion data mining model.

5. Conclusion
In order to improve the capture effect of motion data, the innovation of data mining model in China is imperative. Based on this, this paper constructs a motion data mining model by using discrete dynamic modeling technology and sensor technology. Firstly, three characteristic parameters related to motion data analysis are selected, and a model evaluation system based on motion data capture effect is proposed. The model is evaluated from many angles through the research on the motion types, motion characteristics, data evaluation, and mining effect in the analysis process. The neural network algorithm is used for comprehensive analysis to realize the multivariate analysis and objective evaluation of all data in the process of dynamic motion, and the accurate analysis and evaluation are carried out according to the different data characteristics of different types of motion data. The results show that the data mining model based on discrete dynamic modeling technology and wearable sensor technology has the advantages of high feasibility, high intelligence, and wide application range. However, this study does not analyze the data capture effect and classification effect for specific types of motion, so it can be deeply studied in the scope of application and customized analysis.

Data Availability
The data used to support the findings of this study are available from the corresponding author upon request. The research data used to support the findings of this study are included within the article.

Conflicts of Interest
The authors declare that they have no conflicts of interest.

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