Research on Resource Allocation Optimization of Information Management System Based on Big data Association Mining

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Abstract: Aiming at the problem that the resource allocation accuracy of information management system in cloud computing environment is not high, the resource allocation method of information management system in cloud computing environment is improved and designed. A resource allocation algorithm of information management system is proposed based on big data association mining. The information of resource distribution in information management system is fused and reconstructed according to the key words and semantic association features, and then the feature extraction of association rules of information management system resources in cloud computing environment is carried out. The extracted association rules are used for big data training set to allocate the resources of information management system, and big data association mining and adaptive scheduling method are used for adaptive optimization control of resource allocation. The simulation results show that this method can improve the resource allocation accuracy of information management system, the anti-interference ability of resource allocation, and the efficiency of resource utilization and information management.

1. Introduction

With the development of computer information processing technology, management information system has been more and more widely used in various industries. Information management system is a system which uses computer hardware, software and office equipment to collect, transmit, store, process, maintain and use information through computer network. It can help high level decision-making, middle level control and basic level operation to help enterprises increase income, improve information management and scheduling ability, and improve the efficiency of resource retrieval[1]. With the development of large resource distribution information technology and cloud computing technology, a large number of information resources are stored in cyberspace through information management systems and databases. The efficient and optimal management of information management system resources can improve the information retrieval experience and the recognition of information management software. It has great significance to study the optimization method of information management system resource allocation[2].

The resource allocation optimization problem of information management system is a resource combination optimization problem with continuous variables and discrete variables, which belongs to the research field of optimal power flow problem. Traditionally, the greedy algorithm and genetic algorithm are used to allocate the resources of information management system. Using the advantage of greedy algorithm, the initial resource allocation solution space of the structure is obtained. Because of the characteristics of the algorithm, the space scale is minimized[3]. Genetic algorithm is used to optimize the initial solution space to improve the efficiency. The research of resource allocation algorithm in information management system is based on the time series analysis and information...
processing of the resource information flow[4]. Based on the feature extraction and time series feature fitting of the resource information flow, the corresponding information scheduling algorithm is combined. The optimal allocation of resources in the information management system is realized. In reference [5], an information resource load balancing scheduling algorithm based on fuzzy cyclic stack control for information management system in cloud computing environment is proposed to design the storage of information resource load data stack in information management system under cloud computing environment. Based on extracting semantic ontology features of information resource load data flow in information management system, the information resource scheduling of information management system based on mobile cloud resources is carried out. The advantage of this method is that it has better anti-interference ability and convergence performance. But the computation cost of this method is high, and the real-time performance is not good[6].

Aiming at the above problems, a resource allocation algorithm of information management system based on big data association mining is proposed. Firstly, the information of resource distribution in information management system is fused and reconstructed according to the key words and semantic association features, and then the feature extraction of association rules of information management system resources in cloud computing environment is carried out. The extracted association rules are used for big data training set to allocate the resources of information management system, and big data association mining and adaptive scheduling method are used for adaptive optimization control of resource allocation. Finally, a simulation test is carried out to demonstrate the superior performance of this method in optimizing the resource allocation ability of information management system.

2. Resource information preprocessing in information management system

2.1. Information fusion of information management system resources

In order to realize the resource allocation of information management system in cloud computing environment, information fusion is needed to reduce the computing cost of resource allocation. The adaptive feature segmentation model is used to reconstruct and segment the data features of the resource database of the information management system, the redundant information features are removed, so as to improve the positioning accuracy of the resource information retrieval and mining.

In the resource storage area of information management system $D$, the information fusion is carried out according to the key words and semantic association features of the information management system resources, and the semantic features of the information management system resources under the cloud computing environment are constructed and collected. According to the playing environment and the popularity of the information management system resources, the grid model of the resource distribution interval is constructed[7]. The state distribution structure of the resource storage in the information management system satisfies the $A_1 \cup A_2 \cup \cdots \cup A_k = A$, in which $i, j = 1, \cdots, m$ and $i \neq j$. Thus, the decision tree model is used to construct the feature access control model for information retrieval and mining in information management system, which is described in figure 1.

![Decision tree model for access control of information management system resources.](image)
According to the decision tree model shown in figure 1, it is necessary to create an empty node root as the root node in the information management system resource information fusion. The branch structure model of information fusion is created at the parent node of the matching node, and the additional storage space of the information management system resources is provided through the rule data set to match the nodes[8]. The search node is a root node. The leaf node B: 0.7 is used as the starting node for information fusion. The candidate data items obtained at the parent node of the matching node are as follows: BC, BD, BCD, BA, BCA, BDA, BCDA, node C: 0.8 is used as the search node, and obtains the adaptive probability distribution of information fusion is 0.7*0.8=0.56. thus, a compressed UF-tree decision tree model is constructed. The information fusion of information storage space of information management system in cloud computing environment is obtained as:

\[
H_i(x) = \sum_{k=1}^{K} p_i \ln \frac{1}{p_i} = -\sum_{k=1}^{K} p_i \ln p_i
\]

(1)

The feature space sampling data set \(X =\{x_1, x_2, \cdots, x_n\}\), in the resource database of information management system is analyzed based on the result of information fusion of information management system.

2.2. Support degree calculation of information management system resource data item

The minimum cost of performing a mixed scheduling task for a storage replica \(m\) of an information management system resource can be described as

\[
\text{MCC} = \min_{j=1}^{N} C_{ij},
\]

where \(N\) is the number of virtual resources available within the BR scope. According to the frequency and environment of the information management system resources in the information management system resources playing software, resource information phase space reconstruction is carried out, and three parameter vector sets of information management system resource feature reconfiguration distribution \(\alpha\), \(u\), \(\Sigma\) are constructed by using the eigenvector composed of the frequency \(w\) of resource playback in the information management system:

\[
\alpha = [\alpha_1, \alpha_2, \cdots, \alpha_i]
\]

(2)

\[
u = [u_1, u_2, \cdots, u_i]
\]

(3)

\[
\Sigma = \sum_{i=1}^{n} \sum_{j=1}^{n},
\]

(4)

The database is divided into \(P\) blocks and decomposed into vector groups for each generated data item. The weight \(w_{BLCMF}\) of distributed resource scheduling configuration of information management system in cloud computing environment is obtained as follows:

\[
w_{BLCMF} = R^{-1}_y[a_i(\theta_0), C][a_i(\theta_0), C]^\top R_y[a_i(\theta_0), C]^{-1}
\]

(5)

Where, \(a_i(\theta_0)\) represents the time series sampling of the information flow of the information management system, the \(R_y\) denotes the feature of the closed frequent itemsets in the process of the information management system resource playing, and \(C\) represents the information distribution space of the resource mining in the information management system[9]. Thus, the support level of the information management system resource data items is calculated as follows:

\[
F(x_i) = i = \sum_{j=1,j\neq i} x_j r_j(x) p_j^i(x) - \sum_{j=1,j\neq i} x_j r_j(x) p_j^i(x)
\]

\[
= \sum_{j=1} x_j r_j(x) p_j^i(x) - x_i r_i(x)
\]

(6)

In the above formula, \(r_i(x)\) is the fusion degree of the state information of the resource data item in the information management system, and \(x_i\) is the bit feedback coefficient.
3. Improved implementation of resource allocation method

3.1. Feature mining of association rules for information management system resources

In this paper, a resource allocation algorithm of information management system based on big data association mining is proposed to mine the association rules feature of information management system resources in cloud computing environment, and the subspace module of information management system resource fusion \( C = [c_1, c_2, \cdots, c_j] \), uses directed graph model \( G(A), G(B) \) to represent the distributed feature points of information management system resource base in cloud computing environment, \(<x, y>\) is a pair of nodes of A, B, and the fitting model of resource flow of information management system is obtained as follows:

\[
M_v = w_1 \sum_{i=1}^{n_1} (H_i - S_i) + w_2 \sum_{i=1}^{n_2} (S_i - V_i) + w_3 \sum_{i=1}^{n_3} (V_i - H_i)
\]

(7)

The average \( CM_h \) of the load balancing values most suitable for resource allocation and scheduling in information management systems through cloud computing and the \( SCM_h \) of the frequent itemsets of uncertain datasets are represented as follows:

\[
CM_h = \frac{\sum_{i=1}^{N} M_v \times q_j}{r(\eta(u)) + \mu(u) / N}
\]

(8)

\[
SCM_h = \sum_{i=1}^{M} (M_v - CM_h)^2 + \sigma_h w_h
\]

(9)

In the above formula, \( q_j \) is the number of requests for information management system resource access, \( \mu(u) \) indicates the actual number of information management system resource files played, and \( N \) is the number of times of access. According to the support degree of data items, the priority list of information management system resource playing is constructed, and the mining results of association rules feature of information management system resources are obtained as follows:

\[
x(t) = \sum_{i=1}^{n} c_i + r_n
\]

(10)

According to the results of the above feature mining, the extracted association rules feature is trained by big data to allocate the resources of the information management system.

3.2. Implementation of resource allocation based on big data association mining

The probability vector graph assignment method is used to match the feature of association rules, which improves the ability of locating information mining in information management system resource database, and carries out the distribution section of information management system resources according to the result of association rule mining\[10\]. The efficient function \( E(i, j) \) of resource adaptive equalization control in cloud computing environment is described as follows:

\[
E(i, j) = \begin{cases} 
  e_y - e(i, j), & e(i, j) < e_y \\
  e_{\min} - e(i, j), & e(i, j) \geq e_y
\end{cases}
\]

(11)

Set the constraint control weight of the information management system resource library as \( \alpha_1, \alpha_2, \alpha_3, \alpha_4 \), satisfy the control rights of information management system resource allocation. The time function of \( t_i \) the resource information flow node set is:
The iterative update formula of adaptive cascaded list for resource retrieval location under security constraint control is obtained as follows:

\[
T(i, j) = \begin{cases} 
\frac{t_y - t(i, j)}{t_y} & t(i, j) < t_y \\
0 & t(i, j) \geq t_y
\end{cases}
\]

(12)

Where, \( Clustdist(M, M') \), while \((i \neq j, 1 \leq i \leq q, 1 \leq j \leq q)\), with big data association mining, the candidate itemsets and frequent itemsets of information management system resources are mined, and the ability of accurate retrieval and configuration of information management system resources is improved.

4. Experimental test analysis

The simulation experiment of resource configuration of information management system is established on the platform of Hadoop cloud computing. The simulation hardware CPU is Intel® Core™ i7-2600. It uses Matlab simulation tool to carry on mathematical simulation, and combines library information management system resource software to carry on information. Embedded access interface for management system resources and storage of compatible database is used. The software of information management system resources is connected to the Internet by 100m Ethernet. The scale of information fusion of information management system resources is \( r = 1.45 \). Resource distribution of information management system resources sampling sample length of information flow is 1024, bandwidth of 12~24 KHz, time band is 12 ms, information sampling and mining simulation of information management system resources in DeepWeb database are carried out. The result of big data association mining is shown in figure 2.

![Figure 2. Big data association mining results.](image)

The efficiency of resource allocation of information management system is tested by different methods and the results are shown in Figure 3.
Figure 3. Comparison of resource allocation efficiency in information management system.

The information management system resource allocation method designed in this paper and the traditional mining method are used to allocate the information management system resources. The results of the recall comparison are shown in figure 4.

Figure 4. Comparison of resource recall rate in information management system.

The simulation results show that the method proposed in this paper is more accurate in resource allocation of information management system in cloud computing environment, and the recall rate of information is higher than traditional methods.

5. Conclusions

In this paper, the problem of resource allocation and optimal retrieval of information management system in cloud computing environment is studied, and an information management system resource allocation algorithm based on large data association mining is proposed. Feature extraction of association rules from information management system resources, resource allocation of information management system is carried out by taking the extracted association rules as large data training set, and adaptive optimization control of resource allocation is carried out by using large data association mining and adaptive scheduling method to improve the accuracy of resource mining. The experimental analysis shows that the method proposed in this paper can improve the accuracy of resource mining. The information management system resources have higher mining accuracy, better retrieval performance and higher recall rate of resource allocation.

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