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Design of the Sports Training Decision Support System Based on the Improved Association Rule, the Apriori Algorithm

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ABSTRACT
In order to improve the judgment decision ability of the sports training effect, a design method of the sports training decision support system based on the improved association rule, the Apriori algorithm is proposed, and a phase space model of the sports training decision support data association rule distribution is constructed. The association rule mining method is used to support the data mining model of sports training, and the decision judgment of the sports training effect is carried out in the mixed cloud computing environment. The fuzzy information fusion and the data structure feature reorganization method is adopted, and the adaptive scheduling and information fusion of the sports training decision support data are realized. The judgment ability of the sports training decision support has improved, and the algorithm design of the sports training decision support system is carried out by using the association rule, the Apriori algorithm. The adaptive resource scheduling and feature recombination are used to improve the Apriori algorithm of the association rules. According to the results of the Apriori feature extraction of the association rules, the decision of the sports training is judged. The simulation results show that this method is used to design the sports training decision support system, which has a good mining performance and strong decision judgment ability for the sports training decision support vector set, and it has a good effect on the sports training decision making.

KEY WORDS: Association rules; Apriori algorithm; mining; sports training decision.

1 INTRODUCTION

WITH the development of the artificial intelligence theory and data mining technology, the support system decision for college students' sports training develops continuously. Through the data mining of the college students' physical fitness and training, the rules used to assist the decision-making are produced and then a corresponding training plan for college students' physical training is developed. In the system, the association rule, the Apriori algorithm based on data mining is used to classify students with different characteristics (Gu Q, Yuan L, Xiong Q J, et al., 2011). However, the traditional association rule, the Apriori algorithm consist of a problem of a multi-value tendency, so the selection of split attributes is not in line with objective facts. In the process of a constructing tree, it is necessary to sort and scan the data sets from top to bottom numerous times, which leads to low efficiency of the algorithm. How to improve the algorithm to make the classification more accurate is a problem we need to solve urgently (Mao W T, Tian Y Y, Wang J W, et al., 2016).

The association rule mining is a very important topic in data mining. As its name implies, it is to discover the possible association or relation between things from behind the data. The first is to discover the relationship between different commodities in the supermarket trading database. The purpose of this paper is to find out the potential relationship between data items. The information extracted from the data items will help people to grasp and predict the rules of development of the industry, and to make a better development plan and avoid risks. The most famous association rule mining algorithm is the Apriori algorithm, which is a probabilistic association rule algorithm that can be implemented from less to more (Guo H P, Zhou J, Wu C A, Fan M, 2018). Searching for maximal frequent sets from simplicity to complexity, the Apriori algorithm mainly uses the

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downward closed attribute. If an item set is a frequent itemset, then its non-empty subset must be a frequent itemset. The 1-frequent item sets are generated first, then the 2-frequent item sets are generated by the 1-frequent item sets, then the 3-frequent item sets are generated according to the 2-frequent item sets, and so on, until all frequent item sets are generated. Finally, the association rules that meet the requirements are found from the frequent item set (Wu Hong-hua, Mu Yong, Qu Zhong-feng, Deng Li-xia, 2016). The grey relational analysis is a method of quantitative description and comparison of the development and change situation of a system. The analysis takes in account the correlation between various factors, which is more reasonable and scientific than the method of comparison of factors commonly used in the system analysis. At the same time, considering that the curve of the sinusoidal function is relatively mild, the problem of the information gain factor correction will not be excessive. Therefore, this paper introduces the sinusoidal value of the grey correlation degree as the correction factor of the Apriori algorithm, and puts forward a design method of the sports training decision support system based on the improved association rule, the Apriori algorithm (Bi Anqi, Dong Aimei, and Wang Shitong, 2016). Begin construction of the phase space model of the sports training decision support data association rule distribution, adopt the association rule mining method to carry on the sports training support data mining model and carry on the decision judgment of the sports training effect under the mixed cloud computing environment. Adoption of the methods of the fuzzy information fusion and data structure feature reorganization is completed. The adaptive scheduling and information fusion processing of the sports training decision support data are realized, and the ability of the sports training decision support judgment is improved. The algorithm of the sports training decision support system is designed by the association rule, the Apriori algorithm, and adaptive resource scheduling and feature reorganization are adopted. Finally, the simulation experiment is carried out and it shows the superior performance of this method in the realization of the sports training decision support (Jiang Y Z, Chung F L, Wang S T, et al. 2015).

2 THE FRAME MODEL OF THE DECISION SUPPORT SYSTEM FOR SPORTS TRAINING

ACCORDING to the characteristics of the MIS at present, it is necessary to synthesize, classify and analyze the data in different information systems at a higher level, that is, to establish the DW (Data Warehouse). Based on the DW, on-line analytical processing and data mining are carried out, which provides the basis for scientific decision making. The DWN OLAP and the DM are three independent and interrelated technologies (FU Z, SUN X, LIU Q, et al.2015). The DW consist of data organization and storage technology, which comes from the development of the database technology (BI Anqi, WANG Shitong, 2016). It is composed of the basic data, historical data, synthetic data and metadata. The DW provides decision information such as comprehensive analysis, time trend analysis and so on. OLAP is a technique for analyzing multidimensional data. Since a large amount of data is concentrated in a multidimensional space, the OLAP technology provides analytical data from multiple perspectives to obtain the auxiliary decision data required by users (Liu Jun, Liu Yu, He You, Sun Shun, 2016). The DM uses a series of methods to mine, analyze, identify and extract hidden and potentially useful information from the database or the DW data, and uses these techniques to assist the decision-making (MI Jie, ZHANG Peng, YU Haipeng, 2016).

They assist the decision making from their own different perspectives. The DW is the foundation, and OLAP and DM are the two different analytical tools (Xue Jingying, Ni Xiaoyong, 2015). According to the characteristics of the sports training, the DW OLAP DM is adopted to construct the decision support system. Based on the above situation, the structure of the sports training decision support system is shown in Figure 1.

3 THE DATA MINING AND FEATURE EXTRACTION OF THE DECISION SUPPORT FOR SPORTS TRAINING

3.1 The Data Mining of the Decision Support for Sports Training

THE data mining technology refers to the knowledge that people are interested in extracting data from large databases and data warehouses, which includes hidden and unknown potential useful information in advance. It is a combination of database technology, artificial intelligence, machine learning, statistical analysis, fuzzy logic and artificial neural networks. The object of data mining is not only a structured database but also a semi-structured hypertext file or even and unstructured multimedia data. Data mining in a data warehouse will be the mainstream of the data mining technology. From a technical point of view, the basic process of the data mining is divided into four main stages: The data preparation, mining operation, result representation and interpretation. In the data preparation, stage, we integrate data from multiple operational data sources, resolve the semantic fuzziness, and deal with the missing and clean dirty data. The mining stage is a process of the hypothesis generation, synthesis, correction and verification propagation, which is also the core of the above three stages. The process of data mining is shown in Figure 2. The main input in the

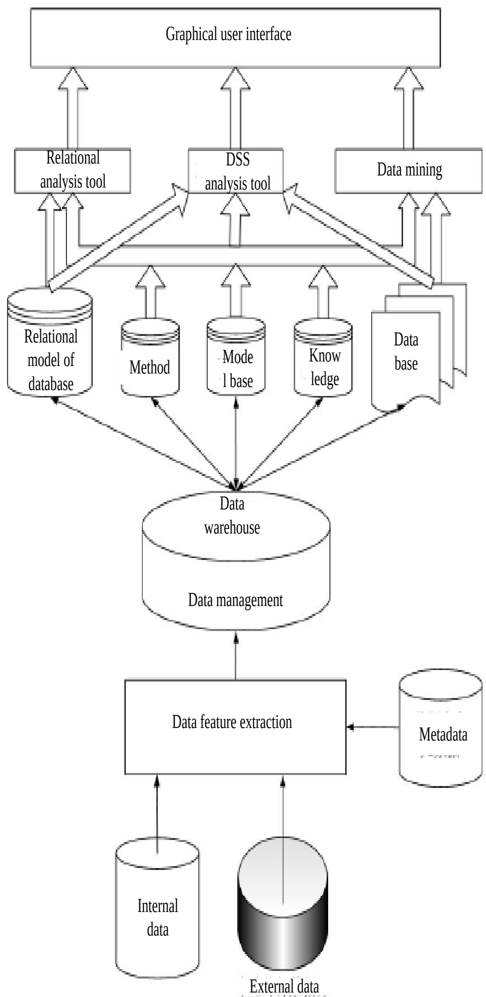

Figure 1 **Framework of the Sports Training Decision Support System.**

data mining system is the data from the data warehouse, the guidance of the instructor and the knowledge and experience in the knowledge base of the data mining system. The data selected from the data warehouse in the knowledge discovery engine provides large numbers of extraction algorithms in the engine. In order to generate auxiliary patterns and relationships, some discoveries also need to be added to the knowledge base for subsequent extractions and evaluation (Zheng Bifang, Gu Xufei,2016).

The data mining process of the decision support for the sports training is as follows(Mezhuyev, V; Gunchenko, Y; Shvorov, S, 2020):

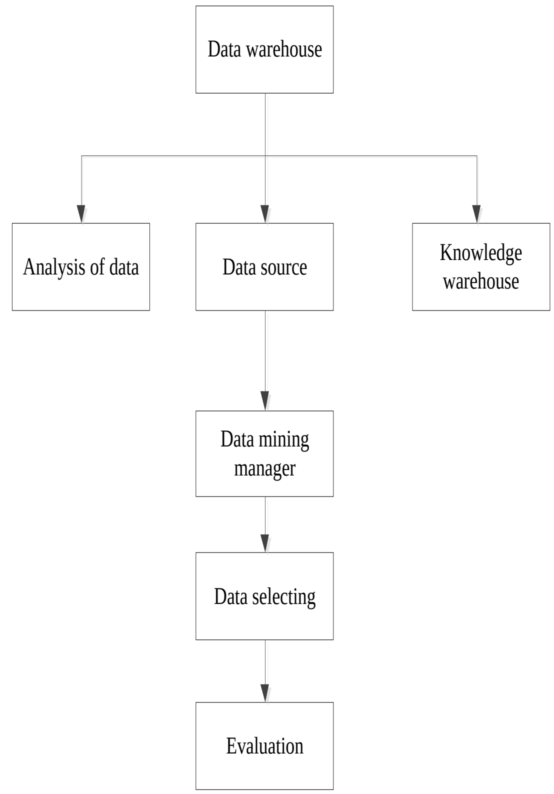

Figure 2 **The Data Mining Process.**

When calculating the grey correlation degree between each characteristic attribute and the category attribute, determines the root node of the decision tree by using the Apriori algorithm of the association rules, then selecting the force with the greatest information gain as the split attribute using the SVD easily finds the least-squares solution of the sports training decision support (Shen Wei, Wynter L, 2012), and the decomposes the decision matrix X of the sports training decision support by the singular value decomposition:

$$\mathbf{X} = \mathbf{U}\boldsymbol{\Sigma}\mathbf{V}^T \tag{1}$$

The $n \times m$-dimension is $\mathbf{X}$, and the rank is r. In the large-scale sports training decision support problem, the association rule mining method is used to decompose the feature and recombine the frequent item sets without losing the generality. Considering the rank loss of the sports training decision support vector set, that is $r < m$, then $\boldsymbol{\Sigma}$ can be expressed as (Rao C S,Reddy K C K,Rao D S, 2012):

$$\boldsymbol{\Sigma} = \begin{bmatrix} \boldsymbol{\Sigma}_1 & \mathbf{0} \\ \mathbf{0} & \mathbf{0} \end{bmatrix} \tag{2}$$

where, $\boldsymbol{\Sigma}_1 = diag(\delta_i), i = 1, 2, \cdots, r$, the correlation matrix $\mathbf{U}$ and $\mathbf{V}$ of the sports training decision support are decomposed into:

$$\mathbf{U}=[\mathbf{U}_1 \quad \mathbf{U}_2], \mathbf{V}=[\mathbf{V}_1 \quad \mathbf{V}_2] \tag{3}$$

Using the adaptive iterative method, the fuzzy cost function of the sports training decision support is constructed as follows:

$$\begin{aligned}\min_{\beta}\|\mathbf{Y}-\mathbf{X}\boldsymbol{\beta}\| &= \min_{\beta}\|\mathbf{U}^T\mathbf{Y}-\boldsymbol{\Sigma}\mathbf{V}^T\boldsymbol{\beta}\| = \min_{\beta}\left\|\begin{bmatrix}\mathbf{U}_1{}^T\\ \mathbf{U}_2{}^T\end{bmatrix}\mathbf{Y}-\begin{bmatrix}\boldsymbol{\Sigma}_1 & 0\\ 0 & 0\end{bmatrix}\begin{bmatrix}\mathbf{V}_1{}^T\\ \mathbf{V}_2{}^T\end{bmatrix}\boldsymbol{\beta}\right\| = \min_{\beta}\left\|\begin{bmatrix}\mathbf{U}_1{}^T\mathbf{Y}-\boldsymbol{\Sigma}_1\mathbf{V}_1{}^T\boldsymbol{\beta}\\ \mathbf{U}_2{}^T\mathbf{Y}\end{bmatrix}\right\|\\ &= \min_{\beta}\left\{\|\mathbf{U}_1{}^T\mathbf{Y}-\boldsymbol{\Sigma}_1\mathbf{V}_1{}^T\boldsymbol{\beta}\|+C\right\}\end{aligned} \tag{4}$$

where C is independent of β, and different students are added to different types according to the model, namely:

$$\min_{\beta}\|\mathbf{Y}-\mathbf{X}\boldsymbol{\beta}\| = \min_{\beta}\|\mathbf{U}_1{}^T\mathbf{Y}-\boldsymbol{\Sigma}_1\mathbf{V}_1{}^T\boldsymbol{\beta}\| \tag{5}$$

The mathematical classification model of the decision support for the sports training is constructed, and the least square solution of the degree of the support function is obtained as follows:

$$\boldsymbol{\beta}^* = \mathbf{V}_1\boldsymbol{\Sigma}_1{}^{-1}\mathbf{U}_1{}^T\mathbf{Y} \tag{6}$$

The singular value decomposition is used to solve the cost function of the sports training decision support. The matrix is composed of $\mathbf{Y}\to\mathbf{U}_1{}^T\mathbf{Y}$, $\mathbf{X}\to\boldsymbol{\Sigma}_1\mathbf{V}_1{}^T$, and the environment and rules of a certain decision process can be described by a definite model or language, and the scale of operation is reduced by the iterative method (Shi Hai-yan, Wang Wan-liang, Kwok N M, et al. 2012). The data mining regression analysis model of the sports training decision support is constructed, which includes:

$$N_{i1}=N_{i2}=\cdots=N_{i,p(i)-1}=L$$
$$N_{ip_i}=N(i)-(p(i)-1)L$$

Using the decision support system to support the decision, the $\mathbf{Y}(i)$ is decomposed into the $p(i)$ submatrix $N_{ij}\times 1$ with the size of $\mathbf{Y}_{ij}$, which is (Robertson S, Bartlett J D, Gastin P B. Red, Amber. 2017):

$$\min_{\beta}\|\mathbf{Y}(i)-\mathbf{X}(i)\boldsymbol{\beta}\| = \min_{\beta}\left\|\begin{bmatrix}\mathbf{Y}_{i1}\\ \mathbf{Y}_{i2}\\ \vdots\\ \mathbf{Y}_{ip(i)}\end{bmatrix}-\begin{bmatrix}\mathbf{X}_{i1}\\ \mathbf{X}_{i2}\\ \vdots\\ \mathbf{X}_{ip(i)}\end{bmatrix}\boldsymbol{\beta}\right\| \tag{7}$$

The database is scanned again, the entries sorted in each transaction according to the support size in the F-List, and singular value decomposition is performed for the j sub design matrix $\mathbf{X}_{ij}$:

$$\mathbf{X}_{ij}=\mathbf{U}_{ij}\boldsymbol{\Sigma}_{ij}\mathbf{V}_{ij}{}^T \tag{8}$$

The closed frequent item mining algorithm based on the MapReduce is used to obtain the decomposition matrix of the sports training decision support system, which is respectively described as $\boldsymbol{\Sigma}_{ij}^{'}$, $\mathbf{U}_{ij}^{'}$, $\mathbf{U}_{ij}^{''}$, $\mathbf{V}_{ij}^{'}$ and $\mathbf{V}_{ij}^{''}$. The closed frequent item mining algorithm based on the MapReduce is used for the data mining of the sports training decision support (Roveri M I, Manoel E D J, Onodera A N, et al. 2017).

3.2 The Feature Extraction of the Data Association Rules in the Sports Training Decision Support

The phase space model of the sports training decision support data association rule distribution is constructed, and the statistical variable of the sports training decision judgment is obtained as (Li Y. 2015):

$$\mathbf{Y}(i+1)=\begin{bmatrix}\mathbf{U}_{i1}^{'}{}^T\mathbf{Y}_{i1}\\ \mathbf{U}_{i2}^{'}{}^T\mathbf{Y}_{i2}\\ \vdots\\ \mathbf{U}_{ip(i)}^{'}{}^T\mathbf{Y}_{ip(i)}\end{bmatrix} \tag{9}$$

$$\mathbf{X}(i+1)=\begin{bmatrix}\boldsymbol{\Sigma}_{i1}^{'}\mathbf{V}_{i1}^{'}{}^T\\ \boldsymbol{\Sigma}_{i2}^{'}\mathbf{V}_{i2}^{'}{}^T\\ \vdots\\ \boldsymbol{\Sigma}_{ip(i)}^{'}\mathbf{V}_{ip(i)}^{'}{}^T\end{bmatrix} \tag{10}$$

The Parallel FP-Growth mining is carried out on the

Processed data (Kaiyong X U, Gong X, Cheng M. 2016):

$$\min_{\beta}\|\mathbf{Y}(i)-\mathbf{X}(i)\boldsymbol{\beta}\| = \min_{\beta}\|\mathbf{Y}(i+1)-\mathbf{X}(i+1)\boldsymbol{\beta}\| \tag{11}$$

Recalculation of the information gain of this attribute to obtain is:

$$\min_{\beta}\|\mathbf{Y}(i)-\mathbf{X}(i)\boldsymbol{\beta}\| = \min_{\beta}\left\|\begin{bmatrix}\mathbf{Y}_{i1}\\ \mathbf{Y}_{i2}\\ \vdots\\ \mathbf{Y}_{ip(i)}\end{bmatrix}-\begin{bmatrix}\mathbf{U}_{i1}\boldsymbol{\Sigma}_{i1}\mathbf{V}_{i1}\\ \mathbf{U}_{i2}\boldsymbol{\Sigma}_{i2}\mathbf{V}_{i2}\\ \vdots\\ \mathbf{U}_{ip(i)}\boldsymbol{\Sigma}_{ip(i)}\mathbf{V}_{ip(i)}\end{bmatrix}\boldsymbol{\beta}\right\| \tag{12}$$

Assume that $\mathbf{U}(i)=diag(\mathbf{U}_{ij}), j=1,2,\cdots,p(i)$, is using the multi value bias correction method to carry on the sports training decision support, make decision judgments of the sports training effect under the mixed cloud computing environment (Cheng M, Xu K, Gong X. 2016), and the decision function $\mathbf{U}(i)$ is still the orthogonal matrix.

$$\min_{\beta}\|\mathbf{Y}(i)-\mathbf{X}(i)\boldsymbol{\beta}\| = \min_{\beta}\left\|\begin{bmatrix}\mathbf{Y}_{i1}\\ \mathbf{Y}_{i2}\\ \vdots\\ \mathbf{Y}_{ip(i)}\end{bmatrix}-\mathbf{U}(i)\begin{bmatrix}\boldsymbol{\Sigma}_{i1}\mathbf{V}_{i1}{}^T\\ \boldsymbol{\Sigma}_{i2}\mathbf{V}_{i2}{}^T\\ \vdots\\ \boldsymbol{\Sigma}_{ip(i)}\mathbf{V}_{ip(i)}{}^T\end{bmatrix}\boldsymbol{\beta}\right\| = \min_{\beta}\left\|\mathbf{U}(i)^T\begin{bmatrix}\mathbf{Y}_{i1}\\ \mathbf{Y}_{i2}\\ \vdots\\ \mathbf{Y}_{ip(i)}\end{bmatrix}-\begin{bmatrix}\boldsymbol{\Sigma}_{i1}\mathbf{V}_{i1}{}^T\\ \boldsymbol{\Sigma}_{i2}\mathbf{V}_{i2}{}^T\\ \vdots\\ \boldsymbol{\Sigma}_{ip(i)}\mathbf{V}_{ip(i)}{}^T\end{bmatrix}\boldsymbol{\beta}\right\| = \min_{\beta}\left\|\begin{bmatrix}\mathbf{U}_{i1}{}^T\mathbf{Y}_{i1}-\boldsymbol{\Sigma}_{i1}\mathbf{V}_{i1}{}^T\boldsymbol{\beta}\\ \mathbf{U}_{i2}{}^T\mathbf{Y}_{i2}-\boldsymbol{\Sigma}_{i2}\mathbf{V}_{i2}{}^T\boldsymbol{\beta}\\ \vdots\\ \mathbf{U}_{ip(i)}{}^T\mathbf{Y}_{ip(i)}-\boldsymbol{\Sigma}_{ip(i)}\mathbf{V}_{ip(i)}{}^T\boldsymbol{\beta}\end{bmatrix}\right\| \tag{13}$$

Then using the methods of the fuzzy information fusion and the data structure feature recombination, we arrive at:

$$\min_{\beta}\|\mathbf{Y}(i)-\mathbf{X}(i)\boldsymbol{\beta}\| = \min_{\beta}\left\|\begin{bmatrix} \mathbf{U}_{i1}^{'\,T}\mathbf{Y}_{i1}-\boldsymbol{\Sigma}_{i1}^{'}\mathbf{V}_{i1}^{'\,T}\boldsymbol{\beta} \\ \mathbf{U}_{i2}^{'\,T}\mathbf{Y}_{i2}-\boldsymbol{\Sigma}_{i2}^{'}\mathbf{V}_{i2}^{'\,T}\boldsymbol{\beta} \\ \vdots \\ \mathbf{U}_{ip(i)}^{'\,T}\mathbf{Y}_{ip(i)}-\boldsymbol{\Sigma}_{ip(i)}^{'}\mathbf{V}_{ip(i)}^{'\,T}\boldsymbol{\beta} \end{bmatrix}\right\| = \min_{\beta}\|\mathbf{Y}(i+1)-\mathbf{X}(i+1)\boldsymbol{\beta}\| \tag{14}$$

The number of rows of the sports training decision vectors $\mathbf{X}(i+1)$ and $\mathbf{Y}(i+1)$ are known as:

$$N(i+1)=\sum_{j=1}^{p(i)} r_{ij} \tag{15}$$

Because $r_{ij} \le m < N_{ij}$, $N(i)=\sum_{j=1}^{p(i)} N_{ij}$, the association rule set of the sports training support system is determined, and the sports training decision and support statistics are realized (Pan H, Xue C, University S M. 2016).

4 THE SPORTS TRAINING DECISION SUPPORT SYSTEM OPTIMIZATION

THIS paper constructs a phase space model of the sports training decision support data association rule distribution and adopts the association rule mining method to carry on sports training support data mining model and the sports training effect decision under the mixed cloud computing environment. In this paper, the fuzzy information fusion and data structure feature reorganization are used to realize the adaptive scheduling and information fusion processing of the sports training decision support data (Singh S K, Kumar P. 2016). In this paper, the Apriori algorithm of the association rules is used to carry out the sports training decision support. The number of Gaussian distributions of state K_j^m in m chain, which is represented by S_j^m , and $w_{j,k}^m$. The weight of the k-th Gaussian distribution of state $\mu_{j,k}^m$ in m chain, $\sum_{j,k}^m$ is the average distribution of state S_j^m in the m chain, respectively. The grey correlation between each characteristic attribute and the category attribute is calculated as follows (Liu L, Yu S, Wei X, et al. 2018):

$$b_j^m(\mathrm{o}_t^m)=\sum_{k=1}^{K_j^m} w_{j,k}^m b_{j,k}^m(\mathrm{o}_t^m)=\sum_{k=1}^{K_j^m} w_{j,k}^m N(\mathrm{o}_t^m,\mu_{j,k}^m,\textstyle\sum_{j,k}^m) \tag{16}$$

The training sample set described by the multiple attributes, and the candidate attribute set, the AttributeSet, and the Reversed viterbi algorithm train to produce parameter set λ, then inputs the observation sequence of the sports training decision support test set data. According to the Viterbi algorithm, we arrive at the hidden sequence (Yuan X. 2017). The hidden state probability distribution of the sports training decision support data is:

$$\widehat{a}_1(\mathrm{i})=P(o_1^{\bar{m}},q_1=S_i\mid\lambda)=\pi_i b_{i_{\bar{m}}}^{\bar{m}}(\mathrm{o}_1^{\bar{m}}) \tag{17}$$

The information gain of each attribute in the Attribute set is calculated (Feng D, Zhu L, Zhang L. 2017), and attribute A with the maximum information gain and the most valued attribute B are selected, and the probability of the recursive missing data is (Li J S, Qin S J. 2017):

$$\begin{aligned} \widehat{a}_t(\mathrm{j}) &= \mathrm{P}(\widehat{o}_{1:t-1},o_t^{\bar{m}},q_t=S_j\mid\lambda)\widehat{a}_t(\mathrm{j})=\mathrm{P}(\widehat{o}_{1:t-1},o_t^{\bar{m}},q_t=S_j\mid\lambda) \\ &= \sum_i P(\widehat{o}_{1:t-1},\mathrm{q}_{t-1}=\mathrm{S}_i\mid\lambda)P(\mathrm{o}_t^{\bar{m}},\mathrm{q}_t=\mathrm{S}_j\mid\mathrm{q}_{t-1}=\mathrm{S}_i,\lambda) \\ &= \sum_i \widehat{a}_{t-1}P(\mathrm{q}_t=\mathrm{S}_j\mid\mathrm{q}_{t-1}=\mathrm{S}_i,\lambda)P(\mathrm{o}_t^{\bar{m}}\mid\mathrm{q}_t^{\bar{m}}=\mathrm{S}_{j_{\bar{m}}}^{\bar{m}},\lambda) \end{aligned} \tag{18}$$

The methods of the fuzzy information fusion and the data structure feature recombination is taken, and the missing data of the sports training decision support are expressed as follows:

$$P(O\mid\lambda)=\sum_i P(\widehat{o}_{1:T},\mathrm{q}_t=\mathrm{S}_i)=\sum_i \widehat{a}_T(\mathrm{i}) \tag{19}$$

The most important attribute of the information gain is selected from the Attribute set (Yang J, Huang H, Jin X. 2017), and the mathematical model of the multi-objective close degree for constructing the sports training decision support data is expressed as follows (Yin Y J. 2017):

$$\begin{aligned} &\max \quad \Theta_{Q_i}=\frac{a_{Q_i}}{a_{Q_i}+c_{Q_i}} \\ &\max \quad \Theta_{E_i}=\frac{a_{E_i}}{a_{E_i}+c_{E_i}} \\ &\max \quad \Theta_{C_i}=\frac{a_{C_i}}{a_{C_i}+c_{C_i}} \\ &S.t. \quad Q_i \ge Q_{th} \\ &\qquad E_i \ge E_{th} \\ &\qquad C_i \le C_{th} \\ &\qquad Q_{jk}\ge 0, E_{jk}\ge 0, C_{jk}\ge 0 \\ &\qquad \sum_{j=1}^{Nj} x_{jk}=1,\forall i,1\le k\le M,1\le j\le N_j \end{aligned} \tag{20}$$

Taking the explanatory variable of the sports training decision support as the optimization objective, Θ is called the closeness degree, and it is the objective function based on the relative certainty. Among them, Θ_{Q_i} is the closeness degree of the decision support for the sports training. Θ_{E_i} is the contribution of the decision support for the sports training,. Θ_{C_i} is the degree of the quality opposition and a_{Q_i} is the same degree of efficiency. Under the constraint of the multi-value bias problem, the decision function is obtained as follows:

$$b_j(O_t) = \prod_{m=1}^{n} b_{j_m}^m(o_t^m) = \prod_{m=1}^{n} P(o_t^m \mid q_t^m = S_{j_m}^m) \quad (21)$$

In the mixed cloud computing environment, the decision of the sports training effect is obtained, and the intra class dispersion D_{ic} and inter class dispersion D_{ac} are obtained.

$$D_{ic} = \frac{\sqrt{\frac{1}{m}\sum_{j=1}^{m}(df_i(t) - \overline{df_i(t)})^2}}{\frac{m}{\sqrt{m-1}}\overline{df_i(t)}} \quad (22)$$

$$D_{ac} = \frac{\sqrt{\frac{1}{n-1}\sum_{i=1}^{r}(df_i(t) - \overline{df(t)})^2}}{\overline{df(t)}} \quad (23)$$

The semi-structured decision method is used for the pattern recognition and the structural distribution rearrangement of the decision support system:

$$\hat{h}(t) = f(d_{ij})\sum_{i=1}^{M} h_i^{'}(t) * h_i(-t) \quad (24)$$

The decision-making process is described by the deterministic model and language, and the unstructured and semi-structured decision of the sports training is realized (Feng X, Yang Q, Li J, et al. 2016). In the mixed cloud computing environment, the decision judgment of the sports training effect is carried out. The method of the fuzzy information fusion and the data structure feature reorganization is used to optimize the design of the sports training decision support system. The four steps of the decision are described as follows (Lu H, Setiono R, Liu H. 2017):

(a) Discover the problem and form the decision goal, including establishing the decision model, drawing up the scheme and determining the measure of the effect, which is the starting point of the decision-making activity.

(b) The probability of quantifying the outcomes of each scheme.

(c) The decision-makers make quantitative evaluations of the outcomes, which are generally expressed quantitatively by the utility values. The utility value is the quantitative estimate of the value of various outcomes made by the decision makers according to the factors of the individual ability, experience, style and environmental conditions.

(d) By synthetically analyzing all aspects of the information, the final decision is made on the choice of the scheme, and sometimes the sensitivity analysis of the scheme is also made to study the influence of the original data on the optimal solution, and to determine the parameter range, which has a great influence on the scheme.

5 THE ANALYSIS OF SIMULATION EXPERIMENT

IN order to verify the application performance of this method in the decision support judgment of the sports training, the simulation experiment is carried out. SPSS 14.0 software is used to design the experiment, combined with the Matlab simulation analysis. Ten basketball training students' sample set is selected as the theory. Each student has four attributes, each of which is power, height, flexibility, and speed. Each student record indicates; the weak dwarf difference fast in 2010 00007, slow in high in 2010 00008, and slow in 2010 0010. The strength is strong, and the weak, quantization is {0,1}; height is high, middle and short are quantized as {0,1,2}. The flexibility is good, average, difference quantifies {0,1,2}; speed is fast, slow quantization is {0,1}. According to the sample data of the training set, the grey correlation degree between each characteristic attribute and the classification attribute is calculated according to the formula in turn. The result is: r (strength = 0.52, r (height = 0.72), r (flexibility = 0.78, r (velocity = 0.56), and then the information gain of the above attribute is calculated by the Apriori algorithm as; Gain =0.4816, Gain =0.0275, Gain =0.0588, Gain =0.0368, and Gain=-0.2196. According to the above parameter setting, the simulation of the sports training decision support is carried out, and the results of recall test of the association rule mining is obtained as shown in Figure 3 and the recall test results are shown in figure 4.

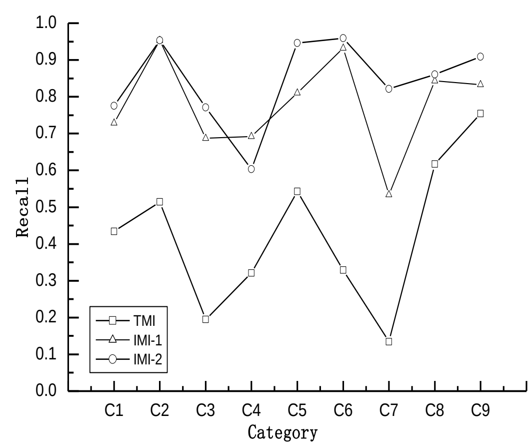

Figure 3. Recall Test Results.

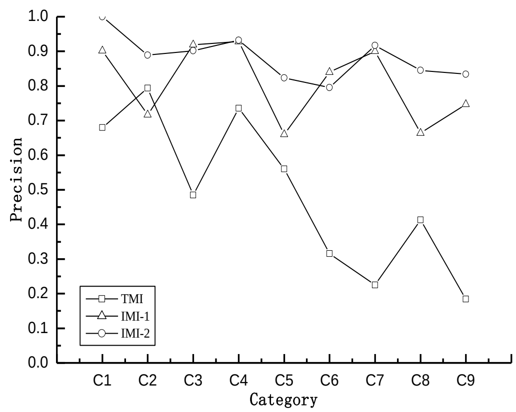

Figure 4. **The Precision Contrast.**

The results of Figure 1 and Figure 2 show that the improved association rule, the Apriori algorithm improves the recall and accuracy of the sports training decision by using the improved association rules. The flexibility is chosen as the split attribute, which conforms to the objective fact, and avoids the strength of the multi value but the non-optimal attribute and the classification of the students is classified by the training set. Through the above model, we predict the newly added students, and then add different students to different types according to the model. After putting the characteristics of the different students into the corresponding user library, the teacher understands the students' information in a timely manner and provides different students based on it. The decision support for the same teaching strategy.

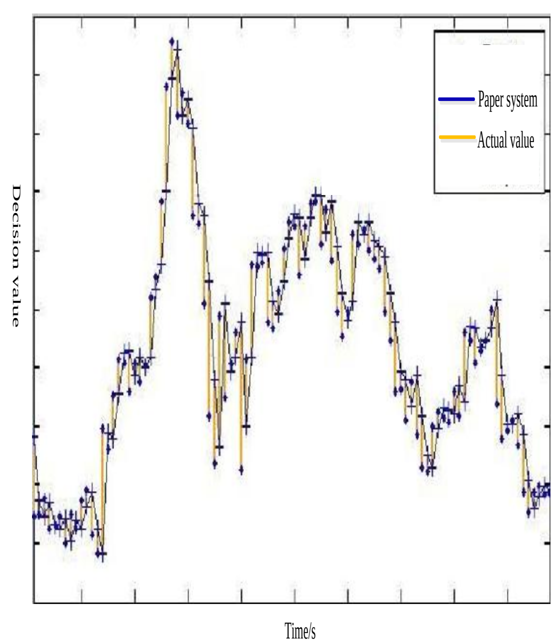

Figure 5. **The Comparison between the Decision Value and the Actual Value of the System.**

According to Figure 5, the design method of the sports training decision support system presented in this paper is in accordance with the actual situation, which shows the superiority of the proposed decision support system.

6 CONCLUSIONS

IN this paper, a design method of the sports training decision support system is proposed based on the improved association rule, the Apriori algorithm, and a phase space model of the sports training decision support data association rule distribution is constructed. The association rule mining method is used to support the data mining model of the sports training, the decision judgment of the sports training effect is carried out in the mixed cloud computing environment, and the fuzzy information fusion and the data structure feature reorganization methods are adopted. The adaptive scheduling and information fusion of the sports training decision support data are realized, and the judgment ability of the sports training decision support is improved. The algorithm design of the sports training decision support system is carried out by using the association rule, the Apriori algorithm. Adaptive resource scheduling and the feature recombination are used to improve the Apriori algorithm of the association rules. According to the results of the Apriori feature extraction of the association rules, the decision of the sports training is judged. The simulation results show that this method is used to design the sports training decision support system, which shows good mining performance and strong decision judgment ability for the sports training decision support vector set, and it shows a good effect on the sports training decision making.

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