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A NEW ALGORITHM OF THE DATA MINING MODEL IN CLOUD COMPUTING BASED ON WEB FUZZY CLUSTERING ANALYSIS

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ABSTRACT

Cloud computing are Internet-based services to increase the use and delivery models, usually involving the Internet to provide easy to dynamically scalable and often virtualized resources. To solve these problems, the proposed web data mining method based on cloud computing: the massive data mining tasks decomposed into parallel processing on multiple servers. Web fuzzy clustering of objects is given Web object collection, object properties of the source data, and its direct role object is a Web fuzzy similarity matrix or the Web, fuzzy equivalent matrix. The paperr presents the new algorithm of the data mining model in cloud computing base on web fuzzy clustering analysis. The experimental results show that this method can effectively improve the performance of data mining.

Keywords: *Fuzzy Clustering, Data Mining, Cloud Computing*

1. INTRODUCTION

Cloud computing is based on the increase in Internet related services, use and delivery models, usually involving the Internet to provide dynamic and easy scalable and often virtualized resources. Cloud network, it is a metaphor of the Internet [1]. In the figure is often cloud said telecommunications network, and later used to represent the Internet and the underlying infrastructure abstraction. Narrow cloud computing refers to the delivery of IT infrastructure and usage patterns, to obtain the necessary resources through the network to demand, and scalable way; generalized cloud computing refers to the delivery of services and usage patterns through the network on-demand, easy to expand The way to get the required services.

Cloud computing is a sea change after a big change in the 1980s mainframe computers to client - server's. In the figure is often cloud said telecommunications network, and later used to represent the Internet and the underlying infrastructure abstraction. Cloud computing describes an Internet-based IT services to increase the use and delivery models usually involve easy to expand via the Internet to provide dynamic and often virtualized resources.

The World Wide Web is a huge, widely distributed, global information service center, covering news, advertising, consumer information, financial management, education, government, e-commerce and many other information services, which includes a rich and dynamic hyperlinks and page views message. Web is a centralized control, absence of a unified structure, integrity constraints, transaction management, non-standard query language and data model, loosely distributed information systems, unlimited expansion of their mining very difficult to obtain knowledge reliable. Internet era, the problem is not difficult to obtain information, but to grasp the hidden behind the truly valuable information from huge amounts of data or users to access information useful knowledge is a breakthrough in the human limit. Web Data Mining to solve this problem that a road.

Data classification, the classification system in the multivariate statistical clustering method, fuzzy clustering analysis in the fuzzy clustering analysis, fuzzy clustering analysis matrix to calculate the fuzzy similarity matrix, and different fuzzy similarity matrix different classification results; even with the same fuzzy similarity matrix, a different the Lanna value will produce different results. "How to determine the validity of the

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classification will become fuzzy clustering and fuzzy.

Web site content is dynamic; a user browses often no clear purpose, with the randomness and fuzziness. See recent important news, browse the pages of interest to understand the market, selling products, "important", "interesting" and "hot" epitaxial distinct concepts are fuzzy. Fuzzy cluster analysis has been widely applied in the economic life and science, fuzzy techniques to analyze Web log data is meaningful. Cloud computing often associated with grid computing, utility computing, autonomic computing confused. Grid computing: a kind of distributed computing, a super virtual computer composed by a group of loosely coupled computer used to perform some tasks; utility computing: a packaging and billing of IT resources, such as in accordance with the calculation, storage separate measurement of costs, like electricity and other public facilities; autonomic computing: self-management capabilities of computer systems. The paper presents the new algorithm of the data mining model in cloud computing base on web fuzzy clustering analysis.

2. THE DATA MINING MODEL OF CLOUD COMPUTING

Cloud security, by definition, is a new term that evolved from a "cloud computing". "Cloud Security Cloud Security" through the mesh of a large number of customer-side software on the network behavior anomaly detection, access to the Internet, Trojans, malicious programs, pushed to the Server side for automatic analysis and processing, and then viruses and Trojan solutions distributed to each client [2]. Cloud computing is Internet - based computing, whereby shared resources, software and information are provided to computers and other devices on - demand, like the electricity grid.

Cloud computing (cloud computing), is an Internet-based method of calculation, this way, the shared hardware and software resources and information on demand for computers and other devices. The cloud is in fact the network, a metaphor of the Internet. The core idea of cloud computing, a large number of unified management and scheduling for network-connected computing resources to form a pool of computing resources on-demand service to users. Provide resources to the network known as the "cloud". Narrow cloud computing refers to the delivery of IT infrastructure and usage patterns, to obtain the necessary resources through the network to demand, and scalable way; generalized cloud computing refers to the delivery of services and usage patterns through the network on-demand, easy to expand The way to get the required services. This service can be the IT and software, Internet-related, but other services.

Cloud computing is in order to software changes mainly in Saas (Software as a Service). The stand-alone installation of the software will gradually cloud computing platform deployment, instead, the user simply can enjoy a fast high-quality cloud services through a web browser, the SME either in the public cloud computing platform cloud services software can also be in the hardware expenses not deploy their own cloud computing platforms in order to achieve high performance, low-cost computing [3]. With cloud computing, a lot of public demand for services will increasingly meet the needs of the public, Pratt & Whitney in various industries, as is shown by equation1.

$$\tilde{V}_{j-1} = V_{j-1} \otimes V_{j-1} = (V_j \oplus W_j) \otimes (V_j \oplus W_j) = (V_j \otimes V_j) \oplus [(V_j \otimes W_j) \oplus (W_j \otimes V_j) \oplus (W_j \otimes V_j)] \quad (1)$$

Data mining is more complex than information search. Massive data processing to achieve high-performance machine or large-scale computing devices, cloud computing-based data mining to better achieve their goals. The cloud computing model has many advantages, low cost, fault tolerance, the calculation speed; convenient program development nodes increase more easily. Can be said that cloud computing is generally applicable to data mining is more ideal computing model, from huge amounts of data to find useful and understandable knowledge of the technical means.

Cloud computing is an Internet-based computing model, public participation, the computing resources (including computing power, storage capacity and interactive capabilities, etc.) is a dynamic, scalable, virtualization, and the way services. : Dynamic cloud computing and scalable computing power and efficient mass data mining has brought the possibility of; cloud computing environment the wisdom of public participation in environment swarm intelligence groups for the study set a new data mining method; cloud calculate the service features of the mass of data mining possible. The same time, the development of cloud computing can not do without the support of data mining to search, for example, cloud computing-based search including web store, search, processing and front-end interaction of three parts. Data mining in these parts have a wide range of applications, such as the web store page to re search

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process in the page ranking and the front-end interactive query suggestions, each of which needs the support of data mining technology.

Through cloud computing, mass data storage and distribution of computing, massive data mining environment for cloud computing provides new ways and means to effectively solve the distributed storage of massive data mining and efficient computing [4]. Carry out data mining method based on cloud computing, more and more complex mass data mining can provide new theoretical and support tools. Extension of cloud computing will drive the Internet and technological achievements in the public service is to promote the depth of information resources sharing and sustainable use of new methods and new ways of traditional data mining.

Order to make the user through a simple development to achieve parallel computing results, the researchers made a series of parallel computing models. Parallel computing model to build a bridge between user needs and the underlying hardware system makes the representation of the parallel algorithm becomes more intuitive and more convenient processing of large-scale data. According to the user to use a different hardware environment, parallel programming model can be divided into multi-core machines, multiple types of GPU computing, mainframe computers and computer clusters, as is shown by equation2.

$$\bigcup_{j=\infty}^{-\infty} V_j^2 = L^2(R^2), \quad \bigcap_{j=\infty}^{-\infty} V_j^2 = \{0\} \tag{2}$$

Web-oriented research, the recent Institute of Computing Technology, Chinese Academy of Sciences has developed a cloud service platform COMS data mining. COMS system has four parts - Data management, task management, user management and system help module, providing cloud-based computing, parallel data mining cloud service model [5]. The system can input and output parameters of the task set, the configuration data platform, in accordance with the workflow can add another task. During the mission which, Map / the reduce of the process is visible, which is a data mining cloud services.

MapReduce model is a parallel programming framework proposed by Google, Inc., it is first to provide users with a distributed file system, allowing users to easily handle large-scale data; then all the procedures for computing abstract Map and Reduce two basic operations inMap stage model will be decomposed into smaller scale, and executed on different nodes of the cluster, and the results integrated summary in the Reduce phase [6], as is shown by equation 3.

$$\begin{cases} \Psi^1(x,y) = \varphi(x)\psi(y) \\ \Psi^2(x,y) = \psi(x)\varphi(y) \\ \Psi^3(x,y) = \psi(x)\psi(y) \end{cases} \tag{3}$$

Cloud computing outside to provide users with a common parallel programming model and massive data processing capacity, another important feature is to provide users with an open computing services platform [7]. In the direction of data mining, a series of systems have been developed for the public to provide data mining services cloud computing platform, as is shown by figure1.

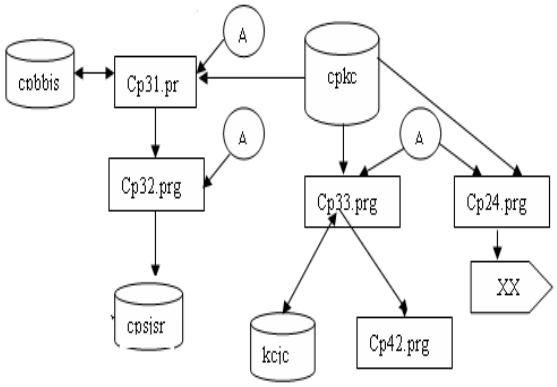

Figure 1. Common Parallel Programming Model And Massive Data Processing Capacity Model

Internets of Things and embedded systems have two basic modes, namely cloud computing mode and material mode of calculation. The cloud computing model is to collect data through a distributed architecture, and then focus on information processing. This mode is generally used in the process of macroeconomic policy-making and information processing, such as smart grid, smart transportation, smart logistics, and smart medical care [8]. The system's intelligence is mainly reflected in the processing center, the need for strong centralized computing capability and high bandwidth, but the terminal equipment is relatively simple. Objects computing model emphasizes real-time control, higher performance requirements for terminal equipment, such as intelligent automotive electronics, CNC machine tools, security monitoring systems, smart home. The system's intelligence is mainly reflected in the terminal equipment, centralized processing power

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and system bandwidth requirements are relatively low.

First, the data mining algorithm design and programming is a need to seriously consider, only select the appropriate algorithm, and take appropriate parallel strategy, in order to improve efficiency. Parameter setting and adjustment is also very important, and improper disposal will directly affect the final result. Second, the data mining process, there are many uncertainties, such as: the description of the tasks, data collection, and the methods used and the results have uncertainties in the data mining process, the uncertainty finalized [9]. The credibility of software services, data mining is entangled, the service is correct, the system status is normal, the quality of services cross the border, require special attention and validation testing., as is shown by equation4.

$$MEAN = \sum_{i=0}^{M-1}\sum_{j=0}^{N-1} F(i,j)/(M \times N) \quad (4)$$

In this paper, cloud computing, data mining services can be provided from the four levels: the basic steps of the underlying composition data mining algorithms; the second layer as a separate data mining services, such as classification, clustering, etc.; the third layer for distributed data mining models, such as parallel classification, aggregation, and machine learning; elements of the fourth floor before the three-complete data mining application. On the basis of this design, they designed a cloud computing-based Data Mining open service framework, and developed a series of data mining services, such as Weka4WS Knowledge Grid, Mobile Data Mining Services, Mining @ home, users can take advantage of the graphical interface define their own data mining workflow, and then executed on the platform.

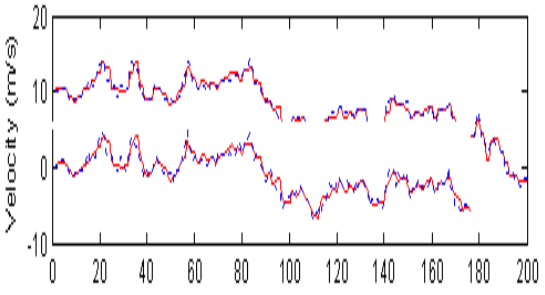

Figure 2. Cloud Computing And Data Mining Services Model

Data mining technology will reduce the threshold, which is reflected in the public data mining service data mining algorithms to provide a test platform. Researchers can focus on this platform and algorithm transformation and innovation, without having to repeat others algorithms or compare with, which can greatly improve the efficiency of research [10]. This platform enables massive data mining to become possible, which is unthinkable in the past, only cloud services has greatly enriched the case, data mining will be Pratt & Whitney in various enterprises and institutions in data mining. Data mining will be used as a generic, as like water and electricity services for enterprises, institutions, researchers, policy-makers to provide services, as is shown by equation 5.

$$\begin{cases} C_{j+1} = HC_jH' \\ D^h_{j+1} = GC_jH' \\ D^v_{j+1} = HC_jG' \\ D^D_{j+1} = GC_jG' \end{cases} \quad (j = 0,1,2,\cdots,J-1) \quad (5)$$

Through cloud computing, mass data storage and distribution of computing, massive data mining environment for cloud computing provides new ways and means to effectively solve the distributed storage of massive data mining and efficient computing. To carry out a study of the characteristics of data mining method based on cloud computing, as more and more complex mass of data mining to provide a new theoretical and support tools. Extension of cloud computing and rich as the traditional data mining, massive data mining based on cloud computing will drive the Internet advanced technological achievements in the public service, is the depth to promote information resources sharing and sustainable use of new methods and new ways.

Needs in terms of, first of all say that we are dealing with data is massive, and we look forward to using high-performance machine or a more large-scale computing device to do this. In fact, we want massive amounts of data get comprehensible knowledge, large-scale data mining is our goal, and the fact that data on the growth of the Internet in particular, fast, complex data mining task than the search task. Mass data mining, there are some specific goals, which led to the need to have a good development environment and application environment in the mining process. This case, the cloud computing-based approach is more appropriate.

Cloud computing-based data mining system design process, based on the idea of the hierarchical

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design, the level of the platform from the bottom up is divided into: the algorithm layer, task layer and user layer. The underlying transparent to its upper, upper call the underlying services through open interfaces between the layers, relatively independent, easy to the secondary development of the system between the layers.

3. THE RESEARCH OF WEB FUZZY CLUSTERING ANALYSIS

As a wealth of information resources, the Web has gradually deep into people learn, work and all aspects of life. With the increasing complexity of the structure of the Web, information is becoming increasingly numerous and users in order to obtain useful information on the website that most did not consider their preferences and browsing interest has become increasingly difficult. Web server log is a good set of records structured to save the users access the Web page, Web log mining techniques can be found Browse the relationship between the model and the Web page for users to access the site, then users clustering and page clustering [11]. Clustering is an important branch of data mining, the introduction of fuzzy theory of fuzzy clustering analysis of fuzzy processing capabilities for real data, in many areas, which the fuzzy means clustering algorithm is widely used fuzzy clustering algorithm However, and it also has some disadvantages. FCM algorithm, it is the presence of various Web log data clustering.

Along with the development and deepening of the fuzzy set theory, vague means cluster analysis has become the mainstream of research in this field. The first systematic presentation and study fuzzy clustering problem is well-known scholar Ruspini, he first defined the concept of fuzzy partition. Using this concept have been proposed a variety of fuzzy clustering analysis method, typical: pass based on fuzzy equivalence relation based on similarity relations and fuzzy relations, closure method based on fuzzy graph theory, the largest tree method based on convex decomposition of the data set, dynamic programming, and difficult to identify the relationship between the methods. However, these methods are not applicable to the large amount of data, it is difficult to meet real-time requirements of the occasion, and therefore is not widely applied in practice, as is shown by equation6.

$$\begin{cases} \psi^{(1)}(x,y) = \phi(x)\psi(y) \\ \psi^{(2)}(x,y) = \psi(x)\phi(y) \\ \psi^{(3)}(x,y) = \psi(x)\psi(y) \end{cases} \quad (6)$$

The practice has been generally welcomed the fuzzy clustering method based on the objective function, that is attributed to the clustering as a constrained nonlinear programming problems with fuzzy classification and clustering of the data sets through the optimization solution. The method is simple in design, a wide range of problem-solving, can be transformed into a nonlinear programming theory with the classical mathematical optimization problem to solve and easy computer implementation [12]. Therefore, it is fuzzy clustering algorithm based on the objective function with the application and development of the computer to become a new hotspot.

Web fuzzy clustering of objects is given Web object collection, object properties of the source data, and its direct role object is a Web fuzzy similarity matrix or the Web, fuzzy equivalent matrix, so we must first abstract source data obtained indicates that the Web object properties Web data matrix, and then transformed into fuzzy equivalence matrix for Web fuzzy clustering method for operating Web fuzzy similarity matrix or the Web, and finally, on this basis, the use of certain web fuzzy clustering method to get the clustering results.

Let R be a fuzzy similarity matrix of order n, Web, then there exists a smallest natural number k ($k \leq n$) makes a pass closure t (R) = Rk, all greater than k a natural number l, constant Rl = Rk, andt (R) for the fuzzy equivalence matrix of order n Web, as is shown by equation 7 [13].

$$R = AR_S A^H + \sigma^2 I = U_S \Sigma_S U_S^H + \sigma^2 U_N U_N^H \quad (7)$$

Fuzzy c-means algorithm (FCM) is a traditional K-means algorithm based on the use of the theory of fuzzy mathematics to improve the Partition-based clustering algorithm, its implementation is relatively simple, relatively fast convergence rate, but the algorithm is essentially, it is a local search technology, for the initial values are very sensitive, vulnerable to local minima, which are not global optimal solution. Use heuristic optimization techniques are to improve the clustering algorithm is an important method of clustering research [14]. The differential evolution algorithm (the Differential Evolution, referred to as DE) in 1995

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by R.Storn and K.Price a heuristic random search technique based on population differences, initially used to solve the Chebyshev polynomial. As an optimization method based on swarm intelligence theory, it is DE to solve complex continuous optimization problems show better results than the GA, the PSO. Controlled coefficient of the algorithm is simple in principle, easy to understand and to achieve better global search ability.

Usually the FCM algorithm, the data object for each specific class membership is determined in accordance with this object to the relative distance of the center of a particular class. The degree of membership of each object that the extent of the data objects belonging to this class, at the same time, membership in the cluster center update also shows the extent of the new cluster center to adjust the contribution of each object. The greater the degree of membership value, the greater the impact of the location of its cluster center, the contrary, the smaller the value of membership degree, affect the smaller, is as shown by figure3.

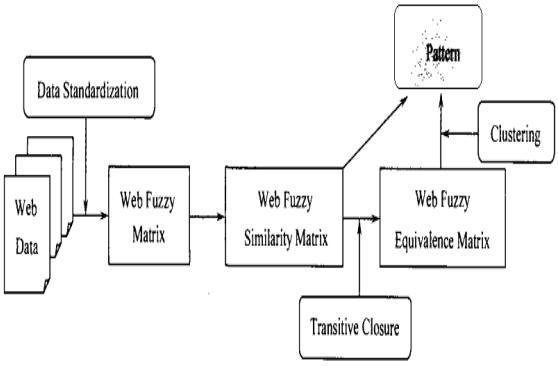

Figure 3. Web Fuzzy Clustering Process Model

Site page, if a valid page as the users to describe one-dimensional vector, then the user vector dimension is huge. Under normal circumstances, the user can only access a small part [15]. This will inevitably result in the sparsity of the user vector, thereby reducing the efficiency of the algorithm. Page in the site is not randomly distributed, but organized in a tree structure, the leaf node represents a simple page, non-leaf nodes represent the integrated page. Point of view, tend to belong to a theme, a simple page of the parent node to a comprehensive page visits a page is the page parent node simple page visits and from the site's organizational structure .In fact, this is to classify all the valid pages of the site will have similar, belong to the same page as a class, which significantly reduces the vector dimension, and to improve the efficiency of the algorithm.

4. USING WEB FUZZY CLUSTERING ANALYSIS TO BUILD THE DATA MINING MODEL OF CLOUD COMPUTING

Cloud computing is a distributed large-scale data center offers a variety of server resources dynamically to meet the needs of the field of scientific research, e-commerce and other computing platforms. Cloud Computing and Distributed Computing (Distributed Computing), the development of parallel computing (Parallel Computing) and Grid Computing (Grid Computing), Virtualization (Virtualization), utility computing (Utility Computing,), IaaS (Infrastructure as a Service) PaaS (Platform as a service), the results of the mixed evolution of the concept of SaaS (software as a Service), and jumped. Use of virtualization technology, cloud computing platforms through scheduling policy, for the different needs of users, dynamic, transparent virtual compute and storage resources, and supply the current user does not use its resources dynamically reclaim other users, signs power plants supply the same for the user to deliver cheap computing and storage resources, so that ordinary users to achieve large-scale parallel computing and massive data operations become possible, but also provides fundamental support to build the unified development of the knowledge network system.

The cloud computing model consists of a front-end and back-end. The two parts of a network connection to the Internet in most cases. Users to interact through the front-end with the system, it is back-end cloud itself. Front-end client computer used to access the cloud applications. The back-end to provide cloud services applications, computers, servers and data storage [16].

The concept of cloud-based layer, it is each layer to provide a class of functions. The cloud component of this tiered approach to the various layers of cloud computing known as a commodity like electricity, it is in order to telephone service or natural gas. Cloud computing will become a new public utility services.

The public cloud available to the general public or industry organizations, owned by the organization of the sales cloud services and supplies. The public cloud as a cloud in the general sense, that is, off-site third-party providers of Web applications through the Internet dynamically provision resources, they provide a shared resource and follow the usage charges [17]. Private cloud located within the corporate firewall, by the

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organization's own management. They create and control within the enterprise cloud services. The private cloud has many of the same benefits as public clouds; the main difference is that your organization is responsible for creating and maintaining.

Algorithm: Web fuzzy clustering analysis technology in building the data mining model of cloud computing

Input: Target system to set up the transparent top of the cloud computing to provide a user interface for a variety of end-user services, but also provide open interfaces to support applications developed based on this system, users can either access the system through a variety of end user interface to use system, you can also indirectly through the application calls the system provides an open interface to use the system to provide a variety of services.

Output: Lower to provide a unified data source algorithm is invoked and its management interface, because the execution order of the three types of algorithms and returns the result of different and separate. Call services: data cleaning algorithm for data sets with noise data pretreatment method prior to the implementation of data mining algorithms call interface, after cleaning the data through the data layer deposited in the cloud computing platform provides storage space for the data mining services.

(1) public void setPrice(BigDecimal price) {

this.price =

SystemConfigUtil.getPriceScaleBigDecimal(price);

(2) Take λ2 for the matrix element values directly from the R 'to find where the degree of similarity (xi, xj) (rij = λ2,), λ2, elements corresponding corresponds to λ1 = 1 is equivalent to classification xiclass, and xj where the merger, all of these cases the merger after the equivalent classification corresponds to λ2;

(3) @SearchableProperty(store = Store.YES)

@Column(nullable = false);

(4) When a member of the type of users visit the Web site again automatically according to the configuration file, given the recommended pages. Visitors have the same access characteristics between groups with each other prompting mechanism to establish additional links in the content similarity between pages, the result of the proposed information from the list of recently visited pages formation of to solve the problem of the proposed information is updated in real time.

(5) public void setIsMarketable(Boolean isMarketable) {

this.isMarketable = isMarketable;}

(6)Stop.

The paper presents the new algorithm of the data mining model in cloud computing base on web fuzzy clustering analysis. Call services: data cleaning algorithm for data sets with noise data pretreatment method prior to the implementation of data mining algorithms call interface, after cleaning the data through the data layer deposited in the cloud computing platform provides storage space for the data mining services. Data mining algorithms called service: unified call interface data mining, data cleaning before use or other unwanted cleaning. Layers above services are XML as a communication language based on Web services form the internal representation of state transition calls in order to better support scalability layers, and finally the form of an open interface opening. The user can do any layer development, the existing services into their systems, which greatly enhanced the system with ease of use are not before the data mining platform architecture, as is shown by figure4.

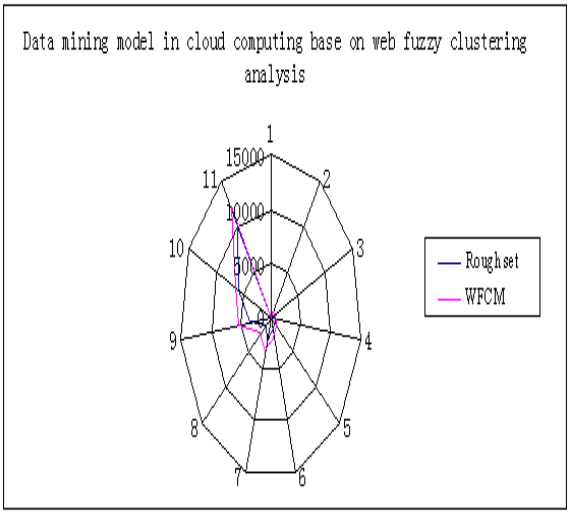

Figure 4. Web Fuzzy Clustering Analysis Technology In Building The Data Mining Model Of Cloud Computing Map

In order to compare CA-WFCM FCM algorithm computational performance, were selected 10000, 20000, 30000, 40000, 50000,60000,9000 clustering run-time by the preprocessed Web log user access session, were recorded using the CA-WFCMCPU

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execution time and the FCM algorithm and Rough set.

5. CONCLUSIONS

In this paper, cloud computing, data mining services can be provided from the four levels: the basic steps of the underlying composition data mining algorithms; the second layer as a separate data mining services, such as classification, clustering, etc.; the third layer for distributed data mining models, such as parallel classification, aggregation, and machine learning; elements of the fourth floor before the three-complete data mining application. The paper presents the new algorithm of the data mining model in cloud computing base on web fuzzy clustering analysis. Web fuzzy clustering of objects is given Web object collection, object properties of the source data, and its direct role object is a Web fuzzy similarity matrix or the Web, fuzzy equivalent matrix.

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